

PROJECT MANUAL

FOR

WARM SPRINGS ELEMENTARY SCHOOL MODERNIZATION

OWNER

SAN BERNARDINO CITY UNIFIED SCHOOL DISTRICT
777 NORTH F STREET
SAN BERNARDINO, CA 92410-3017

ARCHITECT

WLC ARCHITECTS, INC.
8163 ROCHESTER AVENUE, SUITE 100
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PROJECT 1720000
NOVEMBER 2019

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FOR
WARM SPRINGS ELEMENTARY SCHOOL MODERNIZATION

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DECEMBER 2019

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APP: 04-118807 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 08/18/2020

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DSA APPLICATION 04-118807

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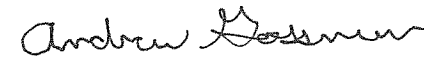


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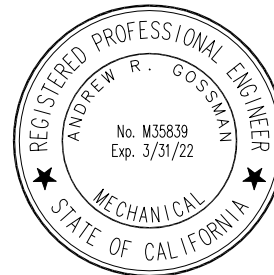


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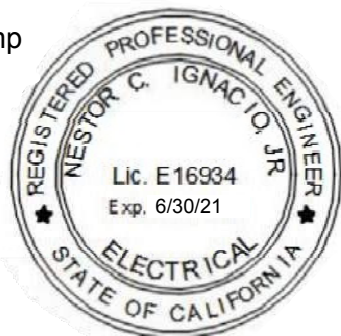


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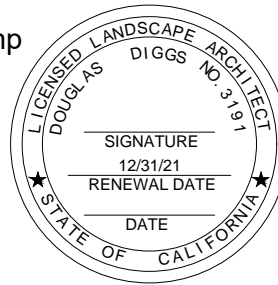
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NOT USED

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NOT USED

SECTION 01 11 00

SUMMARY OF WORK

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work Included.
- B. Work under separate contracts.
- C. Work by Owner.
- D. Owner furnished products.
- E. Contractor use of site and premises.
- F. Work Sequence.
- G. Owner occupancy.
- H. Work restrictions.

1.2 WORK INCLUDED

- A. Work of this Contract comprises general construction including remodeling, demolition of reconfigure and remodel the Administration Building and site work with new entrance. Demolish existing Portable Kitchen Building and Remodel Multipurpose Room with new Kitchen. Upgrade campus-wide low voltage system with path-of-travel upgrades only to scope of work located at 7497 Sterling Avenue, San Bernardino, CA 92410 for San Bernardino City Unified School District, Owner.
- B. Construct the work under a single lump sum contract.

1.3 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.4 WORK BY OWNER

- A. Items noted "NIC" (Not In Contract) will be furnished and installed by Owner.
- B. Owner will remove and retain possession of the following items prior to start of work:

- 1. _____
- 2. _____
- 3. _____
- 4. _____

C. Contractor will remove and Owner will take possession of the following items prior to start of work:

1. _____
2. _____
3. _____
4. _____

1.5 OWNER FURNISHED PRODUCTS

A. Items noted "OFCI" (Owner-Furnished Contractor Installed) will be furnished by Owner and installed by Contractor.

B. Items noted "OFOI" (Owner-Furnished Owner Installed) will be furnished by Owner and installed by Owner.

C. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples to Contractor.
2. Arrange and pay for Product delivery to site.
3. On delivery, inspect Products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturer's warranties, inspections, and service.

D. Contractor's Responsibilities:

1. Review Owner reviewed Shop Drawings, Product Data, and Samples.
2. Receive and unload Products at site; inspect for completeness or damage, jointly with Owner.
3. Handle, store, install and finish Products.
4. Repair or replace items damaged after receipt.

E. Products furnished and installed by Owner (OFOI):

1. [_____].
2. [_____].

F. Items furnished by Owner for installation by Contractor (OFCI):

1. [_____].
2. [_____].

1.6 CONTRACTOR USE OF SITE AND PREMISES

- A. Limit use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Use of site and premises by public students.
 - 3. Work by others and Work by Owner.

1.7 WORK SEQUENCE

- A. Construct work in the following [portions] [phases] [increments] [to accommodate Owner's occupancy requirements] during the construction period with each [phase] [portion] substantially complete before beginning the next [phase] [portion]. Coordinate construction schedule and operations with [Owner] [Architect]:
 - 1. Phase 1: Work of this Phase shall be substantially complete within [____] days after The Notice to Proceed commencement of construction of this Phase.
 - 2. Phase 2: Work of this Phase shall be substantially complete within [____] days after The Notice to Proceed commencement of construction of this Phase.
 - 3. Phase 3: Work of this Phase shall be substantially complete within [____] days after The Notice to Proceed commencement of construction of this Phase.

1.8 OWNER OCCUPANCY

- A. Partial Owner Occupancy: Owner will occupy the entire site and premises during entire construction period, with the exception of areas under construction.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
- C. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
- D. Before partial 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 building.
- E. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.
- F. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.
- G. Perform the Work so as not to interfere with Owner's day-to-day operations.
- H. Maintain existing exits, unless otherwise indicated.
- I. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours, Monday through Friday, except as otherwise indicated or required to conform to construction schedule and labor codes.
 - 1. Weekend Hours: 7:00 a.m. to 10:00 p.m.
 - 2. Early Morning Hours: 5:00 a.m. to 7:00 a.m.
 - 3. Hours for Utility Shutdowns: 3:00 p.m. to 11:00 p.m..
 - 4. Hours for Noisy Operations: Varies depending on school activities.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted to do so and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Architect not less than 2 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Architect's permission.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cash allowances.
- B. Contingency allowances.
- C. Schedule of Values.
- D. Application for Payment.
- E. Defect assessment.
- F. Non-payment for rejected work.
- G. Change procedures.
- H. Alternates.
- I. Unit prices.

1.2 CASH ALLOWANCES

- A. Include in the contract sum all cash allowances stated herein.
- B. Items covered by cash allowances shall be supplied for such amounts and by such persons as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.
- C. Costs Included in Cash Allowances: Cost of Product to Contractor or Subcontractor, less applicable trade discounts; delivery to site and applicable taxes.
- D. Costs Not Included in the Cash Allowance: Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; labor for installation and finishing; and overhead profit and other expenses contemplated. These expenses shall be included in the contract sum and not in the allowance.
- E. Funds will be drawn from cash allowance amount only by written authorization of the Owner.
- F. At closeout of contract, funds remaining in cash allowance amount will be credited to Owner by change order.
- G. Whenever costs are more than cash allowance amount, the contract amount will be adjusted accordingly by change order.
- H. Contractor Responsibilities:
 - 1. Assist Architect in selection of products and suppliers.
 - 2. Obtain proposals from suppliers and offer recommendations.
 - 3. On notification of selection by Owner, execute agreement with designated supplier.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery and product handling at site.

5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for damage.

I. Cash Allowances:

1. Section [] - []: Allow the stipulated sum of \$[] for purchase and delivery of [].
2. Section [] - []: Allow the stipulated sum of \$[] for purchase, and delivery of [].

1.3 CONTINGENCY ALLOWANCE:

- A. Include in the contract sum all contingency allowances stated herein.
- B. Costs included in contingency allowance: Cost of work to Contractor or subcontractor, less applicable trade discounts; delivery to site and applicable taxes; product handling, including unloading, uncrating, and storage; protection of products from damage; labor for installation and finishing; reasonable overhead and profit and other expenses required by work.
- C. Funds will be drawn from contingency allowance amount only by written authorization of Owner.
- D. At closeout of Contract, funds remaining in contingency allowance amount will be credited to Owner by Change Order.
- E. Whenever costs are more than contingency allowance amount, the Contract amount will be adjusted accordingly by Change order.
- F. Contractor Responsibilities:
 1. Assist Architect in selection of products and suppliers.
 2. Obtain proposals from suppliers and offer recommendations.
 3. On notification of selection by Owner, execute agreement with designated supplier.
 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery of product to site.
 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for damage.
- G. Contingency Allowance: A stipulated sum of [\$].00).

1.4 SCHEDULE OF VALUES

- A. Submit Schedule of Values for approval in duplicate within fourteen days after receipt of Notice to Proceed.
- B. Format: Submit typed schedule based upon the [attached Schedule of Values augmented by] the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section.
- C. [Where work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.]
- D. Include in each line item, the amount of Allowances specified in this Section.
- E. Include within each line item, a directly proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, on continuation sheet, with each Application For Payment.

1.5 APPLICATIONS FOR PAYMENT

- A. Submit six copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA Form G703 Continuation Sheet.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Application Times: The date for each progress payment is indicated in the General Conditions of the Contract.
- D. Payment Application Periods: The period of construction covered by each application for payment is the period indicated in the General Conditions of the Contract.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents. Architect will return incomplete applications without action.
- F. Waiver of Stop Notices: With each application for payment, submit waivers of stop notices from subcontractors for construction period covered by previous application.
- G. Final Payment: As specified in the General Conditions of the Contract and in Section 01 77 00 - Closeout Procedures.
- H. Refer to the General Conditions of the Contract for additional payment provisions.

1.6 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct one of the following remedies:
 - 1. The defective Work may remain, but the listed schedule of value will be adjusted to a new value at the discretion of the Architect.
 - 2. The defective Work will be partially repaired to the instructions and satisfaction of the Architect and the listed schedule of value will be adjusted to reflect a new value at the discretion of the Architect.

1.7 NON-PAYMENT FOR REJECTED WORK

- A. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined to be unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required work.
 - 5. Products remaining on hand after completion of the work.
 - 6. Loading, hauling and disposing of rejected products.

1.8 CHANGE PROCEDURES

- A. The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by General Conditions on AIA Form G710 Architect's Supplemental Instructions.

- B. The Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. Proposal Requests are for information only and are not to be considered instructions to stop the work or to execute the proposed change. Contractor will prepare and submit a detailed estimate within 14 days.
- C. Any change in the Work which involves the adjustment to contract sum/price or contract time shall be properly certified by the Contractor as indicated in the General Conditions of the contract.
- D. The Contractor may propose a change by submitting a Change Order Request to the Architect, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.
- E. Stipulated Sum Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's Change Order Request as approved by Architect.
- F. Time and Material/Force Account Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the General Conditions of the Contract.
- G. Maintain detailed records of work done on Time and Material/Force Account basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work as indicated in the General Conditions of the Contract.
- H. Construction Change Directive: Architect may issue a directive, signed by the Owner and Architect, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum or Contract Time. Promptly execute the change.
- I. Allowance Adjustment: Adjustment of allowance amounts shall be based upon a properly documented and detailed Change Order Request which substantiates distribution of allowance amounts and actual costs of work in place.
- J. Change Order Forms: AIA G701 Change Order.
- K. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the General Conditions of the Contract.
- L. All addenda (changes and/or revisions prior to award of contract) and construction changes (changes and revisions after award of contract) shall be approved by the Architect and the Division of the State Architect prior to start of construction covered by those changes and/or revisions in accordance with the requirements of Title 24 of the California Code of Regulations, Part 1, Section 4-338.
- M. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- N. Promptly revise progress schedules to reflect any changes in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change and resubmit.
- O. Promptly enter changes in Project Record Documents.

1.9 ALTERNATES

- A. An alternate is an amount proposed by the bidder and stated on the Bid Form for certain work defined herein that may be [added to] [or] [deducted from] the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
- B. The cost for each Alternate is the net [addition to] [or] [deduction from] the Contract Sum to incorporate the Alternate into the Work.

- C. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not specifically mentioned as part of the Alternate.
- D. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- E. Coordinate related work and modify surrounding work as required to integrate the Work of each Alternate.
- F. Execute accepted alternates under the same conditions as other work of this Contract.

1.10 UNIT PRICES

- A. A unit price is an amount proposed by the bidder and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by change order in the event the estimated quantities of work required by the Contract Documents are increased or decreased.
- B. Unit prices shall include all necessary material, overhead, profit and applicable taxes.
- C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established prices, and to have this work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.
- D. Refer to individual specification sections for construction activities requiring the establishment of unit prices.
- E. Specification sections referenced in the Schedule of Unit Prices contain requirements for materials and methods described under each unit price.
- F. Schedule of Unit Prices:
 - 1. Drilled Concrete Piers (Caissons)
 - (a) Section 03 20 00 - Concrete Reinforcing
 - (b) Section 03 30 00 - Cast-In-Place Concrete

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

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SCHEDULE OF VALUES FORMAT*

Project: Warm Springs Elementary School Modernization

Contractor: _____

Date: _____

Item Description	Amount
1. Mobilization and initial expenses	
2. General Conditions	
Temporary Utilities	
Engineering Layout	
Temporary Construction/Dust Control	
General Clean Up/Trash Removal	
Project Manager/Supervision/Truck	
Rental Equipment	
3. Bonds and Insurance	
4. SITE WORK	
Demolition/Removal	
Site	
Building(s)	
Site Preparation	
General Brush and Tree Clearing	
Earthwork	
Site Improvements	
Termite/Weed Treatment	
AC Paving/Base/Striping	
Concrete Curb/Gutters	
Concrete Retaining Walls	
Concrete Paving	
Concrete Site Stairs	
Masonry Garden Walls	
Chain Link Fences/Gates	
Wrought Iron Fences/Gates	
Irrigation	
Planting	
Site Equipment (misc)	
Site Utilities	
Storm Drainage	
Site Water	
Site Gas	
Site Sewer	
Electrical Site Service/Lighting	

Item Description	Amount
Off-site Work	
AC Paving/Base	
Concrete Curb/Gutters	
Irrigation	
Planting	
Storm Drainage	
Site Water	
Site Gas	
Site Sewer	
Street Lights	
Other	
5. FOUNDATIONS	
Wall Foundations	
Column Foundations	
Special Foundations	
Other	
6. SUBSTRUCTURE	
Slab on Grade	
Trenches/pits/bases	
Subgrade Moisture Protection	
7. SUPERSTRUCTURE	
Columns and Beams	
Concrete Columns/Beams	
Masonry Columns	
Steel Columns/Beams	
Wood Columns/Beams	
Glue Laminated Beams	
Structural Walls	
Concrete Walls	
Masonry Walls	
Wood Framed Walls	
Floor Construction	
Concrete Cast in Place	
Steel Deck/Framing	
Wood Framed Floors	
Roof Construction	
Concrete Cast in Place	
Steel Deck/Framing	
8. EXTERIOR CLOSURE	
Exterior Walls/Soffits	
Sandblast Concrete Seal/Paint	
Sandblast Masonry Seal/Paint	
Metal Studs	
Wood Studs	
Exterior Plaster	
Exterior Insulation	
Windows/Frames/Glazing	
Steel Windows/Glazing	
Aluminum Windows/Glazing	
Store Front/Glazing	

Item Description	Amount
Doors	
Metal Doors/Frames	
Wood Doors/Frames	
Aluminum Doors/Frames/Glazing	
Sectional Doors/Frames	
Roll Up Doors/Frames	
Store Front	
Frames	
Hardware	
Insulation	
Thermal Wall	
Sound Wall	
Sealants/Caulking	
Other	
9. ROOFING	
Roof Coverings and Flashing	
Built Up Roofing	
Single Ply	
Preformed Metal	
Asphalt Shingle	
Flashing and Trim	
Roof Openings	
Roof Hatches	
Ladders to Roof	
Other	
10. INTERIOR CONSTRUCTION	
Fixed Partitions	
Metal Studs	
Wood Studs	
Gypsum Board	
Interior Plaster	
Interior Doors	
Wood Doors	
Metal Doors	
Aluminum Doors	
Roll Up Doors	
Special Doors	
Frames	
Interior Finishes	
Painting	
Walls	
Ceiling	
Vinyl Wall Coverings	
Ceramic Tile	
Fiberglass Reinforced Panels	
Concrete Sealer	
Vinyl Sheet/Tile	
Carpet	
Suspended Acoustical Ceiling System	
Specialties	
Chalkboard/Markerboard/Tackboards	
Cabinets	
Toilet Room Accessories	
Graphics and Signage	

Item Description	Amount
11. CONVEYING SYSTEMS	
Other	
12. EQUIPMENT	
Multipurpose/Stage	
Projection Screen(s)	
Classroom	
Window Coverings	
Food Service	
Kitchen Equipment	
Walk in Freezer/Refrigerator	
Other	
13. MECHANICAL	
Plumbing	
Supply Service	
Disposal Service	
Rainwater Service	
Gas Service	
Finish Fixtures	
Fire Protection	
Fire Extinguishers	
HVAC System	
Equipment	
Ductwork/Distribution	
System Controls	
Testing and Balancing	
Other	
14. ELECTRICAL	
Distribution	
Lighting and Power	
Special Systems	
Alarm System	
Communications	
Emergency System	
Other	
TOTAL COST	\$ _____

*The above categories may be subdivided and items added if the overall order remains the same and the subtotal cost for each category complies with the format as shown. Items not applicable to a particular job may be deleted from this list. Overhead and profit shall be a combined mark up and added proportionally to each line item.

SECTION 01 25 13

PRODUCT SUBSTITUTION PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Product options.
- B. Substitution procedures.

1.2 DEFINITIONS

- A. Requests for changes in products, materials, or equipment required by Contract Documents proposed by the Contractor prior to and after award of the Contract are considered requests for substitutions. The following are not considered substitutions:

- 1. Revisions to Contract Documents requested by the Owner or Architect.
- 2. Specified options of products, materials, and equipment included in Contract Documents.

1.3 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with Provision for Substitution: Products of manufacturers named and meeting specifications with substitution of products or manufacturer only when submitted under provisions of this section.
- C. Products Specified by Naming One or More Manufacturers without Provision for Substitution: No substitution allowed.

1.4 LIMITATIONS ON SUBSTITUTIONS SUBMITTED PRIOR TO THE RECEIPT OF BIDS

- A. The Bid shall be based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.
- B. The opportunity to request a substitution is not for the convenience of the Bidder to request acceptance of equipment and/or materials which may be more familiar or have a lesser cost.
- C. Architect may consider requests for substitutions of specified equipment and/or materials only when requests are received by Architect prior to the date established for the receipt of bids as stipulated in Document 00 21 13 - Instructions to Bidders.
- D. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.
- E. Burden of proof of merit of requested substitution is the responsibility of the entity requesting the substitution.
- F. It is the sole responsibility of the entity requesting the substitution to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.
- G. Architect's decision on substitution requests are final and do not require documentation or justification.
- H. When substitution is not accepted, provide specified product.
- I. Substitute products shall not be included within the bid without written acceptance by Addendum.

1.5 LIMITATIONS ON SUBSTITUTIONS SUBMITTED AFTER THE AWARD OF THE CONTRACT

- A. The Contract is based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.
- B. The opportunity to request a substitution is not for the convenience of the Contractor to request acceptance of equipment and/or materials which may be more familiar or have a lesser cost.
- C. Consideration by Architect of substitution requests received after the established date of the receipt of bids or contract award will only be made when one or more of the following conditions are met and documented:
 - 1. Specified item fails to comply with regulatory requirements.
 - 2. Specified item has been discontinued.
 - 3. Specified item, through no fault of the Contractor, is unavailable in the time frame required to meet project schedule.
 - 4. Specified item, through subsequent information disclosure, will not perform properly or fit in designated space.
 - 5. Manufacturer declares specified product to be unsuitable for use intended or refuses to warrant installation of product.
 - 6. Substitution would be, in the sole judgement of the Architect, a substantial benefit to the Owner in terms of cost, time, energy conservation, or other consideration of merit.
- D. Notwithstanding the provisions of Article 1.4 of this section and the above, the Architect may consider a substitution request after the date of the receipt of bids or contract award, if in the sole discretion of the Architect, there appears to be just cause for such a request. The acceptance of such a late request does not waive any other requirement as stated herein.
- E. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.
- F. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals without separate written request as required by provisions of this section.
- G. Review of shop drawings does not constitute acceptance of substitutions indicated or implied on shop drawings.
- H. Substitutions will not be considered when requested or submitted directly by subcontractor or supplier.
- I. Substitutions will not be considered as a result of the failure to pursue the work promptly or coordinate activities properly.
- J. Burden of proof of merit of requested substitution is the responsibility of the Contractor.
- K. It is the sole responsibility of the Contractor to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.
- L. Owner shall receive full benefit of any cost reduction as a result of any request for substitution.
- M. Architect's decision on substitution requests is final and does not require documentation or justification.
- N. When substitution is not accepted, provide specified product.
- O. Substitute products shall not be ordered or installed without written acceptance.

1.6 REGULATORY REQUIREMENTS

- A. It shall be the responsibility of the entity requesting the substitution to obtain all regulatory approvals required for proposed substitutions.
- B. All regulatory approvals shall be obtained for proposed substitutions prior to submittal of substitution request to Architect.
- C. All costs incurred by the Owner in obtaining regulatory approvals for proposed substitutions to include the costs of the Architect and any authority having jurisdiction over the project shall be reimbursed to the Owner. Costs of these services shall be reimbursed regardless of final acceptance or rejection of substitution.
- D. Substitutions of materials or work procedures which affect the health, safety and welfare of the public shall have prior approval of the Division of the State Architect (DSA) field representative.

1.7 SUBSTITUTION REPRESENTATION

- A. In submitting a request for substitution, the entity requesting the substitution makes the representation that he or she:
 - 1. Has investigated the proposed substitution and has determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty or guarantee for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other work which may be required for the work to be completed with no additional cost to the Owner.
 - 4. Waives claims for additional cost or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner for the cost of Architect's review or redesign services associated with substitution request.

1.8 SUBMITTAL PROCEDURE

- A. Submit each Substitution Request in conformance with the requirements of this section.
- B. Assemble complete Substitution Request into a single bookmarked Portable Document Format (PDF) file.
- C. Transit electronic PDF files via Architect's Project Collaboration Site address or designated email address.
- D. Submit request with Architect's Substitution Request Form. Form may be obtained at the office of the Architect. Substitution requests received without request form will be returned unreviewed.
- E. Limit each request to one proposed substitution.
- F. Request to include sufficient data so that direct comparison of proposed substitution can be made.
- G. Provide complete documentation for each request. Documentation shall include the following information, as appropriate, as a minimum:
 - 1. Statement of cause for substitution request.
 - 2. Identify product by specification section and article number.
 - 3. Provide manufacturer's name, address, and phone number. List fabricators, suppliers, and installers as appropriate.
 - 4. List similar projects where proposed substitution has been used, dates of installation and names of Architect and Owner.

5. List availability of maintenance services and replacement materials.
 6. Documented or confirmation of regulatory approval.
 7. Product data, including drawings and descriptions of products.
 8. Fabrication and installation procedures.
 9. Samples of proposed substitutions.
 10. Itemized comparison of significant qualities of the proposed substitution with those of the product specified. Significant qualities may include size, weight, durability, performance requirements and visual effects.
 11. Coordination information, including a list of changes or modifications needed to other items of work that will become necessary to accommodate proposed substitution.
 12. Statement on the substitutions effect on the construction schedule.
 13. Cost information including a proposal of the net change, if any, in the Contract sum if the substitution is submitted after the receipt of bids or contract award.
 14. Certification that the substitution is equal to or better in every respect to that required by the Contract Documents and that substitution will perform adequately in the application intended.
 15. Waiver of right to additional payment or time that may subsequently become necessary because of failure of substitution to perform adequately.
- H. Inadequate warranty, vagueness of submittal, failure to meet specified requirements, or submittal of insufficient data will be cause for rejection of substitution request.

1.9 ARCHITECT'S REVIEW

- A. Within 14 days of receipt of request for substitution, the Architect will accept or reject proposed substitution.
- B. If a decision on a substitution cannot be made within the time allocated, the product specified shall be used.
- C. There shall be no claim for additional time for review of proposed substitutions.
- D. Final acceptance of a substitution submitted prior to the date established for the receipt of bids will be in the form of an Addendum.
- E. Final acceptance of a substitution submitted after the award of the contract will be in the form of a Change Order.

2. PART 2 PRODUCTS

Not Used.

3. PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination.
- B. Preconstruction conference.
- C. Progress meetings.
- D. Request for Information (RFIs).
- E. Preinstallation conferences.
- F. Closeout conference.
- G. Post construction dedication.

1.2 DEFINITIONS

- A. RFI - Request from Contractor seeking additional information, interpretation or clarification of the Contract Documents.

1.3 COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Coordinate construction operations of the different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- C. Prior to commencement of a particular type or kind of work examine relevant information, contract documents and subsequent data issued to the project.
- D. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. In locations where several elements of mechanical and electrical work must be sequenced and positioned with precision in order to fit into available space, prepare coordination drawings showing the actual conditions required for the installation. Prepare coordination drawings prior to purchasing, fabricating or installing any of the elements required to be coordinated.
- H. Closing up of walls, partitions or furred spaces, backfilling and other covering up operations shall not proceed until all enclosed or covered work and inspections have been completed. Verify before proceeding.
- I. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owners partial occupancy.

- J. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- K. Coordinate all utility company work in accordance with the General Conditions.
- L. Coordinate field engineering with the provisions of Section 01 73 00.

1.4 PRECONSTRUCTION CONFERENCE

- A. Architect will schedule a conference immediately after receipt of fully executed contract documents prior to project mobilization.
- B. Mandatory Attendance: Owner, Owner's Resident Inspector, Owner's Testing Laboratory Representative, Architect, Contractor, Contractor's Project Manager and Contractor's Job Superintendent.
- C. Optional Attendance: Architect's consultants, subcontractors and utility company representatives.
- D. Architect will preside at conference, record minutes and distribute copies.
- E. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Issue Notice to Proceed.
 - 3. Submission of executed bonds and insurance certificates.
 - 4. Distribution of Contract Documents.
 - 5. Federal and State labor law requirements applicable to Contract.
 - 6. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 - 7. Designation of responsible personnel representing the parties.
 - 8. Procedures and processing of RFIs, field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders and Contract closeout procedures.
 - 9. Procedures for testing and inspection.
 - 10. Temporary facilities and controls.
 - 11. Procedures for moisture and mold control.
 - 12. Procedures for disruptions and shutdowns.
 - 13. Scheduling.
 - 14. Critical work sequence and long lead items.
 - 15. Work restrictions and working hours.
 - 16. Progress meetings.
 - 17. Use of site and premises.
 - 18. Storage.
 - 19. Authorities having jurisdiction over project.
 - 20. Owner occupancy requirements.

21. Owner-Furnished equipment.
22. Construction waste management.
23. SWPPP requirements.
24. Preparation of Record Drawings.
25. Security.
26. Parking availability.
27. Progress cleaning.

1.5 PROGRESS MEETINGS

- A. Architect will schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
- B. Architect will make arrangements for meetings, prepare agenda, preside at meetings, record minutes (Field Reports), and distribute copies.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Owner's Inspector, and Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 1. Review minutes of previous meetings. (Field Reports)
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems which impede planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Requests For Information (RFIs).
 7. Status of Proposal Requests (PRs).
 8. Status of Change Order Requests (CORs).
 9. Status of Change Orders (Cos).
 10. Status of corrective or deficient items.
 11. Review of off-site fabrication and delivery schedules.
 12. Maintenance of construction schedule.
 13. Corrective measures to regain projected schedules.
 14. Planned progress during succeeding work period.
 15. Coordination of projected progress.
 16. Maintenance of quality and work standards.
 17. Effect of proposed changes on progress schedule and coordination.

18. Temporary facilities and controls.
19. Progress cleaning.
20. Other business relating to Work.

1.6 REQUEST FOR INFORMATION (RFI'S)

- A. Procedure: Immediately on discovery of the need for additional information, interpretation of the Contract Documents, and if not possible to request interpretation at Progress Meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 3. Each RFI shall address only one subject matter.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 1. Date.
 2. Project name.
 3. Owner's name.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. Specification Section number and title and related paragraphs, as appropriate.
 8. Drawing number and detail references, as appropriate.
 9. Field dimensions and conditions, as appropriate.
 10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 11. Contractor's signature.
 12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above. Attachments shall be electronic files in a format that will allow electronic editing by the Architect.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow fifteen days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day. If the RFI is required to be forwarded to a consultant, subconsultant, or Owner for a response, the response time will be twenty five days.
 1. The following RFIs will be returned without action:

- (a) Requests for approval of submittals.
 - (b) Requests for approval of substitutions.
 - (c) Requests for information already indicated in the Contract Documents.
 - (d) Requests for coordination information which is the responsibility of the Contractor.
 - (e) Requests for adjustments in the Contract Time or the Contract Sum.
 - (f) Requests for interpretation of Architect's actions on submittals and substitutions.
 - (g) Incomplete RFIs or RFIs with numerous errors.
- 2. Architect's action may include a request for additional information, in which case Architect's allowable time for response will start again.
 - 3. Architect's review of or response to RFIs shall not constitute an approval, direction, or procedure related to construction means, methods, techniques, sequences, or procedures of Contractor.
 - 4. Architect's review of or response to RFIs shall not constitute an approval, direction, or procedure related to the construction site safety precautions, procedures or methodology of Contractor.
 - 5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Order Request according to Division 01 Section 01 20 00 - Price and Payment Procedures.
 - (a) If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.
 - (b) Under no circumstances is the Architect's review of or response to RFIs to be considered an authorization to depart from the Contract Documents or an authorization to perform extra work.
- F. On receipt of Architect's action immediately distribute the RFI response to affected parties.
 - G. Review response and notify Architect within three days if Contractor disagrees with response.

1.7 PREINSTALLATION CONFERENCES

- A. When required in individual specification Section, convene a preinstallation conference prior to commencing work of the Section. Refer to individual specification section for timing requirements of conference.
- B. Require attendance of parties directly affecting, or affected by, work of the specific Section.
- C. Notify Architect a minimum of seven days in advance of meeting date.
- D. Preinstallation conference to coincide with regularly scheduled progress meeting.
- E. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants.
- F. Agenda:
 - 1. Review of Contract Documents.
 - 2. Manufacturer's recommendations.
 - 3. Status of submittals.
 - 4. Related RFIs.

5. Related Change Orders.
6. Schedule of work activities.
7. Deliveries of materials and equipment.
8. Sequence of operation.
9. Acceptable substrates.
10. Interface requirements.
11. Possible conflicts.
12. Access.
13. Site utilization.
14. Tests and inspections.
15. Review of Mockups.
16. Temporary facilities and controls.
17. Quality and work standards.
18. Weather limitations.

G. Preinstallation Schedule:

1. Section 01 57 23 - Storm Water Pollution Prevention Plan
2. Section 01 74 19 - Construction Waste Management and Disposal
3. Section 02 43 00 - Structure Moving
4. Section 03 30 00 - Cast-in-Place Concrete
5. Section 04 20 00 - Reinforced Unit Masonry System
6. Section 07 52 00 - Modified Bituminous Membrane Roofing
7. Section 07 54 23 - Thermoplastic-Polyolefin Roofing

1.8 PROJECT CLOSEOUT CONFERENCE

- A. Architect will schedule a project closeout conference, at a time convenient to Owner and Contractor, but no later than 90 days prior to the scheduled date of Substantial Completion.
- B. Mandatory Attendance: Owner, Owner's Resident Inspector, Owner's Testing Laboratory, Architect, and Contractor.
- C. Architect will preside at conference, record minutes, and distribute copies.
- D. Refer to Section 01 77 00 for additional closeout requirements.
- E. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 1. Submittal procedures for closeout documents.
 2. Preparation of Record Documents.

3. Procedures required prior to review for Substantial Completion and for final review for acceptance.
4. Procedures for completing and archiving web-based Project software site data files.
5. Submittal of written warranties.
6. Requirements for preparing operations and maintenance data.
7. Requirements for delivery of material samples, attic stock, and spare parts.
8. Requirements for demonstration and training.
9. Preparation of Contractor's punch list.
10. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
11. Coordination of separate contracts.
12. Owner's partial occupancy requirements.
13. Installation of Owner's furniture, fixtures, and equipment.
14. Responsibility for removing temporary facilities and controls.
15. DSA closeout and certification process.

1.9 POST CONSTRUCTION DEDICATION

- A. Attendance Required: Project superintendent, project manager, major subcontractors, Owner and Architect.
- B. Preparation prior to Dedication:
 1. Assist Owner in operation of mechanical systems.
 2. Verify operation and adjust controls for communication systems.
 3. Assist Owner in operation of lighting systems.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULE - NETWORK ANALYSIS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References.
- B. Performance requirements.
- C. Quality assurance.
- D. Qualifications.
- E. Project record documents.
- F. Submittals.
- G. Review and evaluation.
- H. Format.
- I. Cost and schedule reports.
- J. Early work schedule.
- K. Construction schedule.
- L. Short interval schedule.
- M. Requested time adjustment schedule.
- N. Recovery schedule.
- O. Updating schedules.
- P. Distribution.

1.2 REFERENCES

- A. Construction Planning and Scheduling Manual - A Manual for General Contractors and the Construction Industry, The Associated General Contractors of America (AGC).
- B. CSI - Construction Specifications Institute MP-2-1 Master Format.
- C. National Weather Service - Local Climatological Data.

1.3 PERFORMANCE REQUIREMENTS

- A. Ensure adequate scheduling during construction activities so work may be prosecuted in an orderly and expeditious manner within stipulated Contract Time.
- B. Ensure coordination of Contractor and subcontractors at all levels.
- C. Ensure coordination of submittals, fabrication, delivery, erection, installation, and testing of materials and equipment.
- D. Ensure on-time delivery of Owner furnished materials and equipment.

- E. Ensure coordination of jurisdictional reviews.
- F. Assist in preparation and evaluation of applications for payment.
- G. Assist in monitoring progress of work.
- H. Assist in evaluation of proposed changes to Contract Time.
- I. Assist in evaluation of proposed changes to Construction Schedule.
- J. Assist in detection of schedule delays and identification of corrective actions.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with Construction Planning and Scheduling Manual published by the AGC.
- B. Maintain one copy of document on site.
- C. In the event of discrepancy between the AGC publication and this section, provisions of this section shall govern.

1.5 QUALIFICATIONS

- A. Scheduler: Personnel or specialist consultant with 5 years minimum experience in scheduling construction work of a complexity and size comparable to this Project.
- B. Administrative Personnel: 5 years minimum experience in using and monitoring schedules on comparable projects.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 01 77 00.
- B. Submit one electronic file and three copies of final Record Construction Schedule which reflects actual construction of this Project.
- C. Record schedule shall be certified for compliance with actual way project was constructed.
- D. Receipt of Record Construction Schedule shall be a condition precedent to any retainage release or final payment.

1.7 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Within 7 days from the Notice of Award submit proposed Early Work Schedule and preliminary Cost Report defining activities for first 60 days of Work.
- C. Within 45 days from Notice of Award submit proposed Construction Schedule and final Cost Report.
- D. Submit updated Construction Schedule at least 10 days prior to each Application for Payment.
- E. Submit Short Interval Schedule at each Construction Progress Meeting.
- F. Submit Time Adjustment Schedule within 10 days of commencement of a claimed delay.
- G. Submit Recovery Schedules as required by completion of work.
- H. Submit one electronic file and three copies of each schedule and cost report.

1.8 REVIEW AND EVALUATION

- A. Early Work Schedule shall be reviewed during Preconstruction Conference with Owner and Architect.
- B. Within 5 days of receipt of Owner and Architect's comments provide satisfactory revision to Early Work Schedule or adequate justification for activities in question.
- C. Acceptance by Owner of corrected Early Work Schedule shall be a condition precedent to making any progress payments for first 60 days of Contract.
- D. Cost loaded values of Early Work Schedule shall be basis for determining progress payments during first 60 days of Contract.
- E. Participate in joint review of Construction Schedule and Reports with Owner and Architect.
- F. Within 7 days of receipt of Owner and Architect's comments provide satisfactory revision to Construction Schedule or adequate justification for activities in question.
- G. In the event that an activity or element of work is not detected by Owner or Architect review, such omission or error shall be corrected by next scheduled update and shall not affect Contract Time.
- H. Acceptance by Owner of corrected Construction Schedule shall be a condition precedent to making any progress payments after first 60 days of Contract.
- I. Cost-loaded values of Construction Schedule shall be basis for determining progress payments.
- J. Review and acceptance by Owner and Architect of Early Work Schedule or Construction Schedule does not constitute responsibility whatsoever for accuracy or feasibility of schedules nor does such acceptance expressly or impliedly warrant, acknowledge or admit reasonableness of activities, logic, duration, manpower, cost or equipment loading stated or implied on schedules.

1.9 FORMAT

- A. Prepare diagrams and supporting mathematical analyses using Precedence Diagramming Method, under concepts and methods outlined in AGC Construction Planning and Scheduling Manual.
- B. Listings: Reading from left to right, in ascending order for each activity.
- C. Diagram Size: 42 inches maximum height x width required.
- D. Scale and Spacing: To allow for legible notations and revisions.
- E. Illustrate order and interdependence of activities and sequence of work.
- F. Illustrate complete sequence of construction by activity.
- G. Provide legend of symbols and abbreviations used.

1.10 COST AND SCHEDULE REPORTS

- A. Activity Analysis: Tabulate each activity of network diagram and identify for each activity:
 - 1. Description.
 - 2. Interface with outside contractors or agencies.
 - 3. Number.
 - 4. Preceding and following number.
 - 5. Duration.

6. Earliest start date.
7. Earliest finish date.
8. Actual start date.
9. Actual finish date.
10. Latest start date.
11. Latest finish date.
12. Total and free float.
13. Identification of critical path activity.
14. Monetary value keyed to Schedule of Values.
15. Manpower requirements.
16. Responsibility.
17. Percentage complete.
18. Variance positive or negative.

B. Cost Report: Tabulate each activity of network diagram and identify for each activity:

1. Description.
2. Number.
3. Total cost.
4. Percentage complete.
5. Value prior to current period.
6. Value this period.
7. Value to date.

C. Required Sorts: List activities in sorts or groups:

1. By activity number.
2. By amount of float time in order of early start.
3. By responsibility in order of earliest start date.
4. In order of latest start dates.
5. In order of latest finish dates.
6. Application for payment sorted by Schedule of Values.
7. Listing of activities on critical path.
8. Listing of basic input data which generates schedule.

1.11 EARLY WORK SCHEDULE

- A. Shall establish scope of work to be performed during first 60 days of Contract.
- B. Shall designate critical path or paths.
- C. Shall contain the following phases and activities:
 - 1. Procurement activities to include mobilization, shop drawings and sample submittals.
 - 2. Identification of key and long-lead elements and realistic delivery dates.
 - 3. Construction activities in units of whole days limited to 14 days for each activity except non-construction activities for procurement and delivery.
 - 4. Approximate cost and duration of each activity.
- D. Shall contain seasonal weather considerations. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.
- E. Activities shall be incorporated into Construction Schedule.
- F. No application for payment will be evaluated or processed until Early Work Schedule has been submitted and reviewed.
- G. Shall be updated on a monthly basis while Construction Schedule is being developed.
- H. Failure to submit an adequate or accurate Early Work Schedule or failure to submit on established dates will be considered a substantial breach of Contract.

1.12 CONSTRUCTION SCHEDULE

- A. Include Early Work Schedule as first 60 days of Construction Schedule.
- B. Shall be a computer generated time scaled network diagram of activities.
- C. Indicate a completion date for project that is no later than required completion date subject to any time extensions processed as part of a change order.
- D. Conform to mandatory dates specified in the Contract Documents.
- E. Should schedule indicate a completion date earlier than any required completion date, Owner or Architect shall not be liable for any costs should project be unable to be completed by such date.
- F. Seasonal weather shall be considered in planning and scheduling of all work. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.
- G. Level of detail shall correspond to complexity of work involved.
- H. Indicate procurement activities, delivery, and installation of Owner furnished material and equipment.
- I. Designate critical path or paths.
- J. Subcontractor work at all levels shall be included in schedule.
- K. As developed shall show sequence and interdependence of activities required for complete performance of Work.
- L. Shall be logical and show a coordinated plan of Work.

- M. Show order of activities and major points of interface, including specific dates of completion.
- N. Duration of activities shall be coordinated with subcontractors and suppliers and shall be best estimate of time required.
- O. Shall show description, duration and float for each activity.
- P. Failure to include any activity shall not be an excuse for completing all work by required completion date.
- Q. No activity shall have a duration longer than 14 days or a value over \$20,000.00 except non-construction activities for procurement and delivery.
- R. An activity shall meet the following criteria:
 - 1. Any portion or element of work, action, or reaction that is precisely described, readily identifiable, and is a function of a logical sequential process.
 - 2. Descriptions shall be clear and concise. Beginning and end shall be readily verifiable. Starts and finishes shall be scheduled by logical restraints.
 - 3. Responsibility shall be identified with a single performing entity.
 - 4. Additional codes shall identify building, floor, bid item and CSI classification.
 - 5. Assigned dollar value (cost-loading) of each activity shall cumulatively equal total contract amount. Mobilization, bond and insurance costs shall be separate. General requirement costs, overhead, profit, shall be prorated throughout all activities. Activity costs shall correlate with Schedule of Values.
 - 6. Each activity shall have manpower-loading assigned.
 - 7. Major construction equipment shall be assigned to each activity.
 - 8. Activities labeled start, continue or completion are not allowed.
- S. For major equipment and materials show a sequence of activities including:
 - 1. Preparation of shop drawings and sample submissions.
 - 2. Review of shop drawings and samples.
 - 3. Finish and color selection.
 - 4. Fabrication and delivery.
 - 5. Erection or installation.
 - 6. Testing.
- T. Include a minimum of 15 days prior to completion date for punch lists and clean up. No other activities shall be scheduled during this period.

1.13 SHORT INTERVAL SCHEDULE

- A. Shall be fully developed horizontal bar-chart-type schedule directly derived from Construction Schedule.
- B. Prepare schedule on sheet of sufficient width to clearly show data.
- C. Provide continuous heavy vertical line identifying first day of week.
- D. Provide continuous subordinate vertical line identifying each day of week.

- E. Identify activities by same activity number and description as Construction Schedule.
- F. Show each activity in proper sequence.
- G. Indicate graphically sequences necessary for related activities.
- H. Indicate activities completed or in progress for previous 2 week period.
- I. Indicate activities scheduled for succeeding 2 week period.
- J. Further detail may be added if necessary to monitor schedule.

1.14 REQUESTED TIME ADJUSTMENT SCHEDULE

- A. Updated Construction Schedule shall not show a completion date later than the Contract Time, subject to any time extensions processed as part of a Change Order.
- B. If an extension of time is requested, a separate schedule entitled "Requested Time Adjustment Schedule" shall be submitted to Owner and Architect.
- C. Indicate requested adjustments in Contract Time which are due to changes or delays in completion of work.
- D. Extension request shall include forecast of project completion date and actual achievement of any dates listed in Agreement.
- E. To the extent that any requests are pending at time of any Construction Schedule update, Time Adjustment Schedule shall also be updated.
- F. Schedule shall be a time-scaled network analysis.
- G. Accompany schedule with formal written time extension request and detailed impact analysis justifying extension.
- H. Time impact analysis shall demonstrate time impact based upon date of delay, and status of construction at that time and event time computation of all affected activities. Event times shall be those as shown in latest Construction Schedule.
- I. Activity delays shall not automatically constitute an extension of Contract Time.
- J. Failure of subcontractors shall not be justification for an extension of time.
- K. Float is not for the exclusive use or benefit of any single party. Float time shall be apportioned according to needs of project.
- L. Float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity durations, or imposed dates shall be apportioned according to benefit of project.
- M. Extensions will be granted only to extent that time adjustments to activities exceed total positive float of the critical path and extends Contract completion date.
- N. Owner shall not have an obligation to consider any time extension request unless requirements of Contract Documents, and specifically, but not limited to these requirements are complied with.
- O. Owner shall not be responsible or liable for any construction acceleration due to failure of Owner to grant time extensions under Contract Documents should requested adjustments in Contract Time not substantially comply with submission and justification requirements of Contract for time extension requests.
- P. In the event a Requested Time Adjustment Schedule and Time Impact Analysis are not submitted within 10 days after commencement of a delay it is mutually agreed that delay does not require a Contract time extension.

1.15 RECOVERY SCHEDULE

- A. When activities are behind Construction Schedule a supplementary Recovery Schedule shall be submitted.
- B. Form and detail shall be sufficient to explain and display how activities will be rescheduled to regain compliance with Construction Schedule.
- C. Maximum duration shall be one month and shall coincide with payment period.
- D. Ten days prior to expiration of Recovery Schedule verification to determine if activities have regained compliance with Construction Schedule will be made. Based upon this verification the following will occur:
 - 1. Supplemental Recovery Schedule will be submitted to address subsequent payment period.
 - 2. Construction Schedule will be resumed.

1.16 UPDATING SCHEDULES

- A. Review and update schedule at least 10 days prior to submitting an Application for Payment.
- B. Maintain schedule to record actual prosecution and progress.
- C. Approved change orders which affect schedule shall be identified as separate new activities.
- D. Change orders of less than \$20,000.00 value or less than 3 days duration need not be shown unless critical path is affected.
- E. No other revisions shall be made to schedule unless authorized by Owner.
- F. Provide narrative Progress Report at time of schedule update which details the following:
 - 1. Activities or portions of activities completed during previous reporting period.
 - 2. Actual start dates for activities currently in progress.
 - 3. Deviations from critical path in days ahead or behind.
 - 4. List of major construction equipment used during reporting period and any equipment idle.
 - 5. Number of personnel by craft engaged on Work during reporting period.
 - 6. Progress analysis describing problem areas.
 - 7. Current and anticipated delay factors and their impact.
 - 8. Proposed corrective actions and logic revisions for Recovery Schedule.
 - 9. Proposed modifications, additions, deletions and changes in logic of Construction Schedule.
- G. Schedule update will form basis upon which progress payments will be made.
- H. Owner will not be obligated to review or process Application for Payment until schedule and Progress Report have been submitted.

1.17 DISTRIBUTION

- A. Following joint review and acceptance of updated schedules distribute copies to Owner, Architect, and all other concerned parties.
- B. Instruct recipients to promptly report in writing any problem anticipated by projections shown in schedule.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Related submittals.
- B. Architect's digital data files.
- C. Proposed products list.
- D. Processing time.
- E. Submittal review.
- F. Submittal procedures - paper submittals.
- G. Shop drawings - paper submittals.
- H. Submittal procedures - electronic submittals.
- I. Shop drawings - electronic submittals.
- J. Product data.
- K. Samples.
- L. Manufacturers' instructions.
- M. Manufacturers' certificates.
- N. Submittal schedule.

1.2 RELATED SUBMITTALS

- A. Progress Payments: Section 01 20 00- Price and Payment Procedures.
- B. Schedule of Values: Section 01 20 00- Price and Payment Procedures.
- C. Substitutions: Section 01 25 13 – Product Substitution Procedures.
- D. Coordination Drawings: Section 01 31 00 - Project Management and Coordination.
- E. Construction Schedule: Section 01 32 16 - Construction Schedule - Network Analysis.
- F. Tests and Inspections: Section 01 45 29 – Testing Laboratory Services.
- G. Certified Final Property Survey: Section 01 73 00 – Execution Requirements.
- H. Waste Reduction Progress Reports: Section 01 74 19 - Construction Waste Management and Disposal.
- I. Closeout Procedures: Section 01 77 00 – Closeout Procedures.
- J. The General Conditions set forth additional requirements for submittals.

1.3 ARCHITECT'S DIGITAL DATA FILES

- A. Upon written request, Architect's electronic CAD files will be provided for use in connection with preparation of shop drawings subject to the acceptance of the Architect's standard terms and conditions for electronic file transfer.

1.4 PROPOSED PRODUCTS LIST

- A. Within fourteen days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, model number, and designated specification section of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PROCESSING TIME

- A. Time period for review of submittals will commence upon receipt of submittal by Architect.
- B. Initial Review: Allow ten working days for each submittal.
- C. Resubmittal Review: Allow ten working days for each resubmittal.
- D. Sequential Review: Allow fifteen working days for initial and resubmittal review of each submittal where review is required by Architect's consultant's, Owner or other parties indicated.

1.6 SUBMITTAL REVIEW

- A. The Architect's review is only for general conformance with design concept and Contract requirements. Contractor is responsible for compliance with Contract Documents, dimensions, quantities, fit and coordination with other Work. Review does not authorize substitutions, exclusions and limitations to Contract requirements unless specifically requested by Contractor and acknowledged by Architect.
- B. Definitions for submittal review:
 - 1. Review Completed - Do Not Resubmit: The Work covered by the submittal has been reviewed by the Architect and may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 2. Revise as Noted - Do Not Resubmit: The Work covered by the submittal has been reviewed by the Architect and may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
 - 3. Revise as Noted - Resubmit for Record: The Work covered by the submittal has been reviewed by the Architect and the submittal is to be revised according to the Architect's notations and corrections and a new submittal is to be made. Do not proceed with the Work covered by the submittal. Once the revised submittal is received it will be reviewed again by the Architect and retained as the record submittal. Once reviewed, the Work may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 4. Not Acceptable - Make New Submittal: Do not proceed with the Work covered by the submittal. Prepare a new submittal that complies with the Contract Documents. Once the revised submittal is received it will be reviewed again by the Architect. Once reviewed, the Work may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 5. Comment Box / Line: This line is for the Architect to take other action as may be appropriate for the actual submittal made. Notations may include a request for additional items or a statement regarding the submittal. This area can also be used in conjunction with other boxes that have been marked.

1.7 SUBMITTAL PROCEDURES - PAPER SUBMITTALS

- A. Transmit each submittal in conformance with requirements of this section.
- B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphanumeric suffix.
- C. Identify Project and Architect's project number, Contractor, Subcontractor or supplier; pertinent Drawing and detail number(s), and specification Section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals without Contractor's stamp and signature will be returned without review.
- E. Schedule submittals to expedite the Project, and deliver to Architect at 8163 Rochester Avenue, Suite 100, Rancho Cucamonga, CA 91730. Coordinate submission of related items.
- F. Make submittals in groups containing associated and related items to make sure that information is available for checking each item when it is received.
- G. Submittals for all items requiring color selection must be received before any will be selected.
- H. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- I. Make submittals in advance of scheduled dates for installation to allow specified time for review, revisions, and resubmission prior to final review and subsequent placement of orders.
- J. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit proper processing.
- K. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- L. Provide space for Contractor and Architect review stamps.
- M. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- N. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- O. Partial submittals will be considered non responsive and will be returned without review.
- P. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.
- Q. Architect will not review submittals that contain material safety data sheets (MSDS) and will return them for resubmittal.
- R. Substitutions will not be considered when they are indicated or implied on submittals without separate written request as required by provisions of Section 01 25 13 - Product Substitution Procedures.

1.8 SHOP DRAWINGS - PAPER SUBMITTALS

- A. Submit six prints of each drawing. Four copies will be retained by Architect.
- B. Review comments will be shown on returned print. Contractor will make and distribute copies as required for his purpose.

- C. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.
- D. Do not reproduce Contract Documents or copy standard information and submit as shop drawings.
- E. Standard information prepared without specific reference to project requirements will not be considered a shop drawing.
- F. Do not use or allow others to use shop drawings which have been submitted and have been rejected.

1.9 SUBMITTAL PROCEDURES - ELECTRONIC SUBMITTALS

- A. Transmit each electronic submittal in conformance with requirements of this section.
- B. Submittals for all items requiring color selections will not be accepted as an electronic submittal.
- C. Assemble complete submittal package into a single indexed Portable Document Format (PDF) file. File format licensed by Adobe Systems.
- D. Transmit electronic submittals as PDF files via Architect's Project Collaboration Site address or designated e mail address.
- E. Transmittal form for submittals shall be an electronic form acceptable to the Architect which identifies the Project, the Architect's project number, the Contractor, the Subcontractor or material supplier; pertinent Drawing and detail number(s), and specification Sections, as appropriate.
- F. Provide links enabling navigation to each item of submittal package.
- G. Name electronic submittal file with consistent project identifier composed of Architect's project number, Architect's alpha numeric file designation, and specification section number followed by sequential number. (e.g., 0920800-56-SUB - 06412-01.pdf)
- H. Resubmittals shall include an alphabetic suffix after initial point number. (e.g., 0920800-56-SUB – 06412-01-A.pdf)
- I. Resubmittals shall identify all changes made since previous submittal.
- J. Insert Contractor's review stamp to permanently record Contractor's action.
- K. Contractor's stamp shall be signed or initialed certifying that review, verification of Products required, field dimensions, adjacent work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- L. Submittals without Contractor's stamp and signature will be returned without review.
- M. Provide space for Architect's electronic review stamp.
- N. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- O. Make submittals in advance of scheduled dates for installation to allow specified time for review, revisions, and resubmission prior to final review and subsequent placement of orders.
- P. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit proper processing.
- Q. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

- R. Contractor shall reproduce and distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- S. Partial submittals will be considered non responsive and will be returned without review.
- T. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.
- U. Architect will not review submittals that contain material data safety sheets (MSDS) and will return them for resubmittal.
- V. Substitutions will not be considered when they are indicated or implied on submittals without separate written request as required by provisions of Section 01 25 13 - Product Substitution Procedures.

1.10 SHOP DRAWINGS - ELECTRONIC SUBMITTALS

- A. Submit electronic copy of shop drawings in PDF format as specified in this section.
- B. Review comments will be indicated on reviewed document.
- C. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.
- D. Do not reproduce Contract Documents or copy standard information and submit as shop drawings.
- E. Standard information prepared without specific reference to project requirements will not be considered a shop drawing.
- F. Do not use or allow others to use shop drawings which have been submitted and have been rejected.

1.11 PRODUCT DATA

- A. When specified in individual specification sections, submit copies of data for each product which Contractor requires.
- B. Submit six copies of product data made in paper format. Four copies will be retained by Architect.
- C. Electronic submittals for product data will comply with Article for electronic submittal procedures stated in this section.
- D. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.
- E. Manufacturer's standard product data or catalogs that do not indicate materials or products that are specific to project will be returned without review.
- F. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.

1.12 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Include identification on each sample, with full Project information.
- C. Submit the number of samples which Contractor requires, plus two which will be retained by Architect.
- D. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

- E. Submittals for all items requiring color selection must be received before any will be selected.
- F. If a variation in color, pattern, texture or other characteristic is inherent within the material or product submitted, sample shall approximate limits of variation.

1.13 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.14 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturer's certificate to Architect for review, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect.

1.15 DEFERRED APPROVAL REQUIREMENTS

- A. Installation of deferred approval items shall not be started until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Engineer in general responsible charge of design and signed by a California registered Architect or professional engineer who has been delegated responsibility covering the work shown on a particular plan or specification and approved by the Division of the State Architect. Deferred approval items for this project are the following items:
 - 1. Aluminum Entrances and Storefronts - Section 08 41 13.
- B. Deferred approval drawings and specifications become part of the approved documents for the project when they are submitted to and approved by the Division of the State Architect.
- C. Deferred approval items shall be submitted no later than 60 days after Notice to Proceed.
- D. Submit four prints of each drawing.
- E. Submit four copies of calculations, product data and test reports.
- F. Identify and specify all supports, fasteners, spacing, penetrations, etc., for each of the deferred approval items, including calculations for each and all fasteners.
- G. Submit documents to Architect for review.
- H. Documents shall bear the stamp and signature of the Structural, Mechanical, or Electrical Engineer licensed in the State of California who is responsible for the work shown on the documents.
- I. Architect will forward submittal to project Structural, Mechanical, and Electrical Engineer.
- J. Review of project Architect, Structural, Mechanical, and Electrical Engineer is only for conformance with design concept shown on the documents.
- K. After review by Architect/Engineer, Architect will forward two copies of submittal to the Division of the State Architect for approval.
- L. Respond to review comments made by the Division of the State Architect and revise and resubmit submittal for final approval.

- M. Architect will forward two copies of final revised submittal to the Division of the State Architect for approval.
- N. The Division of the State Architect will return one copy of final submittal to the Architect.
- O. Architect will forward one copy of evidence of submittal approval by the Division of the State Architect for final distribution by the Contractor.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 SUBMITTAL SCHEDULE

END OF SECTION

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products and installation for altering, patching and extending Work.
- B. Transition and adjustments.
- C. Repair of damaged surfaces, finishes, and cleaning.
- D. Fire prevention.

1.2 DEFINITIONS

- A. Protect and Maintain: To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.
- B. Repair: To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Repair also includes limited replacement to match existing, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.
- C. Replace: To duplicate and replace entire features with new material to match existing. Replacement includes the following conditions:
 - 1. Duplication: Includes replacing elements damaged beyond repair or missing. Original material is indicated as the pattern for creating new duplicated elements.
 - 2. Replacement with New Materials: Includes replacement with new material when original material is not available as patterns for creating new duplicated elements.
 - 3. Replacement with Substitute Materials: Includes replacement with compatible substitute materials. Substitute materials are not allowed, unless otherwise indicated.
- D. Remove: To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- E. Remove and Salvage: To detach items from existing construction and deliver them to Owner.
- F. Remove and Reinstall: To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.
- G. Existing to Remain or Retain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.
- H. Match Existing: Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.
- I. Refinish: To remove existing finishes to base material and apply new finish to match original.

1.3 SUBMITTALS

- A. If alternate methods and materials to those indicated are proposed for any work, provide written description of proposed methods and comparable products.

- B. Where existing conditions may be misconstrued as damage caused by alteration procedures submit evidence of adjacent construction before work begins.

1.4 QUALITY ASSURANCE

- A. Qualifications: An experienced firm regularly engaged in similar alteration Work specified in this Section.
- B. Lead Paint: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40CFR 745, Subpart E, and shall use only workers that are trained in lead-safe work practices.
- C. Dust and Noise Control: Provide temporary dust and noise-control partitions when required by alteration operations. Do not block means of egress from occupied spaces.
- D. Debris Hauling: Define hauling routes and provide temporary protective coverings.
- E. Fire-Prevention: Comply with NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations. Prepare a written plan for preventing fires during prosecution of the Work. Indicate placement of fire extinguishers, rag buckets, and other fire-control devices. Coordinate with Owner's fire-protection equipment. Include fire-watch personnel when required by alteration operations.
- F. Safety and Health Standard: Comply with ANSI/ASSE A10.6, Safety and Health Program Requirements for Demolition Operations.

1.5 FIELD CONDITIONS

- A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs.
- B. Discrepancies: Notify Architect of discrepancies between existing conditions and Contract Documents before proceeding with the Work.
- C. Owner's Removal: Before beginning alteration Work, verify with Owner that all items of importance to them have been removed.
- D. Size Limitations of Existing Space: Materials, products, and equipment used for performing Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms and openings.

1.6 PEDESTRIAN AND VEHICULAR CIRCULATION

- A. Coordinate alteration Work with circulation paths.
- B. Circulation patterns cannot be closed off entirely and can only be redirected around small areas.
- C. Plan and execute the Work accordingly.

2. PART 2 PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

- A. New Materials: As specified in product Sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspection and testing products where necessary, referring to existing Work as a standard.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that demolition is complete, and areas are ready for installation of new Work.
- B. Beginning of alteration Work means acceptance of existing conditions.

3.2 FIRE PREVENTION

- A. Comply with NFPA 241 requirements.
- B. Remove and keep area free of combustible rubbish, paper, waste, and chemicals.
- C. Heat-Generating Activities: Comply with the following procedures while performing heat-generating procedures including welding, torch-cutting, soldering, brazing, removing paint by heat, or other procedures with open flames.
 - 1. As far as practical, restrict heat generating activities to area outside the building.
 - 2. Do not perform heat generating activities in or near rooms that contain flammable liquids or explosive vapors.
 - 3. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature materials from reaching surrounding combustible materials.
 - 4. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings and roofs.
 - 5. Fire Watch: Before working with heat generating activities, employ personnel to serve as fire watch at each location where such work will be performed. Fire watch procedures shall be implemented according to NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work and NFPA 241.
 - (a) Prohibit fire watch personnel from other work that would distract them from fire-watch duties.
 - (b) Cease work for heat generating activities whenever fire-watch personnel are not present.
 - (c) Fire-watch personnel shall perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of heat generating activities.
 - (d) Fire-watch personnel shall maintain their duties at each area of heat generating activities until 60 minutes after conclusion of daily work.
 - 6. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids.
 - 7. Fire Sprinklers: Where fire sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. Protect sprinklers from damage by operations. Remove protection when operations are complete.

3.3 PREPARATION

- A. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- C. Remove debris and abandoned items from area and from concealed spaces.
- D. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.

- E. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

3.4 INSTALLATION

- A. Coordinate work of alterations and renovations to expedite completion and to accommodate Owner occupancy.
- B. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring products and finishes to original or specified condition.
- C. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
- D. Install products as specified in individual Sections.

3.5 TRANSITIONS

- A. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patched Work to match existing adjacent Work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new work is not possible, request instructions from Architect.

3.6 ADJUSTMENTS

- A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Where a change of plane of 1/8 inch or more occurs, request instructions from Architect.
- C. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
- D. Fit work at penetrations of surfaces as specified in Section 01 73 29.

3.7 REPAIR OF DAMAGED SURFACES

- A. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
- B. Repair substrate prior to patching finish.

3.8 FINISHES

- A. Finish surfaces as specified in individual Product Sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.9 CLEANING

- A. Match samples of existing materials that have been cleaned and identified for acceptable cleaning levels.
- B. Avoid over cleaning to prevent damage to existing materials.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Definitions.
- B. Specification format and content.
- C. Industry standards.
- D. Codes and standards.
- E. Governing regulations/authorities.

1.2 DEFINITIONS

- A. General: Basic contract definitions are included in the General Conditions.
- B. Regulations: Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work.

1.3 SPECIFICATION FORMAT AND CONTENT

- A. Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 50-Division Master Format 2018 numbering system.
- B. The sections are placed in the Project Manual in numeric sequence; however, this sequence is not complete and the Table of Contents of the specifications must be consulted to determine the total listing of sections.
- C. The section title is not intended to limit the meaning or content of the section, nor to be fully descriptive of the requirements specified therein.
- D. The organization of the specifications shall not control the division of the work among subcontractors or establish the extent of work to be performed by any trade.
- E. Specifications use certain conventions regarding style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are:
 - 1. Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable to maintain the context of the Contract Document indicated.
 - 2. Imperative and streamlined language is generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 - 3. The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. Except where Contract Documents include more stringent requirements, applicable construction industry standards shall apply as if bound into the Contract Documents to the extent referenced. Such standards are made part of Contract Documents by reference.
- B. Conform to reference standard by date of issue current on date for receiving bids except when a specific date is indicated.
- C. Where compliance with 2 or more standards is specified and where standards may establish different or conflicting requirements for quantities or quality levels, the more stringent, higher quality and greater quantity of work shall apply.
- D. The quantity or quality level shown or specified shall be the minimum provided or performed. Indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements.
- E. Each entity engaged in construction of the work is required to be familiar with industry standards applicable to its construction activity.
- F. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required activity, Contractor shall obtain copies directly from publication source.
- G. Trade associations names and titles of general standards are frequently abbreviated. Where such abbreviations are used in the Specifications or other Contract Documents, they shall mean the recognized trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the content of the text provision. Refer to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.
- H. Refer to individual specification sections and related drawings for names and abbreviations of trade associations and standards applicable to specific portions of the work. In particular, refer to Division 23 for names and abbreviations applicable to mechanical work, and refer to Division 26 for names and abbreviations applicable to electrical work.
- I. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 CODES AND STANDARDS

- A. Latest edition of pertaining ordinances, laws, rules, codes, regulations, standards, and others of public agencies having jurisdiction of the work are intended wherever reference is made in either the singular or plural to Code or Building Code except as otherwise specified, including but not limited to latest edition of those in the following listing.
 - 1. 2016 California Building Standards Administrative Code (CBSAC), California Code of Regulations (CCR), Title 24, Part 1
 - 2. 2016 California Building Code (CBC) California Code of Regulations (CCR) Title 24, Part 2 (2015 International Building Code (IBC) with California amendments)
 - 3. 2016 California Electrical Code (CEC) California Code of Regulations (CCR) Title 24, Part 3 (2014 National Electric Code (NEC) with California amendments)
 - 4. 2016 California Mechanical Code (CMC) California Code of Regulations (CCR) Title 24, Part 4 (2015 Uniform Mechanical Code (UMC) with California amendments)
 - 5. 2016 California Plumbing Code (CPC) California Code of Regulations (CCR) Title 24, Part 5 (2015 Uniform Plumbing Code (UPC) with California amendments)

6. 2016 California Energy Code, California Code of Regulations (CCR) Title 24, Part 6
7. 2019 California Fire Code (CFC) California Code of Regulations (CCR) Title 24, Part 9 (2015 International Fire Code (IFC) with California Amendments)
8. State Fire Marshal Regulations California Code of Regulations (CCR) Title 19 (As amended to date)
9. 2016 California Green Building Standards Code (CALGreen) California Code of Regulations (CCR) Title 24, Part 11.
10. 2016 State Referenced Standards Code (CRSC) California Code of Regulations (CCR) Title 24, Part 12
11. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design. (ADAS)

1.6 GOVERNING REGULATIONS/AUTHORITIES

- A. Authorities having jurisdiction have been contacted where necessary to obtain information for preparation of Contract Documents. Contact authorities having jurisdiction directly for information having a bearing on the work.
- B. Comply with all federal, state and local laws, ordinances, rules and regulations indicated and which bear on the conduct of the work.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 43 00

QUALITY ASSURANCE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interpretation of requirements.
- B. Quality assurance and control of installation.
- C. Tolerances.
- D. Field samples.
- E. Mock-up.
- F. Manufacturers' field services and reports.

1.2 INTERPRETATION OF REQUIREMENTS

- A. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
- B. The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation shall comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.
- C. Where codes or specified standards indicate higher standards, more stringent tolerances or more precise workmanship than levels shown or specified, comply with most stringent requirements.
- D. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and - control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
- E. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- F. Comply fully with manufacturers' instructions, including each step in sequence.
- G. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

- H. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 TOLERANCES

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

1.5 FIELD SAMPLES

- A. Install field samples at the site as required by individual specifications sections for review.
- B. Acceptable samples represent a quality level for the Work.
- C. Where field sample is specified in individual sections to be removed, clear area after field sample has been reviewed by Architect.

1.6 MOCK-UP

- A. Mock-up will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.
- C. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- D. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been reviewed by Architect.

1.7 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment and other field services as applicable, and to initiate instructions when necessary.
- B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit report in duplicate within 15 days of observation to Architect for review.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 GENERAL INSTALLATION

- A. Comply with requirements specified in Section 01 73 00.

3.2 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.3 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selection and payment.
- B. Contractor submittals.
- C. Laboratory responsibilities.
- D. Laboratory reports.
- E. Limits on testing laboratory authority.
- F. Contractor responsibilities.
- G. Schedule of inspections and tests.
- H. Test and inspection form.

1.2 REFERENCES

- A. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- B. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- C. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- D. CBC - California Building Code, Title 24, Part 2 of the California Code of Regulations (CCR).
- E. DSA - Division of the State Architect, Office of Regulation Services, Structural Safety Section.
- F. IR - Interpretation of Regulation Documents, Division of the State Architect.

1.3 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory approved by DSA to perform specified inspection and testing as specified by Owner's testing laboratory.
- B. Owner will pay cost of testing and inspection except the following for which the Contractor shall reimburse the Owner through deductive change order:
 - 1. Any retesting and sampling required due to failure of original test.
 - 2. Any testing and inspection required to be performed that requires testing laboratory or agency to perform services outside the state of California.
 - 3. Concrete design mix.
 - 4. Additional testing expenses caused by failure of the Contractor to adhere to construction schedule or caused by failure of the Contractor to give proper advanced notice or caused by Contractor delay.
- C. Contractor shall employ and pay for services required to perform specified inspection and testing specified as Contractor responsibility.

- D. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.4 QUALITY ASSURANCE

- A. Comply with requirements of ASTM E329 and ASTM D3740.
- B. Laboratory Staff: Maintain a full time registered engineer on staff to review services.
- C. Testing Equipment: Capable of performing tests required calibrated at reasonable intervals with devices acceptable to the National Bureau of Standards.
- D. All testing agency management, laboratory, and field supervisory personnel shall have at least five years experience in the inspection and testing of work and materials of construction.
- E. Testing laboratory shall maintain a current letter of acceptance issued by the Division of the State Architect (DSA) demonstrating that it has met the criteria established by the Division of the State Architect for performance of inspection work and testing of materials. Laboratory to furnish copy of acceptance letter upon request.

1.5 OWNER'S TESTING LABORATORY RESPONSIBILITIES

- A. Test samples of mixes submitted by Inspector.
- B. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
- C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
- F. Perform additional inspections and tests required by Architect.
- G. Attend preconstruction conferences and progress meetings when requested by Architect.

1.6 LABORATORY REPORTS

- A. After each inspection and test, promptly submit within no more than 14 days of the date of the inspection or test one copy of laboratory report to Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and to Contractor. Reports of test results of materials and inspections found not to be in compliance with the requirements of the Contract Documents shall be forwarded immediately to the Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and the Contractor.
- B. Include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and Specifications section.
 - 6. Location in the Project.
 - 7. Type of inspection or test.
 - 8. Date of test.

9. Ambient conditions at time of test or sample-taking.
 10. Results of tests and interpretation of test results.
 11. Professional opinion as to whether tested work is in conformance with Contract Documents.
 12. Recommendations on retesting.
- C. Verification of Test Reports: Each testing agency shall submit to the Architect and the Division of the State Architect a verified report in duplicate covering all of the tests which were required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time and at the completion of the project, covering all tests.

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Submit proposed mix designs to Architect for review in accordance with Section 03 30 00.
- B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.
- C. Notify Architect, Owner's Resident Inspector and testing laboratory 48 hours prior to expected time for operations requiring inspection and testing services.
 1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to the Contractor's negligence.
 2. The Contractor shall notify the Owner's representative a sufficient time 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 Owner may arrange for the testing of same at the source of supply.
 3. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.
- D. Employ and pay for services of Owner's testing laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with contract documents.

1.9 SCHEDULE OF INSPECTIONS AND TESTS BY OWNER'S TESTING LABORATORY

- A. Perform tests and inspections for the following in conformance with the (CBC) 2016 California Building Code (International Building Code with State of California Amendments), Title 24, Part 2, of the California Code of Regulations (CCR).
 1. Structural Tests and Special Inspections
 - (a) General - 1701A
 - (b) Approvals - 1703A
 - (c) Special Inspections - 1704A
 - (1) Structural Steel - 1705A.2 and Table 1705A.2.1

- (2) Welding - 1705A.2.5 and Table 1705A.2.1.
- (3) High Strength Fasteners - Table 1705A.2.1
- (4) Concrete - 1705A.3 Table 1705A.3 and 1910A
- (5) Post Installed Anchors In Concrete - Table 1705A.3, 1910A.5
- (6) Masonry - 1705A.4, TMS 402 and TMS 602 Table 3 and 4
- (7) Post Installed Anchors in Masonry - 1705A.4 and 1910A.5
- (8) Wood - 1705A.5
- (9) Soils - 1705A.6 and Table 1705A.6
- (10) Pier Foundation - 1705A.8 and Table 1705A.8
- (11) Exterior Insulation and Finish Systems - 1705A.16
- (12) Water-Resistive Barrier - 1705A.16.1
- (13) Penetration Fire Stops and Joints - 1705A.17
- (14) Smoke Control Systems - 1705A.18
- (d) Special Inspections for Seismic Resistance - Section 1705A.12
 - (1) Structural Steel - Continuous Inspection, Welding - 1705A.12.1, 1705A.2.1, 1705A.2.5
 - (2) Structural Wood - Continuous and Periodic Inspection - 1705A.11.1 and 1705A.12.2
 - (5) Architectural Components - Periodic Inspection - 1705A.12.5
 - (6) Mechanical and Electrical Components - Periodic Inspection - 1705A.12.6
 - (7) Designated Seismic Systems - Verification - 1705A.13.3
- 2. Foundations (Chapter 18A)
 - (a) Earth fill compaction - 1803A.5.8
 - (b) Observation of Caissons - Table 1705A.8
- 3. Concrete (Chapter 19A)
 - (a) Concrete Inspection
 - (1) Portland Cement Tests - 1910A.1
 - (2) Reinforcing Bars Table - 1705A.2.1, 1910A.2
 - (3) Waiver of Reinforcing Bar Tests - 1910A.2
 - (4) Batch Plant Inspection - 1705A.3.3
 - (5) Waiver of Batch Plant Inspection - 1705A.3.3.1, 1705A.3.3.2
 - (6) Frequency of Tests for Concrete - A1.16

- (b) Concrete Quality
 - (1) Proportions of Concrete - 1903A, 1904A, 1905A
- (c) Job Site Inspection
 - (1) Site Placement Inspection - 1705A.3.5
- (d) Anchors in Concrete
 - (1) Drilled-In-Expansion Bolts or Epoxy-Type Anchors in Concrete - 1910A.5
- 4. Masonry (Chapter 21A)
 - (a) Materials
 - (1) Masonry Units - 2103A.1
 - (2) Mortar - 2103A.2
 - (3) Grout - 2103A.3
 - (4) Grout Aggregates - 2103A.3.1
 - (5) Reinforcing Bars - 2103A.4
 - (b) Masonry Tests
 - (1) General - 2105A.1, 1705A.4, TMS 402 and TMS 602, Table 3 and 4
 - (2) Masonry Tests - 2105A.2
 - (3) Mortar and Grout - 2105A.3
 - (4) Masonry Core Tests -2105A.4
- 5. Structural Steel (Chapter 22A)
 - (a) Materials
 - (1) Material Identification - 2203A
 - a) Anchor Bolt - DSA IR 17-11
 - (2) Inspection and Tests of Structural Steel 1705A.2
 - (3) Tests of H.S. Bolts, Nuts, Washers - 2213A.1
 - (4) Tests of End Welded Studs - 2213A.2
 - (5) Shop Fabrication Inspection - 1704A.2.5
 - (6) High Strength Bolt Inspection - 1705A.2.6 - Table 1705A2.1, 2213A.1
 - (7) Welding Inspection - 1705A.2.5 and Table 1705A.2.1
 - (8) Non-Destructive Weld Testing - DSA IR 17-2

- 6. Wood (Chapter 23)
 - (a) Materials
 - (1) Lumber and Plywood Grading - 2303
 - (2) Wood Structural Panels - 2303.1.5
 - (3) Fiberboard - 2303.1.6
 - (4) Hardboard - 2303.1.7
 - (5) Preservative Treatment - 2303.1.9
 - (6) Fire-Retardant Treated Wood - 2303.2
 - (b) Wood Inspection
 - (1) Timber Connectors - 1705A.5.6

- 7. Roof Covering (Chapter 15)
 - (a) Installation
 - (1) Roof Tile - 1507.3.10, 1513

- 8. Aluminum (Chapter 20)
 - (a) Materials
 - (1) General - 2002.1
 - (b) Inspection
 - (1) Testing and Inspection - 2003.1

- 9. Remotely Fabricated Construction Elements
 - (a) Testing and Inspection - DSA IR A-15

B. Special Inspection - 1704 - As indicated on the drawings.

C. Perform additional test required by individual Specification Sections.

1.10 SCHEDULE OF INSPECTIONS AND TESTS BY CONTRACTOR

A. Contractor Responsibility:

- 1. Statement of Responsibility - 1704A.4 Refer to listed special inspections under Article 1.9.

B. Planting and Irrigation:

- 1. Testing as specified in Division 32 including, but not limited to; soils analysis and irrigation pressure testing.

C. Plumbing:

- 1. Testing as specified in Division 22 including, but not limited to: Sterilization, soil waste and vent, water piping, source of water, gas piping, downspouts and storm drains.

D. Automatic Fire Sprinklers:

1. Testing as specified in Division 21 shall include, but not be limited to: hydrostatic pressure.

E. Heating, Ventilating and Air Conditioning:

1. Testing as specified in Division 21 shall include, but not be limited to: Ductwork tests, cooling tower tests, boiler tests, controls testing, piping tests, water and air systems, and test and balance of heating and air conditioning systems.

F. Electrical

1. Testing as specified in Division 26 including, but not limited to: Equipment testing, all electrical system operations, grounding system and checking insulation after cable is pulled.

1.11 INSPECTION BY THE OWNER

- A. An Inspector employed by the Owner and approved by DSA in accordance with the requirements of the California Code of Regulations Title 24, Part 1 will be assigned to the work. His duties are specifically defined in Section 4-342 of Title 24, Part 1.
- B. The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He 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 keep him 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 fulfill this Contract. The presence of an Inspector shall in no way change, mitigate or alleviate the responsibility of the Contractor.
- D. The Inspector is not authorized to change, revoke, alter, enlarge or decrease in any way any requirement of the Contract Documents, drawings, specifications or subsequent change orders.
- E. Whenever there is insufficient evidence of compliance with any of the provisions of Title 24, Part 2 of the California Code of Regulations or evidence that any material or construction does not conform to the requirements of Title 24, Part 2 of the California Code of Regulations, the Division of the State Architect may require tests as proof of compliance. Test methods shall be as specified herein or by other recognized and accepted test methods determined by the Division of the State Architect. All tests shall be performed by a testing laboratory accepted by the Division of the State Architect.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 STRUCTURAL TEST AND INSPECTION FORM

- A. Form DSA 103 attached.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, communication service, water, and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures and fencing. Water, erosion, pollution, noise and fire protection control.
- C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 SUBMITTALS

- A. Moisture-Protection Plan:
 - 1. Submit Moisture - Protection Plan under provisions of Section 01 33 00.
 - 2. Describe procedures and controls for protecting materials and construction from moisture absorption and damage, including delivery, handling, and storage provisions for materials subject to moisture absorption or moisture damage, discarding moisture-damaged materials, protocols for mitigating moisture intrusion into completed Work, and replacing moisture damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, sawing and grinding, and describe plans for dealing with water and moisture from there operations.
 - 4. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.3 TEMPORARY ELECTRICITY

- A. Connect to existing power service at location as directed. Power consumption shall not disrupt Owner's need for continuous service. Owner will pay for cost of energy used. Exercise measures to conserve energy.
- B. Provide power outlets for construction operations, with branch wiring and distribution boxes. Provide flexible power cords as required.
- C. Provide main service disconnect and over current protection at convenient location.
- D. Comply with NECA, NEMA, and UL standards and regulations for temporary electric service.
- E. Permanent convenience receptacles may not be utilized during construction.

1.4 TEMPORARY LIGHTING

- A. Provide and maintain lighting for construction operations, observations, inspections, and traffic conditions.
- B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- D. Maintain lighting and provide routine repairs.
- E. Permanent building lighting may be utilized during construction.

1.5 TEMPORARY HEATING/COOLING

- A. Provide and pay for devices as required to maintain specified thermal conditions for construction operations.
- B. Only electric or indirect fired combustion heaters shall be used. No direct fired space heaters will be allowed.
- C. Heaters will be equipped with controls to automatically turn off heater if airflow is interrupted or internal temperature exceeds design temperature.
- D. Do not use permanent equipment for temporary purposes.
- E. Maintain minimum ambient temperature of 50 degrees F and maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- F. Maintain temperature above dew point of enclosed space based upon relative humidity of enclosed area.
- G. Continuously monitor temperature of enclosed space(s) using an electronic monitoring device (s). Place devices in locations that will record average temperature of building(s). Provide print out to Architect upon request.

1.6 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Do not use permanent equipment for temporary ventilation purposes.
- C. Ventilate enclosed spaces to dissipate humidity. Maintain a maximum relative humidity level of less than 60 percent. Avoid pockets of high humidity.
- D. Continuously monitor humidity of enclosed space(s) using an electronic monitoring device(s). Place devices in locations that will record average humidity of building(s). Provide print out to Architect upon request.

1.7 TEMPORARY HUMIDITY CONTROL

- A. Provide temporary ventilation during construction activities to protect installed construction from adverse effects of high humidity and moisture.
- B. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- C. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- D. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- E. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

1.8 TELEPHONE SERVICE

- A. Provide, maintain and pay for telephone service to field office and Owner's/Inspector's field office at time of project mobilization. Inspector's office to have separate telephone line.
- B. Provide mobile telephone service for project superintendent for use when away from field office.
- C. Provide, maintain and pay for Facsimile machine in field office. Provide separate dedicated telephone line for machine.

1.9 ELECTRONIC COMMUNICATION SERVICE

- A. Provide minimum DSL electronic communication service, including electronic mail, in primary field office.

1.10 TEMPORARY WATER SERVICE

- A. Connect to existing water source for construction operations. Owner will pay cost of water used. Exercise measures to conserve water. Water consumption shall not disrupt Owner's need for continuous service.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.11 TEMPORARY SANITARY FACILITIES

- A. Provide temporary chemical type toilet facilities and enclosures.
- B. Maintain temporary toilet facilities in a sanitary manner.
- C. Existing facilities shall not be used.
- D. Facilities shall comply with the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 11B-201.4.

1.12 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way [and for public access to existing building.
- C. Provide protection for plant life and trees designated to remain and for soft and hardscape areas adjacent to work, replace damaged materials in kind.
- D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.13 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks. Post fences and gates with no trespassing signs.

1.14 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Provide water barriers as required to protect site from running water.

1.15 EROSION AND SEDIMENT CONTROL

- A. Conform to Best Management Practices for erosion and sediment control and non-storm water management as defined in Sections 3 and 4 of the Construction Activity Handbook published by the Storm Water Quality Association.
- B. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- C. Minimize amount of bare soil exposed at one time.
- D. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

- E. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- F. [Coordinate construction activities with control procedures established in the Storm Water Pollution Prevention Plan (SWPPP).]

1.16 TEMPORARY FIRE PROTECTION

- A. Maintain temporary fire protection facilities of the types needed until permanent facilities are installed.
- B. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".
- C. Fire safety during construction shall comply with CFC - California Fire Code (CCR) California Code of Regulations, Title 24, Part 9, Chapter 33.
- D. Store combustible materials in containers in fire-safe locations.
- E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes.
- F. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- G. Refer to Section 01 35 16 Alteration Project Procedures for additional requirements for operations in existing buildings.

1.17 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.18 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Conform to Best Management Practices for waste management and material controls as defined in Section 4 of the Construction Activity Handbook published by the Storm Water Quality Association.
- C. Coordinate construction activities with control procedures established in the Storm Water Pollution Prevention Plan (SWPPP).

1.19 EXTERIOR ENCLOSURES

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

1.20 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

1.21 SECURITY

- A. Provide security and facilities to protect Work and existing facilities and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.22 ACCESS ROADS

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- B. Stabilize temporary vehicle transportation routes and construction entrances to prevent erosion and control dust immediately after grading in accordance with best management practice techniques defined in Section 3 of the Construction Activity Handbook published by the Storm Water Quality Association.
- C. Maintain stabilization techniques as work progresses.
- D. Provide and maintain access to fire hydrants, free of obstructions.
- E. Designated existing on-site roads may be used for construction traffic.

1.23 PARKING

- A. Existing on-site parking areas may be used for construction personnel.
- B. Stabilize temporary surface parking areas immediately after grading to prevent erosion and control dust in accordance with Best Management practice techniques defined in Section 3 of the Construction Activity Handbook published by the storm Water Quality Association.
- C. Maintain stabilization techniques as work progresses.

1.24 TRAFFIC CONTROL

- A. Comply with requirements of authorities having jurisdiction.
- B. Obtain all permits, provide all materials and maintain controls as required of authorities having jurisdiction.
- C. Maintain access for fire-fighting equipment and access to hydrants.

1.25 PROGRESS CLEANING

- A. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- B. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- C. Provide walk-off mats at each building entry.

1.26 WASTE DISPOSAL

- A. Provide waste collection containers in sizes adequate to handle waste from construction operations.
- B. Maintain building areas free of waste materials, debris, and rubbish.
- C. Remove waste materials, debris, and rubbish from site periodically and legally dispose of off site.
- D. Maintain site area in a clean and orderly condition.

1.27 PROJECT IDENTIFICATION

- A. Provide 8 x 4 foot project sign of exterior grade plywood and wood frame construction, painted, with exhibit lettering by professional sign painter to Architect's design and colors.
- B. List title of Project, names of Owner, Architect and Contractor.

- C. List funding source for project in minimum 3 inch high upper and lower case lettering. Funding source statement to contain the following language:

This modernization project was funded by the State Allocation Board from Proposition 51 state bond funds.

- D. Erect on site at location established by Architect.
- E. Sign to remain in place through construction period and shall be removed only after dedication of the project.
- F. Provide temporary directional signs for construction personnel and visitors.
- G. No other signs are allowed except those required by law.

1.28 FIELD OFFICES

- A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack and drawing display table.
- B. Maintain daily janitorial service for offices. Maintain approach to office free of mud and water.
- C. Provide space for Project meetings, with table and chairs to accommodate 8 persons.
- D. Provide separate private office, minimum of 120 sq. ft., similarly equipped and furnished, for use of Resident Inspector.
- E. Permanent facilities shall not be used for field offices.
- E. Facilities shall comply with the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 11B-201.4.

1.29 STORAGE AREAS AND SHEDS

- A. Size to storage requirements for products of individual Sections. Allow for access and orderly provision for maintenance and for inspection of products.

1.30 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Maintain temporary equipment, facilities and controls until Substantial Completion or when use is no longer required.
- B. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion review.
- C. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- D. Clean and repair damage caused by installation or use of temporary work.
- E. Materials and facilities that constitute temporary facilities are property of the Contractor.
- F. Restore existing facilities used during construction to original condition.
- G. Restore permanent facilities used during construction to specified condition.
- H. Replace construction that cannot be satisfactorily restored.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 57 23

STORM WATER POLLUTION PREVENTION PLAN

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Assistance in filing the Notice of Intent (NOI) in the Stormwater Multi-Application and Reporting System (SMARTS) website.
- B. Preparation and implementation of the Storm Water Pollution Prevention Plan (SWPPP).
- C. Plan administration, maintenance and updates.
- D. Placement of erosion/pollution control devices.
- E. Maintenance and monitoring of control devices.
- F. Non-storm water management.
- G. Related work necessary for plan compliance.
- H. Reports and certificates.
- I. Filing the Notice of Termination (NOT) in the Stormwater Multi-Application and Reporting System (SMARTS) website.

1.2 REFERENCES

- A. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association. Available at www.casqa.org.

1.3 SUBMITTALS

- A. Submit SWPPP under provisions of Section 01 33 00.
- B. Submit SWPPP for review within two weeks after Contract award.
- C. Submit manufacturer's installation instructions for all products.

1.4 QUALITY ASSURANCE

- A. Storm Water Pollution Prevention Plan (SWPPP) shall be prepared by a Qualified SWPPP Developer (QSD).
- B. Permit Registration Documents (PRDs) shall be prepared by a Qualified SWPPP Developer (QSD).
- C. Implementation and monitoring of the SWPPP shall be accomplished by a Qualified Storm Water Practitioner (QSP).
- D. Perform work in accordance with Storm Water Pollution Prevention Plan.
- E. Maintain one copy of document on site.

1.5 REGULATORY REQUIREMENT

- A. Prior to the beginning of construction on this site the Owner will file with the State of California, State Water Resources Control Board a Notice of Intent (N.O.I.) that this project will comply with the terms of the State Water Resources Control Board's Order No. 2012-0006 - DWQ and the National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS0000002, General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.
- B. Assist Owner with entering any necessary data, information or Permit Registration Documents into the Stormwater Multi-Application and Reporting System (SMARTS) website.
- C. Comply with requirements of the State's General Permit with regard to the implementation and maintenance of the SWPPP.
- D. Coordinate the SWPPP with the requirements of the Owner's Storm Water Management Plan (SWMP). A copy of the SWMP may be obtained from the Owner upon request.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work at the site, under provisions of Section 01 31 00.
- B. Require attendance of parties directly affecting the work of this Section.
- C. Review requirements of the SWPPP.

1.7 PERFORMANCE REQUIREMENTS

- A. Risk level shall be determined and submitted to the State Water Resources Control Board as part of the Permit Registration Documents (PRDs).
- B. The Storm Water Pollution Prevention Plan is a minimum requirement. Revisions and modifications to the SWPPP are acceptable only if they maintain levels of protection equal to or greater than originally specified.
- C. All modifications to the SWPPP shall be made by a Qualified Storm Water Practitioner (QSP).
- D. Read and be thoroughly familiar with all of the requirements of the SWPPP
- E. Inspect and monitor all work and storage areas for compliance with the SWPPP prior to any anticipated rain.
- F. A Qualified Storm Water Practitioner (QSP) shall develop Rain Event Action Plans (REAPs) during construction.
- G. Complete any and all corrective measures as may be directed by the regulatory agency.
- H. Penalties: Pay any fees and be liable for any other penalties that may be imposed by the regulatory agency for non-compliance with SWPPP during the course of work.
- I. Costs: Pay all costs associated with the implementation of the requirements of the SWPPP in order to maintain compliance with the Permit. This includes installation of all Housekeeping BMPs, General Site and Material Management BMPs, Bi-weekly Inspection requirements, maintenance requirements, monitoring requirements, and all other requirements specified in the SWPPP.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. All temporary and permanent storm water pollution prevention facilities, equipment, and materials as required by or as necessary to comply with the SWPPP as described in the BMP Handbook.
- B. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 PREPARATION AND APPROVAL

- A. Prepare Storm Water Pollution Prevention Plan (SWPPP) as required to comply with storm water pollution regulations.
- B. Prepare SWPPP by following the format in Appendix G of the Stormwater Best Management Practice Handbook (BMP Handbook), January 2015 edition, published by the Storm Water Quality Association.
- C. Prepare and submit all additional Permit Registration Documents (PRDs) required by the State Water Resources Control Board.

3.2 GENERAL IMPLEMENTATION REQUIREMENTS

- A. Obtain a Waste Discharger Identification (WDID) number from the State Water Resources Control Board (SWRCB).
- B. All measures required by the SWPPP shall be implemented concurrent with the commencement of construction. Pollution practices and devices shall be followed or installed as early in the construction schedule as possible with frequent upgrading of devices as construction progresses.
- C. Conduct an inspection of all erosion control and pollution prevention devices prior to any anticipated storm event to verify all SWPPP measures are in place and to identify and mitigate any new potential pollution sources brought by the ongoing construction.
- D. Conduct monitoring to assess compliance with Numeric Action Levels (NALs) or Numeric Effluent Limitations (NELs) as appropriate to the project.
- E. After storm events, conduct an inspection of the project site to verify the performance of the erosion control and pollution prevention devices in reducing pollutant loading of the discharged storm water associated with the construction activity.
- F. Eliminate or reduce to the extent feasible the discharge of materials other than storm water to the storm drain system and/or receiving waters as dictated by the State General Permit and SWPPP

3.3 IMPLEMENTATION REQUIREMENTS DURING THE NON-RAINY SEASON

- A. The non-rainy season in the State of California is between April 1 and September 30.
- B. All requirements of the SWPPP shall apply during the non-rainy season without exception.

3.4 IMPLEMENTATION REQUIREMENTS DURING THE RAINY SEASON

- A. The rainy season in the State of California is between October 1 and March 31.
- B. All requirements of the SWPPP shall apply during the rainy season without exception.

3.5 REPORTING

- A. Prepare all inspection records for each inspection done prior to and just after all storm events as required by the SWPPP with two copies forwarded to the Owner and the Architect.
- B. Prepare the overall certification based upon the inspection reports for Owner's use in the certifying the project site's compliance with the SWPPP and the State's General Permit.

3.6 COMPLETION OF WORK

- A. Clean-up shall be performed as each portion of the work progresses. All refuse, excess material, and possible pollutants shall be disposed of in a legal manner off-site and all temporary and permanent SWPPP devices shall be in place and maintained in good condition.
- B. At completion of work, inspect installed SWPPP devices, and present the currently implemented SWPPP with all backup records to the Owner.
- C. Assist the Owner in submitting a Notice of Termination (NOT) into the SMARTS system when construction is complete and conditions of termination listed in the NOT have been satisfied.
- D. Leave storm water pollution prevention controls in place that are needed for post-construction storm water management. Remove those that are not needed. Post-construction controls will be maintained by the Owner.
- E. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certificates, and related documents to the Owner. Post-construction controls mentioned in the Compliance Certificate are considered to be in place at the end of the Construction Contract.

3.7 EROSION CONTROL PLAN

- A. Refer to Erosion Control Plan that is included in the Contract Documents as a guide for site erosion and sediment control.
- B. Include Erosion Control Plan as a part of the final SWPPP.

END OF SECTION

SECTION 01 61 00

PRODUCT REQUIREMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.
- D. Damage and restoration.

1.2 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.
- B. Products may also include existing materials or components required for reuse that were obtained from this project.
- C. Products specified or recycled from other projects are not considered new products.
- D. Provide interchangeable components of the same manufacturer, for similar components.
- E. Provide products that comply with the Contract Documents, that are undamaged and are unused at the time of installation.
- F. Provide products complete with all accessories, trim, finish, safety guards and other devices and detail needed for a complete installation and for the intended use and effect.
- G. Where a specific manufacturer's product is specified as the basis of design, the designation shall establish the qualities relating to type, function, dimension, in-service performance, physical properties, appearance and other characteristics for comparable products of other named manufacturers.
- H. Where products are specified by name or by manufacturer provide the product or manufacturer specified. No substitutions will be permitted unless made under the provisions of Section 01 25 13.
- I. Where specifications only describe a product or assembly by listing exact characteristics required, provide a product or assembly that provides the characteristics.
- J. Where specifications only require compliance with performance requirements, provide products that comply with those requirements.
- K. Where the specifications only require compliance with an imposed code, standard or regulation, provide a product that complies with the standards, codes or regulations specified.
- L. Where specifications require review and acceptance of a sample, the Architect's decision will be final on whether a proposed product sample is acceptable or not.
- M. Provide materials and products specified in the full range of color, texture and pattern for selection by Architect. Range shall include standard color/texture/pattern not stocked, but available from manufacturer, and special color/ texture/pattern available from manufacturer as advertised in product data and brochures. Unless otherwise indicated in individual specification sections, Architect may select from any color range at no additional cost to Owner.

- N. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- O. Where product is designated to match an existing product, provide product that matches in size, profile, finish, dimension and other characteristics the existing product identified.

1.3 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Schedule delivery to minimize long-term storage at site to prevent overcrowding of construction spaces.
- C. 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.
- D. Deliver products in manufacturer's original sealed container or packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 STORAGE

- A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store sensitive products in weather-tight, climate controlled enclosures.
- C. Store products in a manner that will not damage or overload project structure.
- D. For exterior storage of fabricated products, place on sloped supports, above ground.
- E. Provide off-site storage when site does not permit on-site storage .
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.
- J. Prevent the discharge of pollutants to storm water from storage of materials on-site using best management practice techniques defined in Chapter 4 of the Construction Activity Handbook published by the Storm Water Quality Task Force.

1.5 PROTECTION

- A. Protect installed Work and provide special protection where specified in individual specification Sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Provide humidity and temperature control for installed products as recommended by materials manufacturer.
- G. Prohibit traffic from landscaped areas.

1.6 DAMAGE AND RESTORATIONS

- A. Damage to existing or new work whether accidental or not shall be restored or replaced as specified or directed by Architect.
- B. Restoration shall be equal to structural performance of original work.
- C. Finish shall match appearance of existing adjacent work.
- D. Work not properly restored or where not capable of being restored shall be removed and replaced.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. General procedural requirements governing execution of the Work.

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.

1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Certified Surveys: Submit two copies signed by land surveyor.
- C. Final Property Survey: Submit 2 copies showing the Work performed and record survey data.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: Existence and location of site improvements and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of construction affecting the Work.
- B. Existing Utilities: Existence and location of underground and other utilities indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of underground utilities affecting the Work.
1. Before construction, verify location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where conditions detrimental to performance of the Work are encountered, provide a written report listing the following:
 - (a) Description of the Work.
 - (b) List of detrimental conditions, including substrates.
 - (c) List of unacceptable installation tolerances.

- (d) Recommended corrections.
- 2. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers.
- 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
- 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
- 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of Contract Documents, submit a Request For Information (RFI) to Architect. Include a detailed description of problem encountered, together with recommendations for resolution of the item discovered.

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. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor, registered in the state of California to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 6. 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 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: Control datum for survey is that established by Owner provided survey.
- 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.
 - 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: 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.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain maximum headroom clearance in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 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.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements and limitations for cutting and patching of Work.

1.2 DEFINITIONS

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

1.3 REGULATORY REQUIREMENTS

- A. Unless specifically shown on the drawings, no structural member shall be cut, drilled, or notched without prior written authorization from the Architect and the Division of the State Architect.

1.4 SUBMITTALS

- A. Submit written request in advance of cutting or patching which affects:

- 1. Structural integrity of any element of Project.
- 2. Integrity of weather-exposed or moisture-resistant element.
- 3. Efficiency, maintenance, or safety of any operational element.
- 4. Visual qualities of sight exposed elements.
- 5. Work of Owner or separate contractor.

- B. Include in request:

- 1. Identification of Project.
- 2. Location and description of affected work.
- 3. Necessity for cutting or patching.
- 4. Description of proposed work, and Products to be used.
- 5. Alternatives to cutting and patching.
- 6. Effect on work of Owner or separate contractor.
- 7. Written permission of affected separate contractor.
- 8. Date and time work will be executed.

1.5 QUALITY ASSURANCE

- A. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

- B. Do not cut or patch operating elements that would reduce their capacity to perform or that would result in increased maintenance or decreased operational life or safety.
- C. Do not cut or patch construction that would result in visual evidence of cutting or patching.
- D. Remove and replace construction that has been cut or patched in a visually unsatisfactory manner.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Primary Products: Those required for original installation.
- B. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- B. After uncovering existing Work, inspect conditions affecting performance of work.
- C. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- B. Provide protection from elements for areas which may be exposed by uncovering work.

3.3 CUTTING AND PATCHING

- A. Execute cutting, fitting, and patching to complete Work.
- B. Fit Products together, to integrate with other work.
- C. Uncover work to install ill timed work.
- D. Remove and replace defective or non-conforming work.
- E. Remove samples of installed work for testing when requested.
- F. Provide openings in the Work for penetration of mechanical and electrical work.
- G. Cut rigid materials using saw or drill. Pneumatic tools not allowed without prior approval.

3.4 PERFORMANCE

- A. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- B. Employ skilled and experienced installer to perform cutting and patching.
- C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- D. Restore work with new Products in accordance with requirements of Contract Documents.
- E. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
- G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.5 CLEANING

- A. Clean areas and spaces where cutting and patching was performed.
- B. Completely remove paint, mortar, oils, sealant, and similar materials.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. 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.

1.2 DEFINITIONS

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

1.3 PERFORMANCE [GOALS] [REQUIREMENTS]

- A. Salvage/Recycle Goals: Salvage and recycle as much nonhazardous demolition and construction waste as possible. Owner has established a minimum goal of 5 percent by weight of total waste generated by the Work for the following materials:
 - 1. Demolition Waste:
 - (a) Asphaltic concrete 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) Fire 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) Site-clearing waste.
- (b) Masonry and CMU.
- (c) Lumber.
- (d) Wood sheet materials.
- (e) Wood trim.
- (f) Metals.
- (g) Roofing.
- (h) Insulation.
- (i) Carpet and pad.
- (j) Gypsum board.
- (k) Piping.
- (l) Electrical conduit.
- (m) Packaging: Regardless of salvage/recycle goal indicated 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) Plastic pails.

1.4 SUBMITTALS

- A. Submit waste management plan and progress reports under the provisions of Section 01 33 00.
- B. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.
- C. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit reports. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- D. Forms: Prepare waste reduction progress reports on forms included at end of Part 3.
- E. 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.
- F. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

- G. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- H. 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.
- I. 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.
- J. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.
- K. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section 01 31 00 - Project Management and Coordination. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of 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.

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting 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. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers 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 hauling and tipping fees by donating materials.
 7. Savings in hauling 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.
- E. Forms: Prepare waste management plan on forms included at end of Part 3.

2. PART 2 PRODUCTS

(NOT USED)

3. PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within 3 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, recycled, reused, donated, and sold.
 2. Comply with Division 01 Section 01 50 00 - Temporary Facilities and Controls, for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale: Not permitted to be sold on Project site.
- C. Salvaged Items for Donation: Permitted on Project site.

- D. Salvaged Items for Owner's Use:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: Licensed entity normally engaged in the business of receiving, recycling, and processing waste materials with a minimum of 5 years of documented experience with the types of waste products to be processed under the provisions of this section.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 2. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 3. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 4. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 5. Store components off the ground and protect from the weather.
 - 6. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Bituminous Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete Reinforcement: Remove reinforcement and other metals from concrete and sort with other metals.
- C. Concrete: Break up and transport to concrete-recycling facility.
- D. Concrete: Crush concrete and screen to comply with requirements in Division 31 Section 31 20 00 - Earth Moving for use as satisfactory soil for fill.
- E. Masonry Reinforcement: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
- F. Masonry: Crush masonry and screen to comply with requirements in Division 31 Section 31 20 00 - Earth Moving for use as satisfactory soil for fill.
- G. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- H. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- I. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

- J. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- K. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- L. Acoustical Ceiling Suspension Systems: Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
- M. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
- N. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- O. Plumbing Fixtures: Separate by type and size.
- P. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- Q. Lighting Fixtures: Separate lamps by type and protect from breakage.
- R. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- S. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 - 1. Comply with requirements in Division 32 Section 32 90 00 - Planting for use of chipped organic waste as organic mulch.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - (a) Comply with requirements in Division 32 Section 32 90 00 - Planting for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - (a) Comply with requirements in Division 32 Section 32 90 00 - Planting for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

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

- C. Burning: Do not burn waste materials.
- D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.7 FORMS

- A. Waste Management Plan Forms Attached:
 - 1. Construction Waste Reduction Progress Report.
 - 2. Demolition Waste Reduction Progress Report.
 - 3. Construction Waste Identification.
 - 4. Demolition Waste Identification.
 - 5. Construction Waste Reduction Work Plan.
 - 6. Demolition Waste Reduction Work Plan.
 - 7. Cost/Revenue Analysis of Construction Waste Reduction Work Plan.
 - 8. Cost/Revenue Analysis of Demolition Waste Reduction Work Plan.

END OF SECTION

CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D/Ax100)
			ESTIMATED TONS	ACTUAL TONS (B)	ESTIMATED TONS	ACTUAL TONS (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

DEMOLITION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (D=B+C)	TOTAL QUANTITY OF WASTE RECOVERED % (D/Ax100)
			ESTIMATED TONS	ACTUAL TONS (B)	ESTIMATED TONS	ACTUAL TONS (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panel boards								
Transformers								
Other:								

CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C=AxB)	EST. VOLUME CY	EST. WEIGHT TONS	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

DEMOLITION WASTE IDENTIFICATION				
MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY	EST. WEIGHT TONS	REMARKS AND ASSUMPTIONS
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTATION PROCEDURES
			EST. AMOUNT SALVAGED TONS	EST. AMOUNT RECYCLED TONS	EST. AMOUNT DISPOSED TO LANDFILL TONS	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS	DISPOSAL METHOD AND QUANTITY			HANDLING & TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS	EST. AMOUNT RECYCLED TONS	EST. AMOUNT DISPOSED TO LANDFILL TONS	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN								
MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces or OSB								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

COST/REVENUE ANALYSIS OF DEMOLITION WASTE REDUCTION WORK PLAN								
MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C= A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Asphaltic Concrete Paving Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mech. Equipment								
Electrical Conduit								
Conner Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 77 00

CLOSEOUT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout Procedures.
- B. Final Cleaning.
- C. Pest Control.
- D. Adjusting.
- E. Demonstration and Instructions.
- F. Project Record Documents.
- G. Operation and Maintenance Data.
- H. Warranties.
- I. Spare Parts and Maintenance Materials.
- J. DVBE Participation Report.

1.2 PROJECT CLOSEOUT CONFERENCE

- A. As specified under Section 01 31 00.

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's review.
- B. Prepare and submit to Architect a list of items to be completed or corrected, the value of the items on the list, and reasons why the Work is not complete.
- C. Submit written request to Architect for review of Work.
- D. Submit warranties, bonds, service agreements, certifications, record documents, maintenance manuals, receipt of spare parts and similar closeout documents.
- E. Make final changeover of permanent locks and deliver keys to Owner.
- F. Terminate and remove temporary facilities from Project site.
- G. Advise Owner of change over in heat and other utilities.
- H. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- I. Submit affidavit of payment of debts and claims, AIA Document G706.
- J. Submit affidavit of release of liens, AIA Document G706A.
- K. Submit consent of contractors surety to final payment, AIA Document G707.

- L. Owner will occupy all portions of the building as specified in Section 01 11 00.
- 1.4 REGULATORY REQUIREMENTS
 - A. Provide final verified reports required by Section 39151 and 81141 of the Education Code in the manner prescribed by Title 24, Part 1, Section 4-336 and 4-343 in compliance with DSA Procedure: Project Certification Process PR 13-02.
- 1.5 FINAL CLEANING
 - A. Execute final cleaning prior to final review by Architect.
 - B. Employ experienced professional cleaners for final cleaning.
 - C. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.
 - D. Vacuum carpeted and soft surfaces. Shampoo if visible stains exist.
 - E. Clean equipment and plumbing fixtures to a sanitary condition.
 - F. Clean exposed surfaces of grilles, registers and diffusers.
 - G. Replace filters of operating mechanical equipment.
 - H. Clean debris from roofs, gutters, downspouts, and drainage systems.
 - I. Clean site; sweep paved areas, rake clean landscaped surfaces.
 - J. Remove waste and surplus materials, rubbish, and construction facilities from the site.
 - K. Clean light fixtures and replace burned out lamps and bulbs.
 - L. Replace defective and noisy ballasts and starters in fluorescent fixtures.
 - M. Leave project clean and ready for occupancy by Owner.
- 1.6 PEST CONTROL
 - A. Engage an experienced, licensed exterminator to make final inspection and rid Project of rodents, insects, and other pests. Submit final report to Architect.
- 1.7 ADJUSTING
 - A. Adjust operating Products and equipment to ensure smooth and unhindered operation.
- 1.8 DEMONSTRATION AND INSTRUCTIONS
 - A. Demonstrate operation and maintenance of products, systems, and equipment to Owner's personnel two weeks prior to date of final review.
 - B. For each demonstration submit list of participants in attendance.
 - C. Provide two copies of video tape of each demonstration and instructions session.
 - D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
 - E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.9 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work in contrasting color.
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each Product Section in contrasting color ink, description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Supplier and installer's name and contact information.
 - 3. Changes made by Addenda and Modifications.
- E. Contract Drawings and Shop Drawings: Legibly mark each item in contrasting color ink to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract Drawings.
 - 5. Revisions to electrical circuitry and locations of electrical devices and equipment.
 - 6. Note change orders, alternate numbers, and similar information, where applicable.
 - 7. Identify each record drawing with the written designation of "RECORD DRAWING" located in prominent location.

- F. Record Digital Data Files: Immediately before inspection for Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect for resolution.
 5. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - (a) Refer to Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - (b) Architect will provide data file layer information. Record markups in separate layers.
- G. Final Property Survey: Under the provisions of Section 01 73 00.
- H. Record Construction Schedule: Under the provisions of Section 01 32 16.
- I. Submit documents to Architect at time of Substantial Completion.

1.10 OPERATION AND MAINTENANCE DATA

- A. Summary:
1. Organize operation and maintenance data with directory.
 2. Provide operation and maintenance manuals for products, systems, subsystems, and equipment.
 3. Refer to Divisions 02 thru 49 for specific operation and maintenance manual requirements for the Work in those Divisions.
- B. Submit two sets prior to final review, bound in 8-1/2 inch x 11 inch, three ring D size binders with durable vinyl covers.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with laminated plastic tabs.
- E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Engineers, Contractor, subcontractors, and major equipment suppliers and manufacturers.
- F. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
1. Performance and design criteria.
 2. List of equipment.
 3. Parts list for each component.
 4. Start-up procedures.

5. Shutdown instructions.
 6. Normal operating instructions.
 7. Wiring diagrams.
 8. Control diagrams.
 9. Maintenance instructions for equipment and systems.
 10. Maintenance instructions for finishes, including recommended cleaning methods and materials.
- G. Part 3: Project documents and certificates, including the following:
1. Shop drawings and product data.
 2. Air and water balance reports.
 3. Certificates.
 4. Warranties.

1.11 WARRANTIES

- A. Commencement of warranties shall be date of Substantial Completion.
- B. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- C. Provide duplicate notarized copies in operation and maintenance manuals.
- D. Execute and assemble documents from subcontractors, suppliers, and manufacturers.
- E. Provide Table of Contents and assemble in binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on the work that incorporates the products.
- H. Manufacturer's disclaimer and limitations on product warranties do not relieve suppliers, manufacturer's, and subcontractors required to countersign special warranties with Contractor.
- I. When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- J. When work covered by warranty has failed and has been corrected, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with equitable adjustment for depreciation.
- K. Upon determination that Work covered by warranty has failed, replace or repair Work to an acceptable condition complying with requirements of the Contract Documents.

1.12 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site and place in location as directed.

- C. Obtain signed receipt for delivery of materials and submit prior to request for final review by Architect.

1.13 DISABLED VETERAN BUSINESS ENTERPRISE ("DBVE") PARTICIPATION

- A. Submit DVBE Participation Report as stipulated by Document 00 65 73.
- B. Provide supplemental report to substantiate non-compliance with District goal of three percent (3%) participation if required.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of designated building equipment and fixtures.
- B. Removal of designated construction.
- C. Disposal of materials.
- D. Storage of salvaged materials.
- E. Cap and identify utilities.
- F. Temporary partitions to allow building occupancy.
- G. Temporary fire protection.
- H. Schedule of materials and equipment.

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 recycled.
- B. Disposal: Removal off-site of demolition waste and subsequently deposit in landfill acceptable to authorities having jurisdiction.
- C. Existing to Remain: Items of construction that are not to be removed and that are not indicated to be removed.

1.3 MATERIALS OWNERSHIP

- A. Historic items, relics, cornerstones, commemorative plaques, tablets and similar objects encountered during demolition are to remain the Owner's property.
- B. Carefully remove each item in a manner to prevent damage and deliver to Owner.

1.4 SUBMITTALS

- A. Predemolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.
- B. Record Documents: Submit under provisions of Section 01 77 00. Accurately record locations of utilities and subsurface obstructions.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition work, safety of structure, electrical disconnection and reconnection dust control and disposal of materials.
- B. Comply with California Fire Code (CFC), California Code of Regulations, (CCR) Title 24, Part 9, Chapter 5 - Fire Service Features and Chapter 33 - Fire Safety During Construction and Demolition.
- C. Obtain required permits from authorities.
- D. Notify affected utility companies before starting work and comply with their requirements.

- E. Do not close or obstruct egress width to exits.
- F. Do not disable or disrupt building fire or life safety systems without 3 day prior written notice to the Owner.

1.6 EXISTING CONDITIONS

- A. Areas of buildings to be demolished will be evacuated and their use discontinued before start of work.
- B. Owner will occupy building(s) adjacent to demolition area. Conduct demolition so owner's operation will not be disrupted.
- C. Provide at least 72 hour notice to Owner of activities that will affect Owner's operation.
- D. Maintain access to existing walkways, exits and other adjacent occupied facilities.
- E. Owner assumes no responsibility for areas of buildings to be demolished.
- F. Hazardous Materials: Hazardous materials are present in buildings to be demolished. A report on the presence of hazardous materials is on file for review and use.
 - 1. Hazardous materials remediation is specified in Hazardous Report.
 - 2. Do not disturb hazardous materials except as specified.

1.7 SEQUENCING

- A. Sequence work under the provisions of Section 01 11 00.
- B. Sequence activities in the following [phases] [portions] [increments]:
 - 1. [Phase] [Portion] [Increment] 1 [].
 - 2. [Phase] [Portion] [Increment] 2 [].
 - 3. [Phase] [Portion] [Increment] 3 [].
- C. Owner will conduct salvage operations before demolition begins to remove materials and equipment that the Owner chooses to retain.

1.8 SCHEDULING

- A. Schedule work under provisions of Section [01 32 16] [01 32 17].
- B. Schedule Work to coincide with new construction and owner occupancy.
- C. Perform work during normal hours of operation.
- D. Notify Owner in writing 5 days in advance of any required work to be performed on a weekend or holiday.
- E. Perform noisy, malodorous, dusty work:
 - 1. Between the hours of 7:00 a.m. and 9:00 a.m. or as required by Principal.
- F. Coordinate utility and building service interruptions with Owner.
- G. Schedule tie-ins to existing systems to minimize disruption.
- H. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.9 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.

2. PART 2 PRODUCTS

Not Used.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Correlate existing conditions with requirements indicated.
- B. Inventory and record condition of items to be removed and salvaged.
- C. Execute predemolition photographs.
- D. Verify that hazardous waste remediation is complete.

3.2 PREPARATION

- A. Existing Utilities: Locate, identify, disconnect and seal or cap off indicated utilities serving areas to be demolished.
- B. Salvaged Items: Clean, pack and identify items for delivery to Owner.
- C. Protect existing items which are not indicated to be salvaged, removed, or altered.
- D. Erect and maintain weatherproof closures for exterior openings.
- E. Erect and maintain temporary partitions to prevent spread of dust, fumes, noise, and smoke to provide for Owner occupancy as specified in Section 01 11 00.

3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger. Notify Architect. Do not resume operations until directed.
- C. Maintain protected egress and access to the Work.
- D. Maintain fire safety during demolition in accordance with CFC, Chapter 33.
- E. Demolish in an orderly and careful manner. Protect existing supporting structural members.

3.4 SALVAGING OF DEMOLITION MATERIALS

- A. Clean salvaged items.
- B. Pack or crate items after cleaning. Identify contents.
- C. Store items in secure area until delivery to Owner.
- D. Protect items from damage.
- E. Install salvaged items to comply with requirements for new materials and equipment.

3.5 RECYCLING OF DEMOLITION MATERIALS

- A. Separate recycled demolition materials from other demolished materials.
- B. Stockpile processed materials on-site without intermixing with other materials.
- C. Do not store materials within drip line of trees.
- D. Transport recyclable materials that are not indicated to be reused off Owner's property to recycling receiver or processor.
- E. Recycled incentives received for building demolition materials shall be equally shared between Contractor and Owner.
- F. Wood Materials: Sort and stack members according to size, type and length. Separate dimensional and engineered lumber, panel products, and treated wood materials.
- G. Metals: Separate by metal type. Remove nuts, bolts and rough hardware. Sort structural steel by type and size.
- H. Roofing: Separate organic and fiberglass shingles and felts. Remove nails, staples and accessories.
- I. Doors and Hardware: Brace open end of door frames. Leave hardware attached to doors.
- J. Carpet and Pad: Store clean dry carpet and pad in a closed container or trailer.
- K. Gypsum Board: Stack large clean pieces on pallets. Remove edge trim and sort with metals. Remove and dispose of fasteners.
- L. Acoustical Ceiling Materials: Stack panels and tiles on pallets. Separate suspension system and sort with metals.
- M. Equipment: Drain tanks, piping and fixtures. Seal openings with caps or plugs.
- N. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves and other components.
- O. Lighting Fixtures: Remove lamps and separate by type.
- P. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- Q. Conduit: Reduce conduit to straight lengths and store by type and size.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items to be reused, salvaged, reinstalled, or otherwise indicated to remain, remove demolished materials from Project site and legally dispose of them in an EPA – approved landfill.
- B. Do not burn or bury materials on site.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition.
- B. Remove temporary construction.
- C. Return adjacent areas to condition existing before demolition operations began.
- D. Leave site in a clean condition.

3.8 SCHEDULES

A. Salvage, store, and protect the following [materials] [and equipment] for reinstallation:

1. _____
2. _____
3. _____

B. Salvage the following [equipment] [and materials] for the Owner's retention. Deliver to [location designated by Architect] [_____]:

1. _____
2. _____
3. _____

C. Owner will salvage and keep the following material and equipment:

1. _____
2. _____
3. _____

D. Protect the following materials and equipment to remain:

1. _____
2. _____
3. _____

END OF SECTION

SECTION 02 41 26

SELECTIVE ELECTRICAL DEMOLITION

1. PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
2. Disposal of materials.
3. Storage of removed materials.
4. Identification of utilities.
5. Salvaged items.
6. Protection of items to remain as indicated on drawings.
7. Relocate existing equipment to accommodate construction.

1.2 SUBMITTALS

- A. Division 1 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work. Describe demolition removal procedures and schedule.

1.3 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of capped utilities, conduits and equipment abandoned in place.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State and University.

1.5 PRE-INSTALLATION MEETINGS

- A. Division 1 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.6 SEQUENCING

- A. Division 1 - Summary: Requirements for sequencing.

- B. Sequence work in the following order:
 - 1. Temporary Facility.
 - 2. Permanent Installation.
 - 3. Switchover and Testing.
 - 4. Demolition of Existing and Temporary Facility.

1.7 SCHEDULING

- A. Division 1 - Administrative Requirements and 01 32 16 - Construction Progress Schedule: Requirements for scheduling.
- B. Schedule work to coincide with new construction.
- C. Perform noisy, malodorous, dusty, or intrusive work:
 - 1. Between hours of 10 AM and 6 PM or as instructed by the University Personnel.
- D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.8 COORDINATION

- A. Division 1 - Administrative Requirements: Requirements for coordination.
- B. Conduct demolition to minimize interference with adjacent and occupied building areas.
- C. Coordinate demolition work with Engineer, Architect or Owner.
- D. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.
- E. Shut-down Periods:
 - 1. Arrange timing of shut-down periods of in service panels with Owner, Architect/Engineer. Do not shut down any utility without prior written approval.
 - 2. Keep shut-down period to minimum or use intermittent period as directed by Owner, Architect/Engineer.
 - 3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 3 days in advance.
- F. Identify salvage items in cooperation with Owner.

2. PART 2 PRODUCTS – NOT USED

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- C. Verify termination points for demolished services.

3.2 PREPARATION

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

3.3 DEMOLITION

- A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner, or Architect/Engineer before disturbing existing installation.
- B. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- C. Disconnect or shut off service to areas where electrical work is to be removed or connected.
- D. Install temporary wiring and connections to maintain existing systems in service during construction.
- E. Perform work on energized equipment or circuits with experienced and trained personnel.
- F. Remove, relocate, and extend existing installations to accommodate new construction.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Clean and repair existing equipment to remain or to be reinstalled.
- I. Protect and retain power to existing active equipment remaining.

3.4 REUSABLE ELECTRICAL EQUIPMENT

- A. Carefully remove equipment, materials, or fixtures which are to be reused.
- B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.
- C. Relocate existing pull box as indicated on Drawings. Clean and evaluate to see if it is in good condition before installation at new location.

3.5 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Remove demolished materials as work progresses. Legally dispose.
- C. Keep workplace neat.

END OF SECTION

SECTION 02 43 00

STRUCTURE MOVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparing structure for move.
- B. Moving structure to new location.
- C. Setting structure on new foundation.

1.2 DESIGN REQUIREMENTS

- A. Retain services of Professional Engineer, registered in State of California for the following:
 - 1. To design structural supports for existing structure and associated work. Design framing and reinforcement, and brace connections to transfer loads of structure to transport carrying equipment.

1.3 QUALIFICATIONS

- A. Mover: Company specializing in relocating building structures with minimum five years documented experience.

1.4 REGULATORY REQUIREMENTS

- A. Arrange with authorities having jurisdiction for route of move, traffic control, and police escorts.

1.5 PRE-MOVING CONFERENCE

- A. Convene a pre-moving conference two weeks prior to commencing work of this section, under provisions of Section 01 31 00.
- B. Discuss the following:
 - 1. Ascertain the method of determining damage to existing structure and finishes, before and after the move.
 - 2. Identify existing damage to sidewalks, roads, and curbs.
 - 3. Identify method and responsibility for repairs after moving.
 - 4. Review the intended route for moving.
 - 5. Address coordination with affected utilities.
 - 6. Address coordination with authorities for permits and traffic control.

1.6 SCHEDULING

- A. Schedule work under the provisions of Section 01 32 16.
- B. Arrange schedule with work of other sections and Owner's requirements.

2. PART 2 PRODUCTS

2.1 EQUIPMENT

- A. Equipment and Supports: As required to achieve a successful structure move.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions, surrounding access routes, and conditions of structure to be moved under provisions of Section 01 31 00.
- B. Identify utility services and obstructions to be removed, relocated, or abandoned during progress of the work.
- C. Verify route load limits to ensure conditions are adequate to support moving loads of structure.
- D. Damage Determination:
 - 1. Before the move, inspect existing site and structure thoroughly and notify Architect in writing of visible defects and factors which could affect safe movement of structure to final location.
 - 2. Compile a list of visible defects to site, building structure, finishes, and accessories. This list will form the basis of determining required repair work after the move.

3.2 PREPARATION

- A. Prepare site, route of transport, and destination site.
- B. Protect existing on-site landscaping, irrigation, and paved surface as necessary to safely move the structure and prevent damage.
- C. Coordinate the work of utility disconnection and re-connection with the work of this section.
- D. Remove building walkways, canopy, and ramps prior to move.
- E. Secure supplementary framing and bracing to structure.
- F. Secure operating, moving, or suspended items, such as doors, windows, and light fixtures, in a manner to prevent damage to items or to the structure during move.
- G. Protect elements surrounding the structure from damage or disfiguration.

3.3 RAISE STRUCTURE

- A. Cut structure free of foundation and portions of structure not being moved.
- B. Reinforce, brace, and raise structure clear of foundation, in manner to prevent damage.
- C. Provide necessary framing, bracing, closures, supports, and blocking.
- D. Secure structure to temporary supporting structural members to prevent shifting of structure during move.

3.4 MOVE STRUCTURE

- A. Provide transport vehicles for moving structure to new site.
- B. Move structure, control speed, and provide anchor and restraining devices so that integrity of structure will be maintained.
- C. During move, protect adjacent structures, and private and public property from damage.

3.5 REINSTALL STRUCTURE

- A. Position structure over prepared foundation and transfer full load onto site foundation.
- B. Remove moving equipment.
- C. Leave reinforcing, framing, and bracing intact until structure is fully attached and structure loads are supported by new foundation.
- D. Adjust structure on foundation:
 - 1. To permit doors to swing freely.
 - 2. So that floor surfaces are level, walls are plumb.
- E. Coordinate location with Owner prior to delivery.

3.6 REINSTALLATION TOLERANCES

- A. Maximum Variation from Level and Plumb: 1/4 inch.
- B. Maximum Offset from True Position: 1/4 inch.

3.7 DAMAGE REPAIR

- A. Repair damage to structure not identified in writing prior to move.
- B. Refinish repaired surfaces to match adjacent work.

3.8 CLEANING

- A. Remove moving equipment and materials from original site, final site, and route of travel.
- B. Return grades and contours to original condition and dimension.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

1. PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 REFERENCES

- A. CBC 2016 - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19A.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. PS 1-09 - Structural Plywood.

1.3 SYSTEM DESCRIPTION

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

2. PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Plywood: PS1-09, BB Plyform grade, Class I, Exterior classification.
- B. Lumber: Douglas Fir species; construction grade; with grade stamp clearly visible.
- C. Tubular Column: Round, smooth, fiber reinforced tube with plastic coated paper lining, of sizes required.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than one inch diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Fillets for Chamfered Corners: Wood strips type; 3/4 x 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slots: Minimum 22 gage galvanized steel; foam filled; release tape sealed slots; bent tab anchors; securable to concrete formwork; manufactured by Heckmann Building Products Co., www.heckmannbuildingprods.com.

- E. Flashing Reglets: 26 gage thick galvanized steel; longest possible lengths; release tape sealed slots; with alignment splines for joints; securable to concrete formwork; Type CO reglet manufactured by Fry Reglet www.fryreglet.com.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 PREPARATION

- A. Obtain Architect's approval for use of earth forms for footings.
- B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- C. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.3 ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- C. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- D. Do not displace or damage vapor barrier placed by Section 03 30 00.
- E. Construct formwork to maintain tolerances in accordance with ACI 301.

3.4 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
- B. Do not apply form release agent where concrete surfaces are scheduled to receive applied coverings which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.6 FORM REMOVAL

- A. Do not remove forms and bracing until concrete has sufficient strength to support its own weight and imposed loads.

- B. Do not damage concrete surfaces during form removal.
- C. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

3.7 CLEANING

- A. Clean forms to remove foreign matter as erection proceeds.
- B. Ensure that water and debris drain to exterior through clean-out ports.

3.8 EARTH FORMS

- A. Construct wood edge strips at top sides of excavations as indicated on drawings.
- B. Provide forms for footings and foundation walls wherever concrete cannot be placed against solid earth.
- C. Remove loose dirt and debris from form area prior to concrete placement.
- D. Concrete for foundations may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Architect (Structural Engineer).
- E. When earth formed foundations are used, the minimum formwork shown on the drawings is mandatory to insure clean excavations prior to and during concrete placement.
- F. Provide 3-1/2 inch high starter wall for all concrete and masonry walls below grade.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, welded steel wire fabric fabricated steel bar or rod mats for cast-in-place concrete.
- B. Support chairs, bolsters, bar supports, and spacers, for supporting reinforcement.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19A (ACI 318-14).
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 315 (SP-66) - Details and Detailing of Concrete Reinforcement.
- D. ACI 318-14 - Building Code Requirements for Structural Concrete.
- E. ASTM A1064 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- F. ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- G. ASTM A706 - Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement.
- H. ASTM C1116 - Specification for Fiber-Reinforced Concrete and Shotcrete.
- I. AWS D1.4 - Structural Welding Code Reinforcing Steel.
- J. CRSI - Manual of Practice.
- K. CRSI - Placing Reinforcing Bars.

1.3 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice.
- B. Conform to ACI 301 and ACI 315 (SP-66).
- C. Conform to CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.4 CERTIFICATES

- A. Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing Steel: ASTM A615, Grade 40 for No. 4 bars and smaller, Grade 60 for No. 5 bars and larger. Billet-steel deformed bars, uncoated finish.
- B. Welded Reinforcement: ASTM A706, Grade 60, deformed bars, unfinished.
- C. Welded Steel Wire Fabric: ASTM A1064 plain type; coiled rolls; uncoated finish.
- D. Steel Wire: ASTM A1064, plain, cold drawn steel.

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 installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate in accordance with ACI 315 (SP-66), providing concrete cover specified in Section 03 30 00.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress.
- C. Weld reinforcing bars in accordance with AWS D1.4.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
- C. Mix fibrous reinforcement into concrete material according to Section 03 30 00.
- D. Do not displace or damage vapor barrier required by Section 03 30 00.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29 and as required by the Division of the State Architect and District Inspector.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete foundation walls, and footings.
- B. Floors and slabs on vapor barrier.
- C. Control, expansion, and contraction joint devices associated with concrete work.
- D. Curing and sealing compound.
- E. Building floors.
- F. Retaining walls, utility slabs.
- G. Equipment pads, Thrust blocks, Light pole bases, Flag pole bases.

1.2 REFERENCES

- A. The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC 2016 - California Building Code, (CCR) California Code of Regulations Title 24, Part 2, Chapter 19A.
- C. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. ACI 301 - Specifications for Structural Concrete for Buildings.
- E. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
- F. ACI 305R - Hot Weather Concreting.
- G. ACI 306.R - Standard Specification for Cold Weather Concreting.
- H. ACI 318-14 - Building Code Requirements for Structural Concrete.
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready-Mixed Concrete.
- K. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
- L. ASTM C150 - Portland Cement.
- M. ASTM C260 - Air-Entraining Admixtures for Concrete.
- N. ASTM C289 - Potential Reactivity of Aggregate.
- O. ASTM C309 - Liquid Membrane Forming Compound.

- P. ASTM C330 - Lightweight Aggregates for Structural Concrete.
- Q. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.
- R. ASTM C567 - Unit Weight of Structural Lightweight Concrete.
- S. ASTM C618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture for Concrete.
- T. ASTM C932 - Surface-Applied Bonding Agents.
- U. ASTM C1315 - Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- V. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- W. ASTM D226 - Asphalt Saturated Organic Felt used in Roofing and Waterproofing.
- X. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
- Y. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
- Z. ASTM E154 - Standard Test Methods for Water Vapor Retardants used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- AA. ASTM E1643 - Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slab.
- BB. ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System.
- CC. ASTM E1745 - Standard Specifications for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs.
- DD. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- EE. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- FF. National Ready Mix Concrete Association - Plant Certification Program.
- GG. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Installation of vapor barrier shall be in accordance with ASTM E1643 and manufacturer's installation guides and recommendations. Provide Architect written site reports from manufacturer's field service representative, indicating observation of vapor barrier installation prior to concrete placement.
- C. Obtain concrete materials from same source throughout the Work.

1.4 QUALIFICATIONS

- A. Manufacturer: Manufacturer of ready-mix concrete products complying with ASTM C94 requirements for production facilities and equipment. Certified according to National Ready Mix Concrete Associates Plant Certification Program.

1.5 DESIGN MIX

- A. Submit design mix for each class of concrete, prepared by a California Registered Civil Engineer, to Testing Laboratory and Architect for review.

1.6 REGULATORY REQUIREMENTS

- A. Conform to CBC 2016 - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for access requirements for individuals with disabilities.

1.7 SUBMITTALS

- A. Submit product data and manufacturer's instructions for all accessories under provisions of Section 01 33 00.

1.8 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing placement of floor slab work of this section, under provisions of Section 01 31 00.
- B. Require attendance of parties directly affecting the work of this Section.
- C. Agenda:
 - 1. Placement of subgrade beneath floor slab.
 - 2. Testing of subgrade beneath floor slab.
 - 3. Delivery and placement of concrete.
 - 4. Testing and inspection procedures for concrete.
 - 5. Submittal of mix design for concrete.
 - 6. Hot and cold weather concreting procedures.
 - 7. Vapor barrier location and installation.
 - 8. Placement of control and expansion joints.
 - 9. Steel reinforcement installation.
 - 10. Installation of inserts and embedded items.
 - 11. Finishes and finishing.
 - 12. Forming and form removal limitations.

13. Floor slab flatness and levelness requirements.
14. Curing process and procedures.
15. Protection of finished floor slabs.
16. Floor slab joint and crack repair.
17. Moisture vapor transmission testing.

1.9 WARRANTY

- A. Provide fifteen year warranty from curing, hardening and vapor barrier compound manufacturer under provisions of Section 01 77 00.
- B. Warranty: Include coverage for removal and replacement of finish floor materials that delaminate from interior floor slabs due to moisture migration and excessive vapor emissions or due to presence of efflorescence and alkali contaminants.
 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 2. Subfloor Alkalinity Conditions: A pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.
 3. Warranty to be supported by \$1,000,000.00 product liability insurance policy issued directly to the Owner.
- C. Provide ten year warranty from waterproofing admixture manufacturer that surfaces treated with crystalline waterproofing admixture will remain free from water leakage.
- D. Provide warranty from vapor barrier manufacturer that products meet the current requirements of ASTM E1745 and will be free from material defects for the life of the building.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Provide concrete curing, finishing, and waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

2. PART 2 PRODUCTS

2.1 FORMWORK

- A. As specified in Section 03 11 00.

2.2 REINFORCEMENT

- A. Reinforcing steel as specified in Section 03 20 00.

2.3 FIBROUS REINFORCEMENT

- A. Fibrous reinforcement as specified in Section 03 20 00.

2.4 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I or Type II Portland type; low alkali; grey color.
- B. Fine and Coarse Aggregates Normal Weight Concrete: ASTM C33, non reactive when tested in accordance with ASTM C289 and Appendix X-1 of ASTM C33.
- C. Fine and Coarse Aggregate, Light Weight Concrete: ASTM C330.
- D. Water: ASTM C1602, clean potable and not detrimental to concrete.

2.5 ADMIXTURES

- A. Fly Ash: ASTM C618, Class F.
- B. Water Reducing Admixture: ASTM C494, Type A.
- C. Calcium chloride, or any other admixtures not allowable.

2.6 VAPOR BARRIER

- A. Material: 15 mil thick polyethylene film meeting the requirements of ASTM E1745, Class A, with a maximum permeance of 0.01 perms in accordance with ASTM E96/E154, Section 7, and a Water Vapor Transmission Rate (WVTR) of less than 0.0037 when tested according to ASTM F1249.
- B. Accessories:
 - 1. Minimum 4 inch wide polyethylene seaming tape with pressure sensitive adhesive.
 - 2. Minimum 6 inch wide multi-layered textured polyethylene concrete bonding tape.
 - 3. Polymer-modified liquid vapor retarder mastic.
 - 4. PVC termination bar with pre-drilled holes.
 - 5. All accessories provided by vapor barrier manufacturer.
- C. Manufacturers:
 - 1. Fortifiber Building Products, www.fortifiber.com.
 - 2. Poly-America, www.yellowguard.com.
 - 3. Reef Industries, www.reefindustries.com.
 - 4. Stego Industries, www.stegoindustries.com.
 - 5. Substitutions: Under Provisions of Section 01 25 13.

2.7 ACCESSORIES

- A. Underlayment: ASTM D226, Type I (No. 15) asphalt saturated roofing felt.
- B. Bonding Agent: ASTM C932; Weld-Crete as manufactured by Larsen Products Corp., www.larsenproducts.com.

- C. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7000 psi in 28 days.
- D. Joint Filler: ASTM D1751, 1/2 inch thick.
- E. Sand Fill: Manufactured "crusher run" sand free of silt, clay, loam, friable or soluble materials or organic matters, all passing the No. 4 sieve and only 5 percent passing the No. 200 sieve.
- F. Curing, Hardening and Vapor Barrier Compound: ASTM C1315, Type I, Class A and ASTM C309, Type 1, Class A, with maximum volatile organic compound (VOC) content rating as required to suit regulatory requirements. Material to have no less than 34 percent penetrating solids, have no visible sheen and be compatible with floor finish materials and overlayments. Provide the following:
 - 1. PMC 3300 Penetrating Sealer manufactured by Curranseal, www.curranseal.com.
- G. Sealing Compound: Ashford Formula manufactured by Curecrete Distribution, Inc., www.ashfordformula.com.
- H. Slip Resistant Aggregate: 95 percent minimum fused homogeneous aluminum oxide.
- I. Concrete Floor Slab, Saw Cut, Joint, Crack, Repair Material: Cement-based, polymer-modified product that can be feathered at edges to match adjacent floor elevations. Compressive strength not less than 4,200 psi at 28 days when tested according to ASTM C109. Equivalent to ARDEX SD-F Feather Finish, www.ardex.com. Epoxy base to be equivalent to W. R. Meadows Rezi-Weld Flex semi-rigid epoxy, www.wrmeadows.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.8 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94 ACI 318, Section 26.4.4.
- B. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As noted on drawings.
 - 2. Maximum Water-Cement Materials Ratio: As noted on drawings.
 - 3. Aggregate Size: As noted on drawings.
 - 4. Slump Limit: As noted on drawings.
 - 5. Fly Ash: Maximum 25 percent by weight.
- C. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As noted on drawings.
 - 2. Maximum Water-Cement Materials Ratio: As noted on drawings.
 - 3. Aggregate Size: As noted on drawings.
 - 4. Slump Limit: As noted on drawings.
 - 5. Fly Ash: Maximum 25 percent by weight.

D. Slabs-On-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As noted on drawings.
2. Minimum Cement Materials Content: As noted on drawings.
3. Maximum Water-Cement Materials Ratio: As noted on drawings.
4. Aggregate Size: As noted on drawings.
5. Slump Limit: As noted on drawings.
6. Fly Ash: Maximum 20 percent by weight.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause difficulty in placing concrete.

3.2 PREPARATION

- A. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, and install dowels per plan with adhesive following manufacturer's recommendations.
- B. Place 2 inch thick sand fill over subgrade.
- C. Compact sand fill as specified in Section 31 20 00.
- D. Install underlayment over wood subfloor. Lap joints 6 inches. Fasten in place.

3.3 VAPOR BARRIER

- A. Install vapor barrier in compliance with ASTM E1643 under interior slabs over sand subgrade.
- B. Install vapor barrier to exterior surface of below grade building foundation walls and grade beams. Seal to vertical surface of foundation wall with pressure sensitive tape and termination bar at an elevation consistent with the top of the adjacent finish grade.
- C. Lay vapor barrier with long dimension parallel with long dimension of space.
- D. Lap vapor barrier over footing and seal to vertical surface of interior foundation wall with pressure sensitive tape and termination bar at an elevation consistent with the top of the slab or terminate vapor barrier at horizontal edge of slab and foundation wall with continuous strip of concrete bonding tape.
- E. Overlap all joints in vapor barrier 6 inches and seal with tape.
- F. Seal all pipe penetrations of vapor barrier with pipe boot fabricated from vapor barrier material, tape and mastic.
- G. Repair damaged areas with vapor barrier, overlapping damaged area by 6 inches and taping all four sides.

3.4 PLACING CONCRETE

- A. Notify Architect minimum 48 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301.
- C. Hot Weather Placement: ACI 305R.
 - 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.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete in hot weather. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- D. Cold Weather Placement: ACI 306R.
 - 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 306.1
- E. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- F. Do not disturb or damage vapor barrier while placing concrete. Repair damage as required to maintain integrity of barrier.
- G. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
- H. Place interior floor slabs on fill in a strip sequence pattern.
- I. Excessive honeycomb or embedded debris in concrete is not acceptable.

3.5 JOINTS

- A. Saw cut control joints at an optimum time after finishing. Use 3/16 inch thick blade, cutting 1/3 into depth of slab thickness.
- B. Review locations of joints when indicated and make recommendations for any additional joints or suggestions for new locations. Lack of joints or misplacement of joints will not constitute justification of slab cracking.
- C. Provide control joints at 15 feet on center unless otherwise indicated.
- D. Where indicated on the drawings, separate slabs from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.

3.6 FLOOR SLAB JOINT FILLING AND CRACK REPAIR

- A. Prepare, clean, and install joint repair material according to manufacturer's written instructions.
- B. Defer joint filling and crack repair until concrete has aged a minimum of 60 days.
- C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

- D. Mechanically V-groove as necessary all saw cuts, joints and cracks, to a minimum width of 1/4 inch and a minimum depth of 5/8 inch.
- E. Fill bottom of joint at slab on grade locations to a depth of at least 3/16 inch with semi-rigid epoxy. Omit semi-rigid epoxy at above grade slab locations.
- F. Place silica sand over epoxy filler.
- G. Prepare and prime joint substrate as recommended by joint repair material manufacturer.
- H. Fill all saw cuts, joints, and cracks with cement based joint repair material to top of concrete surface.
- I. Steel trowel edges of joint repair material to a feather edge to match adjacent floor elevation.

3.7 FINISHING OF FORMED SURFACES

- A. Rough form finish:
 - 1. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
 - 2. Remove fins exceeding 1/4 inch in height.
 - 3. Use for below grade foundation walls and concealed spaces.
- B. Smooth form finish:
 - 1. Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces, with number of seams kept to a practical minimum and in a uniform and orderly pattern.
 - 2. Patch tie holes and defects.
 - 3. Remove fins completely.
 - 4. Use for exposed finish surfaces to receive paint.
- C. Smooth rubbed finish:
 - 1. Produce on newly hardened concrete no later than the day following form removal.
 - 2. Wet the surfaces, and rub with carborundum brick or other abrasive until uniform color and texture are produced.
 - 3. Do not use a cement grout other than the cement paste drawn from the concrete itself by the rubbing process.
 - 4. Use for exposed finish surfaces to receive clear sealer.
- D. Grout cleaned finish:
 - 1. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.
 - 2. Do not permit cleaning as the work progresses.

3. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
4. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or spray gun.
5. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
6. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means.
7. After the surface whites from drying (about 30 minutes at normal temperatures), rub vigorously with clean burlap.
8. Keep the surface damp for at least 36 hours after final rubbing.
9. Use for repair of exposed finish surfaces to receive paint or clear sealer and for exposed to view exterior foundation stem walls..

3.8 FINISHING SLABS

- A. Uniformly spread, screed and consolidate concrete. Do not spread concrete by vibration.
- B. Float Finish: Float with hand float or with a powered disc float. High spots to be cut down and low spots to be filled. Use as preparation for further finishing.
- C. Scratched Finish: Mechanically float surfaces. Roughen with stiff brushes before final set. Use for epoxy floor with full bed setting systems and where indicated.
- D. Troweled Finish: After floating, steel trowel to smooth, mark free surface. Use for exposed floors and slabs to receive carpeting and resilient flooring and where indicated. Do not over trowel or burnish surface.
- E. Slip Resistant Finish: After floating and while the surface is still plastic, uniformly broadcast aluminum oxide particles onto surface at the rate of 25 pounds per 100 sq. ft. Trowel particles into surface to provide embedment but do not force below surface. Use for exposed floors and slabs which constitute ramps with slope of 6 percent or greater, exposed stair treads, and as indicated.

3.9 SLAB TOLERANCES

- A. Maintain slab tolerance as defined in ACI 302.1R of (SOV) F_F35 and F_L25 and (MLV) F_F24 and F_L17 as measured by ASTM E1155 for slabs on grade.
- B. Correct the slab surface if the actual F_F/F_L number for the floor installation measures less than required.
- C. After correction of slab surface to specified tolerance, apply curing, hardening and vapor barrier over corrected surface.
- D. In areas of floor drains, maintain floor levels at the walls and slope surface uniformly to drains at 1/8 inch per foot.

3.10 CURING

- A. Apply curing, hardening and vapor barrier compound on all floor slabs that are not exposed and indicated to be sealed.

- B. Cure concrete surfaces in accordance with ACI 301.
- C. Spray apply curing, hardening and vapor barrier compound on finished slab surfaces located below grade, at grade, and above grade in two "wet on wet" flood coats at the total rate of 200 sq. ft./gallon in accordance with manufacturer's instructions.
- D. Application of compound shall be by a trained applicator acceptable to compound manufacturer.
- E. After application of curing, hardening, and vapor barrier compound, moist cure concrete using the following method:
 - 1. Spraying: Fog spray clean, potable water over floor slab areas and maintain moist for 10 days.
 - 2. Polyethylene Film: Spread over floor slab areas, lap edges and sides, maintain in place for 10 days.

3.11 SEALING

- A. Apply sealing compound on finished floor slab surfaces that are not to receive a finished floor covering and are indicated to be exposed and sealed.
- B. Apply sealing compound immediately following finishing operation.
- C. Apply sealing compound in sufficient quantities to keep entire surface wet for a minimum of 30 minutes.
- D. Lightly mist surface with water as compound is absorbed into surface.
- E. Flush surface with water and squeegee surface free of excess compound.
- F. Burnish final concrete surface with propane burnisher.

3.12 PATCHING

- A. Notify Architect immediately upon removal of forms to determine areas that will require patching.
- B. Surface defects shall include color and texture irregularities, stains, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections and discolorations in the surface that cannot be removed by cleaning.
- C. Patch imperfections in accordance with ACI 301.

3.13 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.
- B. Repair or replace concrete not properly placed or of the specified type.

3.14 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29 and as required by the Division of the State Architect and District Inspector.
- B. Owner's Inspector will take cylinders and perform slump and air entrainment tests in accordance with ACI 301 and will arrange for pick-up by Testing Laboratory.
- C. Three cylinders will be taken for every 50 yards, or fraction thereof, for each class of concrete for each day.

- D. Tests of cement and aggregates will be performed by Testing Laboratory to ensure conformance with requirements stated herein.
- E. Slab tolerance as measured by ASTM E1155 shall be performed within 72 hours of floor slab installation.
- F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.15 PROTECTION

- A. Protect finished work under provisions of Section 01 61 00.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION

SECTION 04 05 13

MASONRY MORTAR

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. ASTM C144 - Aggregate for Masonry Mortar.
- C. ASTM C150 - Portland Cement.
- D. ASTM C207 - Hydrated Lime for Masonry Purposes.
- E. ASTM C270 - Mortar for Unit Masonry.
- F. ASTM C404 - Aggregates for Masonry Grout.
- G. ASTM C476 - Grout for Masonry.
- H. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture for Concrete.

1.3 STORAGE AND HANDLING

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

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperatures to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

1.5 MIX DESIGN

- A. Submit design mix prepared by a California Registered Civil Engineer to testing laboratory and Architect for review.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I, low alkali, gray color.
- B. Mortar Aggregate: ASTM C144, standard masonry type, non reactive.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Grout Aggregate: ASTM C404.
- E. Fly Ash: ASTM C618, Class F.
- F. Water: Clean and potable.

2.2 MORTAR MIXES

- A. Comply with CBC, California Building Code, (CCR), California Code of Regulations, Title 24, Part 2, Section 2103A.2.
- B. Limit fly ash content to 15 percent maximum.
- C. Acceptable Alternative: Mix Preblended Masonry Mortars as manufactured by E-Z Mix, Inc., or Amerimix.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use.
- B. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, retemper only within 2 hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 80 degrees F, or 2-1/2 hours at temperatures under 40 degrees F.
- F. Mortar which has hardened or stiffened due to hydration of cement shall not be used.

2.4 GROUT MIXES

- A. Comply with CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2103A.3.
 - 1. Fine Grout: spaces less than 2 inches in horizontal dimension.
 - 2. Coarse Grout: spaces 2 inches or more in least horizontal dimension.
 - 3. Mix 1 lb of grout aid per 100 lbs of cementitious materials.
 - 4. Limit fly ash content to 25 percent maximum.

2.5 GROUT MIXING

- A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
- B. Do not use anti-freeze compounds to lower the freezing point of grout.

3. PART 3 EXECUTION

3.1 PREPARATION

- A. Plug cleanout holes with masonry units to prevent leakage of grout materials. Brace masonry for wet grout pressure.

3.2 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry Section.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not displace reinforcement while placing grout.
- D. Remove grout spaces of excess mortar.

3.3 FIELD QUALITY CONTROL

- A. Testing and analysis of mortar and grout will be performed under provisions of Section 01 45 29 and as required by Division of the State Architect and District Inspector.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.

1.2 REFERENCES

- A. ASTM C90 - Load-Bearing Concrete Masonry Units.
- B. ASTM C652 - Hollow Brick (Hollow Masonry made from Clay or Shale).
- C. ASTM C744- Prefaced Concrete and Calcium Silicate Masonry Units.
- D. ASTM D226 - Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
- E. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- F. ASTM D2000 - Rubber Properties in Automotive Applications.
- G. ASTM D2240 - Rubber Property - Durometer Hardness.
- H. UL - Underwriters' Laboratories.
- I. MSJC - Masonry Standards Joint Committee (ACI 530/ASCE 5/TMS 402).
- J. DSA - Division of the State Architect.

1.3 REGULATORY REQUIREMENTS

- A. Conform to UL requirements for fire rated masonry construction.

1.4 STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 61 00.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Weather Requirements: MSJC - Masonry Standards Joint Committee, Hot and Cold Weather Masonry Construction Manual (ACI 530/ASCE 5/TMS 402).

1.6 SEQUENCING AND SCHEDULING

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

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - CONCRETE MASONRY UNITS

- A. Angelus Block, Co., Inc. www.angelusblock.com.
- B. Basalite Concrete Products, www.basalite.com.
- C. Desert Block Co., Inc., www.desertblock.com.

- D. Orco Block Co., Inc., www.orco.com.
- E. RCP Block and Brick, Inc., www.rcpblock.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units: ASTM C90, medium weight. Masonry units shall be single or double open end units as required for proper installation.
- B. All exterior concrete masonry units shall contain Dry Block, an integral water-repellant admixture as manufactured by GCP Applied Technologies, www.gcpat.com or MasterPel 240 as manufactured by Master Builders, Inc., www.master-builders-solutions.basf.us.com. Quantity of admixture to be in accordance with manufacturer's recommendations.
- C. Provide single, double, and triple faced units as required for all exposed surfaces:
 - 1. Split Faced Units: Provide at all locations indicated on drawings.
 - 2. Three Score Split Face Units: Provide Orco 301 or equivalent units at all locations indicated on drawings.
 - 3. Single Vertical Score Precision Units: Provide at all locations indicated on drawings.
 - 4. Multiple Vertical Score Precision Units (Orco "Lido"): Provide at all exterior locations indicated on drawings.
 - 5. Precision Units: Provide at all exterior and interior exposed and interior concealed locations where not otherwise indicated.
 - 6. Cap Blocks: Provide 2 inch thick solid units at all locations indicated on drawings.
- D. Color:
 - 1. Smooth Units: Orco Grey.
 - 2. Cap Blocks: Orco Grey.
- E. Masonry Units: Nominal modular sizes as indicated on drawings.

2.3 MANUFACTURERS - PREFACED MASONRY UNITS

- A. Trenwyth Industries, www.trenwyth.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR AND GROUT

- A. Mortar: Type specified in Section 04 05 13.
- B. Grout: Type specified in Section 04 05 13.

2.5 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: Type specified in Section 03 20 00; sizes indicated.
- B. Anchors: Types and sizes indicated and required for intended use.

2.6 ACCESSORIES

- A. Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials.
- B. Preformed Expansion Joints: ASTM D2000, designation 2AA-805, rubber material with durometer hardness of 80 when tested in accordance with ASTM D2240. Provide with corner and tee accessories, fused joints.
- C. Joint Filler: ASTM D1056, Type 2, Class A, Grade 1, closed cell neoprene oversized 35 percent to joint width.
- D. Building Paper: ASTM D226, Type I (No. 15) asphalt saturated felt.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied by other Sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- C. Roughen masonry contact surface of foundation and floors by exposing clean aggregate.

3.3 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.4 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- C. Remove excess mortar as Work progresses.
- D. Interlock intersections and external corners.
- E. Intersections of perpendicular walls to be flush. Rake joint at exposed unit faces for placement of backer rod and sealant.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where plaster is directly applied.

3.5 REINFORCEMENT

- A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.6 ANCHORAGES

- A. Embed anchors attached to structural steel members. Embed anchorages at 16 inches on center vertically in mortar joint unless indicated otherwise.

3.7 REINFORCED UNIT MASONRY

- A. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.
- B. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 24 hours for low lift grouting.
- C. Reinforce masonry unit cores with reinforcement bars and grout as indicated.
- D. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 160 bar diameters. Do not splice between lateral support unless otherwise indicated.
- E. Brace reinforcement and secure in place to allow no movement during grouting.
- F. Grouting:
 - 1. Use Fine Grout per Section 04 05 13 for filling spaces less than 2 inches in one or both horizontal directions.
 - 2. Use Coarse Grout per Section 04 05 13 for filling spaces 2 inches or larger in both horizontal directions.
 - 3. Grouting Technique: Low-lift grouting technique subject to requirements specified below.
- G. Low-Lift Grouting:
 - 1. Provide minimum clear dimension of 2-1/2 inch and clear area of 8 sq. in. in vertical cores to be grouted.
 - 2. Place vertical reinforcement prior to laying of masonry units. Extend above elevation of maximum pour height as required for splicing.
 - 3. Lay masonry units to maximum pour height. Do not exceed 4'-0" height, or if bond beam occurs below this height, stop pour at course below bond beam.
 - 4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than 1 hour. Terminate grout pours 1-1/2 inches below top course of pour.
 - 5. Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3.8 CONTROL JOINTS

- A. Size control joint in accordance with Section 07 92 00 for sealant performance.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of masonry unit. Fill resultant joint with mortar. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Form control joints using half size masonry units as required in running bond.

- D. Locate joints in concrete masonry unit walls at intervals not to exceed 24 feet unless indicated otherwise.

3.9 EXPANSION JOINTS

- A. Do not continue reinforcement through expansion joints.
- B. Install preformed expansion joint material in continuous lengths.
- C. Form expansion joints using half size masonry units as required in running bond.
- D. Size expansion joints in accordance with Section 07 92 00 for sealant performance.
- E. Form expansion joints as detailed.

3.10 BUILT-IN WORK

- A. As work progresses, build in metal door frames window frames, wood nailing strips, anchor bolts, plates and other items furnished by other Sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build in organic materials subject to deterioration.

3.11 TOLERANCES

- A. Maximum Variation From Alignment of Columns and Pilasters: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- D. Maximum Variation From Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation From Level Coursing: 1/8 inch in 4 feet and 1/4 inch in 12 feet maximum.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 4 feet.
- G. Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.
- H. Smooth side shall be west face of wall.

3.12 CUTTING AND FITTING

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

3.13 PARGING

- A. Dampen masonry walls prior to parging.
- B. Parge masonry walls in one uniform coat of mortar to a total thickness of 1/2 inch.
- C. Steel trowel surface smooth and flat with a maximum surface variation of 1/8 inch per foot.

3.14 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

3.15 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with non-acid cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.16 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 61 00.
- B. At the end of each days work and during times of inclement weather cover top of masonry wall with polyethylene sheeting. Extend covering down each side of wall for a distance of 2 feet minimum. Secure in place to avoid displacement.
- C. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members and support members.
- B. Baseplates, and anchor bolts.
- C. Grouting under baseplates.

1.2 REFERENCES

- A. CBC 2016 - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. ASTM A36 - Carbon Structural Steel.
- C. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- D. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- E. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- F. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- G. ASTM A490 - Structural Bolts, alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
- H. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- I. ASTM A992 - Standard Specification for Steel for Structural Shapes for Use in Building Framing.
- J. ASTM C1107 - Packaged Dry, Hydraulic Cement Grout (non shrink).
- K. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 KSI Yield Strength.
- L. AWS A2.4 - Standard Welding Symbols.
- M. AWS D1.1 - Structural Welding Code - Steel.
- N. ANSI / ASCE 360 - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- O. ANSI / ASCE 303 - Specification for Architectural Exposed Structural Steel.
- P. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, and locations of structural members, connections, cambers and loads.
 - 2. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Submit under provisions of Section 01 33 00 certifying that products meet or exceed specified requirements.

- D. Mill Test Reports: Submit under provisions of Section 01 33 00 Manufacturer's Certificates, indicating structural strength and destructive and non-destructive test analysis.
- E. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.4 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. Perform Work in accordance with AISC - Specification for Architectural Exposed Structural Steel where indicated on the drawings.
- C. Category for Architecturally Exposed Structural Steel (AESS) shall be 3.

1.5 QUALIFICATIONS

- A. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.
- B. Design connections in accordance with CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 22A.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Structural Steel Members: ASTM A36. W and WT shapes, ASTM A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Steel Pipe: ASTM A53, Grade B.
- D. Shear Stud Connectors: ASTM A108, Grade 1015, forged steel, headed, unfinished.
- E. Threaded Bolts, Nuts, and Washers: ASTM A325 [and A-490].
- F. Anchor Bolts: ASTM A307. ASTM F1554 if over 9-1/2 inches long.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.2 FABRICATION

- A. Fabricate structural steel members in accordance with AISC Specification.
- B. Fabricate Architecturally Exposed Structural Steel in accordance with category designated.
- C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP-2.
- B. Prepare Architecturally Exposed Structural Steel in accordance with SSPC-6.
- C. Shop and Touch-Up Primer: SSPC 15, Type 1, Red Oxide.

- D. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded or in contact with concrete or masonry.
- E. Finish: Site paint exposed to view structural steel members under provisions of Section 09 90 00.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Testing and analysis of components will be performed under provisions of Section 01 45 29.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- B. Field weld components indicated on Drawings.
- C. Field connect members with threaded fasteners indicated; torque to required resistance.
- D. Do not field cut or alter structural members without approval of Architect.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- F. Erect Architecturally Exposed Structural Steel in accordance with category designated.

3.3 GROUTING

- A. Clean concrete on masonry bearing surfaces.
- B. Roughen bearing surface prior to setting base and bearing plates.
- C. Set base and bearing plates on wedges, shims, or setting nuts.
- D. Tighten anchor bolts after members are positioned and plumb.
- E. Cut off protruding wedges or shims flush with edge of base or bearing plate.
- F. Pack grout solidly between bearing surfaces and plates so no voids remain.
- G. Finish exposed surfaces, protect installed materials, and allow to cure.

3.4 ERECTION TOLERANCES

- A. Erect structural steel members in accordance with AISC Specification.
- B. Erect Architecturally Exposed Structural Steel in accordance with category designated.

3.5 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated ferrous metal items, galvanized and prime painted.
- B. Schedule of metal fabrications.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- F. ASTM A492 - Standard Specification for Stainless Steel Rope Wire.
- G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- I. AWS A2.4 - Standard Welding Symbols.
- J. AWS D1.1 - Structural Welding Code - Steel.
- K. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALIFICATIONS

- A. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 FIELD MEASUREMENTS

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

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Sections: ASTM A36.

- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A36.
- D. Pipe: ASTM A53, Grade B, Schedule 40.
- E. Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Shop and Touch Up Primer: SSPC 15, Type 1, red oxide.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC 20.

2.2 FABRICATION, GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds unless indicated otherwise.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with one coat.
- D. Galvanize assembled items to minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A123.
- E. Repair damaged galvanized surfaces in accordance with ASTM A780 Method A2.
- F. Finish: Site paint exposed to view prime painted and galvanized items under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 SCHEDULE

- A. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Miscellaneous Framing and Supports: Steel not a part of structural steel framework as required to complete work; galvanized or prime paint finish. See drawings.
- C. Bumper Posts and Guard Rails: As detailed; prime paint finish.
- D. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- E. Joist Hangers: Joist strap anchors, galvanized finish.
- F. Ledge and Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of metal decking prime paint finish.
- G. Opening Frames for Overhead Doors and Wall Openings: Structural sections; prime paint finish.
- H. Steel Framing and Supports for Countertops: Angle framing fabricated as detailed, prime paint finish.
- I. Reinforcement for Low Partitions: Steel tube shapes as detailed, prime paint finish.

END OF SECTION

SECTION 05 51 33

METAL LADDERS

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Prefabricated aluminum roof access ladders.
- B. Personal fall assist system.

1.2 REFERENCES

- A. AWS D1.2 - Structural Welding Code - Aluminum.
- B. OSHA - Standards of Occupational Safety and Health Administration.
- C. ANSI - ANSI A-14.3 Standards.
- D. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.3 FIELD MEASUREMENTS

- A. Verify actual dimensions on site prior to fabrication.
- B. Contractor shall be responsible for a complete installation of all components required.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. O'Keeffe's Inc., www.okeeffes.com.
- B. Alaco Aluminum Ladders, www.alacoladder.com.
- C. Dur-Red Products, www.dur-red.com.
- D. Lapeyre Stair, Inc., www.lapeyrestair.com.
- E. Precision Ladders, LLC, www.precisionladders.com.
- F. Substitution: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Rungs shall be round or square and a minimum of 1-1/8 inch in section, formed from aluminum extrusion, ASTM B221 alloy 6061-T6, and shall be deeply serrated on all sides to provide maximum foot grip and traction. Rungs shall be able to withstand a 250 pound loading without failure. Space rungs 12 inches o.c. as indicated.
- B. Channel side rail shall be minimum 3 inch x 1 inch x 1/8 inch aluminum extrusions, ASTM B221 alloy 6061-T6.
- C. Personal Fall Assist System: Continuous 3/8 inch diameter cable fall protection system with automatic pass thru cable guide and fall arrestor; top and bottom bracket assembly with bottom life line tensioner and top shock absorber; ladder climbing harness; all meeting OSHA requirements.

D. Welding Materials: AWS D1.2.

E. Finish:

1. Clear natural anodized finish for all interior ladders.

2.3 ACCESSORIES

A. Anchorage devices and bolts necessary for installation as required by manufacturer's recommendations.

2.4 FABRICATION

A. Materials used shall be new stock, straight within industry tolerances and free of any defects in finish or structure.

B. Cutting of stock shall be by mechanical means to assure a smooth square and true working edge.

C. Mechanical Connections: Bolted connections shall be made with cast aluminum connectors and stainless steel anchorage devices.

D. Welded Connections: In accordance with AWS D1.2 requirements.

E. Protection of aluminum from dissimilar materials:

1. Dissimilar metals except stainless steel, white bronze, and solid zinc, shall be painted with a heavy brush coat of zinc-chromate primer and one coat of aluminum paint.
2. Aluminum surfaces in contact with mortar, concrete, plaster or other masonry materials shall be given one heavy brush coat of bituminous paint.

3. PART 3 EXECUTION

3.1 PREPARATION

A. Verify proper timing for ladder installation to prevent undue delay in job progress.

B. Installation of ladder units shall be considered as acceptance by the Contractor of the adjacent construction as substantially conforming to the intended details and capability of supporting the ladder unit.

3.2 INSTALLATION:

A. Secure ladders in position as indicated on the Drawings and as required by manufacturer's specifications.

END OF SECTION

SECTION 05 52 00

METAL RAILINGS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel tube handrails, balusters, and fittings.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A36 - Specifications for Structural Steel.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- E. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- F. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- G. ASTM B429 - Aluminum-Alloy Extruded Structural Pipe and Tube.
- H. ASTM E985 - Permanent Metal Railing Systems and Rails for Buildings.
- I. AWS D1.1 - Structural Welding Code - Steel.
- J. AWS D1.2 - Structural Welding Code - Aluminum.
- K. AWS D1.6 - Structural Welding Code - Stainless Steel.
- L. NAAMM - Metal Finishes Manual.
- M. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- N. SSPC - The Society for Protective Coatings.

1.3 DESIGN REQUIREMENTS

- A. Design, engineer, fabricate and install railing assembly, wall rails, and attachments to resist force of 200 lbs applied in any direction at any point on the rail without damage or permanent set.
- B. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- C. Fabricate railing assembly, wall rails, and attachments to ASTM E985 requirements.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.5 FIELD MEASUREMENTS

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

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Craneveyor Corp., www.craneveyor.com.
- B. R and B Wagner, Inc., www.rbwagner.com.
- D. P & P Artec, www.artec-rail.com.
- C. Tubular Specialties Mfg. Inc., www.calltsm.com.
- D. Substitutions: Under provisions of Section 01 25 13.

2.2 STEEL RAILING SYSTEM

- A. Rails and Posts: ASTM A500, Grade B, 1-1/2 inch diameter square steel tubing, 3/16 inch wall thickness, welded joints with steel inserts for casting in concrete, steel brackets for embedding into masonry.
- B. Structural Plates, Shapes, and Bars: ASTM A36.
- C. Fittings: Elbows, T-shapes, flanges, escutcheons; machined steel.
- D. Wall Brackets: Julius Blum No. 1378, www.juliusblum.com.
- E. Splice Connectors: Steel welding collars.
- F. Welding Materials: AWS D1.1.

2.3 FABRICATION

- A. Fit and shop assemble components in largest practical sizes, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Continuously seal joined pieces by continuous welds in accordance with AWS requirements.
- F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G. Accurately form components to suit ramps, stairs and landings, to each other and to building structure.

2.4 FINISHES

- A. Apply bituminous paint to separate dissimilar metals and metal surfaces in contact with cementitious materials.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Do not prime surfaces in direct contact with concrete or where field welding is required.

- D. Shop and Touch-up Primer: SSPC, Type 1, red oxide.
- E. Touch-Up Primer for Galvanized Surfaces: SSPC 20.
- F. Finish: Site paint under provisions of Section 09 90 00.
- G. Stainless Steel: No. 4 finish.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete and embedded in masonry with setting templates, to appropriate Sections.

3.3 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors required for connecting railings to structure. Anchor railing to structure.
- C. Field weld anchors as indicated on Drawings. Grind welds smooth. Touch-up welds with primer.
- D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Install wall mounted handrail brackets to bottom of handrail.
- F. Install wall mounted handrails with a 1-1/2 inch space between wall and inside face of handrail.
- G. Extend handrail at top of stairs a minimum of 1'-0" past face of riser. Extend handrail at bottom of stairs a minimum distance of 1'-0" plus depth of one stair tread. The 1'-0" handrail extensions to be level and parallel with the landing surface.
- H. Extend handrails at top and bottom of ramps a minimum of 1'-0". The 1'-0" handrail extensions to be level and parallel with the landing surface.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Structural floor, wall, and roof framing.
- B. Built-up structural beams and columns.
- C. Floor, wall, and roof sheathing.
- D. Plywood underlayment over all wood subfloors.
- E. Combination subfloor - underlayment.
- F. Wood furring, backing and grounds.
- G. Preservative treatment of wood.

1.2 REFERENCES

- A. CBC 2016 - California Building Code, (CCR) California Code of Regulations Title 24, Part 2.
- B. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- C. ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction.
- D. ANSI/SDPWS - Special Design Provisions for Wind and Seismic.
- E. APA - The Engineered Wood Association.
- F. ASTM D6109 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber.
- G. ASTM E84 - Standard Test Method for Surface burning Characteristics of Building Materials.
- H. AWPAA - American Wood Preservers' Association: Book of Standards.
- I. FSC – Forest Stewardship Council.
- J. National Bureau of Standards - Product Standard PS-1-09 for Construction and Industrial Plywood.
- K. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- L. WWPA - Western Wood Products Association.

1.3 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Plywood Grading Agency: Certified by APA.
- C. Accredited certification bodies shall be one of the following:
 - 1. Rainforest Alliance, www.rainforest-alliance.org.
 - 2. SCS Global Services, www.scsglobalservices.com.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 23.
- B. Allowable stress design values shall be in compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2306, ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction, and ANSI/SDPWS - Special Design Provisions for Wind and Seismic.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide technical data on wood preservative materials and application instructions..

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 61 00.
- B. Deliver materials free from pest infestation. Protect materials on site to prevent termite, beetle or other wood boring insect attacks.
- C. Stack lumber flat, off grade, with spacers between each bundle to promote air circulation. Provide for air circulation around and under coverings.

2. PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WCLIB and WWP. Lumber shall bear WCLIB grade stamp.
- B. Beam Framing: Per structural drawings.
- C. Joist Framing: Per structural drawings.
- D. Rafter Framing: Per structural drawings.
- E. Structural Framing, Studs, Plate and Blocking: Per structural drawings.
- F. Non-structural Light Framing Studs, Plate and Blocking: Per structural drawings.
- G. Plank and Decking: Douglas Fir species, Com Dex.

2.2 MOISTURE CONTENT

- A. 2x and 3x material, 19 percent moisture content, S-Dry. Structural and non structural framing, beam, rafters, joists, studs, plates and blocking.
- B. 4x and 6x material, 19 percent moisture content at time of application of Architectural finishes. 22 percent maximum moisture content at time of delivery to project site. Materials to be air dried as required to achieve 22 percent moisture content prior to delivery to site. Structural and non structural framing, beam, rafters, joists, studs, plates and blocking.
- C. Lumber materials with a moisture content above 19 percent and less than 22 percent at the time of installation shall be tested for moisture content prior to covering with Architectural finishes. Moisture tests shall be performed under the provisions of Section 01 45 29.
- D. No lumber shall be covered with an Architectural finish until the moisture content of the lumber is 19 percent or below.

2.3 PLYWOOD MATERIALS

- A. Roof Sheathing: APA Structural I, Grade C-D, Exposure 1 minimum 5-ply construction, meeting product Standard PS-1-09.
- B. Wall Sheathing: APA Structural I, Grade C-D, Exposure 1 minimum 5-ply construction, meeting product standard PS-1-09.
- C. Telephone and Electrical Panel Boards: APA Grade C-D with exterior glue, minimum 5 ply, 3/4 inch thick, meeting PS-1-09.

2.4 ORIENTED STRAND BOARD (OSB)

- A. OSB sheathing shall conform to ICC ESR - 2586.
- B. Roof Sheathing: APA rated sheathing, Exposure 1, Structural 1, meeting PS-2 and PRP-108 with radiant aluminum foil barrier. Nominal thickness not less than 15/32 inch. Span rating of 32/16.
- C. Wall Sheathing: APA rated sheathing, Exposure 1, Structural 1, meeting PS-2 and PRP-108. Nominal thickness not less than 15/32 inch. Span rating of 32/16.

2.5 ACCESSORIES

- A. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.
- B. Connectors: As indicated.
- C. Joist Hangers: Galvanized steel, sized to suit joists and framing conditions; manufactured by Simpson, USP Connectors or KC Metals.
- D. Anchors: Thru bolt or anchor bolt to concrete or masonry unless otherwise noted. Bolt for anchorage to steel unless otherwise noted.
- E. Building Paper: No. 15 asphalt felt. Plain untreated cellulosic building paper.

2.6 WOOD TREATMENT

- A. Preservative Treatment: Where lumber or plywood is indicated as treated or is specified herein to be treated, comply with applicable requirements of AWWA Standards C2 (Lumber) and C9 (Plywood).
- B. Pressure treat all lumber in contact with ground. After treatment kiln-dry lumber to a maximum moisture content of 19 percent.
- C. Pressure treat above ground items as indicated. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - 2. Horizontal wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
 - 3. Horizontal wood framing members less than 18 inches above grade.
 - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
 - 5. Ends of wood girders entering masonry or concrete walls.
 - 6. Framing members used in exterior door, window, or louver openings.

- D. Complete fabrication of treated items prior to treatment, where possible. If cut or drilled after treatment, coat cut or drilled surfaces with heavy brush coat of same chemical used for treatment and to comply with AWP4 M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

3. PART 3 EXECUTION

3.1 FRAMING

- A. Erect wood framing members level and plumb.
- B. Place horizontal members laid flat, crown side-up.
- C. Construct framing members full length without splices.
- D. Double members at openings over 1 sq ft. Space short studs over and under opening to stud spacing.
- E. Construct double joist headers at floor and ceiling openings. Frame rigidly into joists.
- F. Construct double joists under wall studding.
- G. Bridge joists in excess of 8 feet span at mid-span members. Fit solid blocking at ends of members.

3.2 FURRING, BLOCKING AND GROUNDS

- A. Provide wherever shown and where required for attachment of other work. Coordinate with work of other sections.
- B. Item locations include but are not limited to toilet accessories, toilet partitions, door frames, window frames, hardware, access doors and ladders, cabinetry, miscellaneous equipment locations and mechanical, plumbing and electrical item locations and all other locations of wall mounted items.
- C. Install plywood backboards for telephone, data and other electrical equipment.
- D. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- E. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
- F. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- G. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
- H. Firestop all concealed spaces of wood stud walls, ceilings and floor levels at 10 foot intervals both vertically and horizontally.
- I. Firestop all concealed vertical and horizontal spaces as occur at soffits, vents, stair stringers, pipes and similar openings in compliance with CBC, (CCR) Title 24, Part 2, Section 718.
- J. Firestopping shall consist of closely fitted wood blocks of 2 inch nominal thickness lumber of same width as framing members.

3.3 SHEATHING

- A. Secure roof sheathing perpendicular to framing members with ends staggered. Secure sheet edges over firm bearing. Provide solid edge blocking between sheets. Space panels 1/8 inch apart at ends and edges. Install radiant barrier towards interior of roof.
- B. Secure wall sheathing perpendicular to wall studs, with ends staggered, over firm bearing.

- C. Install telephone and electrical panel back boards where required. Size of backboards to be 12 inches beyond size of electrical panel boards.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Lumber materials will be inspected for compliance with material grading rules, limitations for moisture content and pest infestation prior to any materials being concealed from view or being covered with an architectural finish.

3.5 TOLERANCES

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

END OF SECTION

SECTION 06 41 16

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Special fabricated cabinet units.
- B. Countertops.
- C. Preparation for utilities.
- D. Cabinet hardware.
- E. Glass for cabinet units.

1.2 REFERENCES

- A. WI - Woodwork Institute of California: North American Architectural Woodwork Standards 3.1. (NAAWS)
- B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- E. ASTM C615 – Standard Specification for Granite Dimension Stone.
- F. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
- G. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- H. FSC – Forest Stewardship Council.

1.3 QUALITY ASSURANCE - MONITORED COMPLIANCE PROGRAM

- A. Manufacture casework items in accordance with quality standards of the North American Architectural Woodwork Standards of the Woodwork Institute.
- B. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Monitored Compliance Program (MCP).
- C. Fees charged by the Woodwork Institute for their monitored compliance service are the responsibility of the casework manufacturer.
- D. Provide WI Inspection Service at the millwork fabricator. Provide to Architect a written report showing the results of the inspection.
- E. Provide WI Certified Compliance Labels on all items of casework and countertops.

- F. Provide WI Inspection Service at the job site. Provide to Architect a written report showing the results of the inspection.
- G. Self Certification by the millwork fabricator or inspection by other than an authorized representative of The Woodwork Institute is not acceptable.
- H. Upon completion of the installation, provide a WI Monitored Compliance Certificate.

1.4 QUALITY ASSURANCE - CERTIFIED SEISMIC INSTALLATION PROGRAM

- A. Install casework items in accordance with the Woodwork Institute's Certified Seismic Installation Program (CSIP).
- B. Install casework in accordance with the Office of Statewide Health Planning and Development (OSHPD) Preapproval of Fixed Equipment Anchorages (OPA-2649-10 and OPM-0092-13).
- C. Prior to walls being closed up and covered, provide a written Woodwork Institute Certified Seismic Installation report confirming that backing is provided in all locations required for casework installation. Identify those areas where backing is missing or improperly located.
- D. On completion of installation of casework provide a Woodwork Institute Certified Seismic Installation Program Certificate. Identify the work covered and certify that the work as installed is in compliance with the requirements of the Woodwork Institute's Certified Seismic Installation Program (CSIP).
- E. Fees charged by the Woodwork Institute for monitoring and compliance for their Certified Seismic Installation Program (CSIP) are the responsibility of the casework manufacturer and installer.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC requirements for flame spread classification in accordance with CBC Section 803 and Table 803.11.
- B. Conform to Flame Spread Classifications for Interior Millwork for flame spread ratings as tested according to ASTM E84.
- C. Materials of this section shall meet the requirements for formaldehyde as specified in the California Air Resources Board's Air Toxics Control Measure (ATCM) for Composite Wood (17CCR 93120 et seq.).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Conform to Section 2 of the North American Architectural Woodwork Standards for a climate controlled application.
- C. Delivery of casework shall be made only when the area of installation is enclosed, all plaster and concrete work is dry, the area is broom clean and environmental conditions are as specified.

1.7 ENVIRONMENTAL CONDITIONS

- A. Area of casework installation shall be fully enclosed, well ventilated, and protected from direct sunlight, excessive heat, rain and moisture.

- B. Relative humidity of the area of casework installation shall be maintained between 25 percent and 55 percent with a temperature range of between 60 degrees F to 90 degrees F.
- C. Casework shall be acclimated to the area of installation for a minimum of 72 hours prior to installation.

1.8 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes.
- C. Provide WI Certified Compliance Label for the Certified Seismic Installation Program on the first page of shop drawings.
- D. Provide WI Certified Compliance label on first page of shop drawings. Include WI inspector's signature.
- E. Provide WI certificates of compliance and inspection reports.
- F. Operable parts for all accessible casework shall comply with CBC Section 11B-309.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Active member of the Woodwork Institute licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this section www.woodworkinstitute.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Material shall conform to standards of the North American Architectural Woodwork Standards as follows: Section 3, Section 4, Section 10, and Section 11.

2.3 CABINET DESIGN

- A. Individual cabinets are indicated on the drawings by the WI Cabinet Design Series (CDS) numbering system, Design Ideas.

2.4 MODULAR CASEWORK - LAMINATED PLASTIC COVERED

- A. Fabricate in accordance with Section 10 of the North American Architectural Woodwork Standards.

- | | |
|-----------------------|----------------------------------|
| 1. WI Grade: | Custom |
| 2. Core Material: | Medium Density Fiberboard (MDF). |
| 3. Construction: | Style - Frameless. |
| 4. Joinery: | Doweled Joints. |
| 5. Cabinet Backs: | Blind Dadoed. |
| 6. Cabinet Door Type: | Flush overlay. |

- 7. Base: Moisture resistant.
- 8. Substitutions: Under the provisions of Section 01 25 13.

2.5 LAMINATED PLASTIC COUNTERTOPS

A. Fabricate in accordance with Section 11 of the North American Architectural Woodwork Standards.

- 1. WI Grade: Premium.
- 2. Core Thickness: 0.75 inch minimum.
- 3. Laminate Thickness: 0.050 inch or .042 inch for postformed use.
- 4. Front Edge Covering: Waterfall.
- 5. Backsplash at Top: Horizontal butt.
- 6. Top of Back Splash: Square with scribe.
- 7. Construction Type: Assembly 2, deck mount, manufacturer assembled.
- 8. Plastic Colors and Pattern: To be selected from standard patterns, satin finish and/or textured finish.

2.6 EPOXY RESIN COUNTERTOPS

A. Epoxy resin tops and splashes shall be fabricated in accordance with the following:

- 1. Core Thickness : 1 inch
- 2. Edge : Radius 1/4 inch with drip groove.
- 3. Backsplash : Square butt. 4 inch height.
- 4. Color : Black

2.7 GALVANIZED SHEET METAL COUNTERTOPS

- A. Galvanized Steel: ASTM A653, Grade 33, G90 zinc coating in accordance with ASTM 924, 0.0428 inch thick.
- B. Core: Particle board, minimum 3/4 inch total thickness.
- C. Edge: Square front edge with 1/2 inch flange return under core, 1-1/2 inch total thickness.
- D. Backsplash: Integral cove with corners radiused, 1-1/2 inch total thickness. 4 inch height.
- E. Seams: Continuous solder smooth all seams.

2.8 QUARTZ SURFACE COUNTERTOPS

- A. Manufacturer:
 - 1. Caesar Stone, www.caesarstone.com.
 - 2. Cambria, www.cambriaUSA.com.

3. Difiniti Quartz, www.difinitiquartz.com.
 4. Dupont Zodiaq, www.dupont.com.
 5. Radianz, www.staron.com.
 6. Silestone, www.silestoneusa.com.
 7. Substitutions: Under provisions of Section 01 25 13.
- B. Quartz surface tops and splashes shall be fabricated from 93 percent crushed quartz aggregate.
 - C. Finish: Polished.
 - D. Nominal Thickness: 3/4 inch.
 - E. Edge Detail: 1-1/2 inch thick laminated bullnose.
 - F. Splashes: 3/4 inch thick backsplashes and end splashes. 4 inch height. Straight butt joint, slightly eased at edges.
 - G. Joints: Fabricate countertop without joints.
 - H. Cutouts: Form cutouts in shop to smooth, even curves.
 - I. Fittings: Drill countertop in shop for plumbing fittings and similar items.

2.9 JANITOR ROOMS

- A. Provide economy grade casework in accordance with Section 10 of the North American Architectural Woodwork Standards.

2.10 GLAZING

- A. Glass Doors: 1/4 inch thick clear laminated safety glazing with all exposed edges ground.
- B. Glass Shelves: 5/8 inch thick laminated safety glazing with all exposed edges ground.

2.11 HARDWARE

- A. Finish: Satin Aluminum.
- B. Shelf Supports: Metal or molded polycarbonate clips set in drilled holes spaced 32 mm on center. Clips to have vertical locating pin for retention of shelf.
- C. Drawer and Door Pulls: Epco MC-402-4 U-shaped wire pull.
- D. Cabinet Locks: Olympus 500/600.
- E. Drawer Slides for Drawers 24 inch Wide or Less: Accuride 7432.
- F. Drawer Slides for Drawers over 24 inch Wide: Accuride 3640.
- G. Drawer slides for File Drawers: Accuride 4034.

- H. Hinges: Grass Nexus 170 with 170 degree opening. Hinges per leaf: 3'-0" high doors - 2 hinges, 3'-0" to 5'-0" high doors - 3 hinges, 5'-0" to 7'-4" high doors - 4 hinges, 7'-0" to 8'-0" - 5 hinges.
- I. Magnetic Door Catch: Epco 591/592.
- J. Sliding Door Track Assemblies: Grant 2023N sheaves and Grant 2011 track.
- K. Grommets: Doug Mockett and Company, Inc., www.mockett.com. 10 required. LO Series; plastic 6 x 3 inch 6 required. Colors as selected by Architect.
- L. Countertop Support Bracket: 24 inch x 24 inch x 1/8 inch thick pre-manufactured angled steel bracket, black paint finish, minimum 1,000 lb. load support capability, with 7 predrilled anchor holes per bracket leg. Manufactured by A & M Hardware, Inc. www.aandmhardware.com
- M. Remainder of hardware required shall meet requirements of ANSI/BHMA Grade 1.
- N. Plumbing and electrical service fixtures as indicated in Division 22 and Division 26.
- O. Substitutions: Under the provisions of Section 01 25 13.

2.12 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- C. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.
- D. Before installation, seal unfinished material installed for backs, bases, self-edge backing, stripping and other concealed portions with a water-repellant sealer.
- E. Install plastic grommets in the field in plastic laminate casework and Owner furnished furniture as directed by the Owner's Representative and/or Architect.
- F. Install one adjustable shelf for each 1'-0" of height for all wall mounted cabinets.
- G. Provide stretcher at top face of all door and drawer fronts.
- H. Provide locks as indicated at location shown on drawings for both doors and drawers.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

- A. Set and secure casework in place rigid, plumb, and level.
- B. Install casework in accordance with Section 10 of the North American Architectural Woodwork Standards.

- C. Install casework items in accordance with the Woodwork Institute's Certified Seismic Installation Program (CSIP)
- D. Install countertops in accordance with Section 11 of the North American Architectural Woodwork Standards.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

SECTION 07 12 00

BUILT-UP BITUMINOUS WATERPROOFING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cold applied asphalt bitumen waterproofing.
- B. Fabric reinforcement.
- C. Protective covering.
- D. Application Schedule.

1.2 REFERENCES

- A. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.
- B. ASTM D41 - Asphalt Primer Used in Roofing, Dampproofing and Water proofing.
- C. ASTM D1227 - Emulsified Asphalt Used as a Protective Coating for Roofing.
- D. ASTM D1668 - Glass Fabrics (Woven and Treated) for Roofing and Water proofing.
- E. NRCA (National Roofing Contractors Association) - Waterproofing Manual.

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System: Prevent moisture migration to interior.
- B. System: Capable of resisting water head of 6 feet.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum of five years documented experience.
- B. Applicator: Company specializing in bituminous waterproofing systems with five years minimum experience.
- C. Perform work in accordance with NRCA Waterproofing Manual.

1.5 SUBMITTALS

- A. Submit manufacturer's certificate under provisions of Section 01 33 00 that installed materials meet or exceed specified requirements.

1.6 WARRANTY

- A. Provide five year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of waterproofing failing to resist penetration of water except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered as structural failure.
- C. Include coverage during warranty period for removal and replacement of materials concealing waterproofing.

2. PART 2 PRODUCTS

2.1 BITUMEN MATERIALS

- A. Asphalt Primer: ASTM D41, compatible with substrate.
- B. Asphaltic Emulsion: ASTM D1227, Type II, Class 1, with fiberglass fibers.

2.2 SHEET MATERIALS

- A. Glass Fiber Fabric: ASTM D1668, Type III, woven.

2.3 ACCESSORIES

- A. Protection Board: ASTM C578, 1/2 inch thick expanded polystyrene board.

2.4 SUMMARY OF MATERIALS PER 100 SQUARE FEET

- | | |
|--|---------|
| A. Asphalt Primer (1-1/2 gallons) | 15 lbs. |
| B. First Course Coating (3 gals) | 30 lbs. |
| C. Glass Fabric (1 ply) | 1 lb. |
| D. Second Course Coating (3 gals) | 30 lbs. |
| E. Third Course Coating (3 gals) | 30 lbs. |
| F. Protection Course: 1/2 inch thick protection board. | |

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.
- B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer.
- C. Verify items which penetrate surfaces to receive waterproofing are securely installed.
- D. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- B. Apply emulsion to seal penetrations, small cracks, and honeycomb in substrate.

3.3 APPLICATION

- A. Conform to drawing details included in NRCA - Waterproofing Manual.
- B. Prime surfaces with brush or spray coat.
- C. Apply brush coat of emulsion at 3 gallons per 100 sf and embed 12 inch wide ply of glass fabric extending out 6 inches on each surface at vertical wall angles and angles at footings and offsets.
- D. Apply brush or spray coat of emulsion at 3 gallons per 100 square feet. While wet, embed fabric, lapping 2 inches on sides and 4 inches on ends, butting all angles and corners. Brush surface to eliminate wrinkles and voids and allow to dry.

- E. Apply 18 inches wide reinforcing strip of fabric to vertical angles and angles at footings and offsets.
- F. Apply second and third courses of emulsion at rate of 3 gallons per 100 sf. Allow each course to dry before application of next course.

3.4 PROTECTION

- A. Protect finished membrane from damage during backfill operations by adhering protection board with mastic over treated surfaces.
- B. Scribe boards around pipes and projections.

3.5 APPLICATION SCHEDULE

- A. Interior vertical face of below grade planter walls.
- B. Exterior building walls where raised planters occur.

END OF SECTION

SECTION 07 21 16

BLANKET INSULATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Batt insulation and vapor barrier in exterior wall and roof construction.
- B. Batt insulation for filling perimeter window and door shim spaces crevices in exterior wall and roof.
- C. Batt sound insulation in interior walls and partitions and above ceiling.

1.2 REFERENCES

- A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- B. ASTM C1320 - Installation of Mineral Fiber Batt and Thermal Insulation for Light Frame Construction.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 6.
- E. Business and Professions Code.

1.3 PERFORMANCE REQUIREMENTS

- A. Materials of this Section shall provide continuity of thermal and moisture barrier at building enclosure elements.
- B. Materials of this Section shall provide continuity of sound control where indicated or scheduled.

1.4 REGULATORY REQUIREMENTS

- A. Installation of insulation may only commence if insulation meets mandatory manufacturer certification to the California Energy Commission required by Title 24, Part 6, Section 110.8 of the CBC - California Building Code, (CCR) California Code of Regulations that insulation complies with Title 24, Part 12, Chapter 12-13, Article 3 of the California Quality Standards for Insulating Materials.
- B. Insulation products 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."
- C. Insulation materials to be certified in compliance with Business and Professions Code Section 19165.
- D. Insulation manufacturer to be licensed by the California Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation according to Business and Professions Code, Section 19059.7.

1.5 SUBMITTALS

- A. Submit manufacturer's certificates under provisions of Section 01 33 00 that materials meet or exceed specified regulatory requirements.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

- A. Certain Teed Corp., www.certainteed.com.

- B. Johns Manville Corp., www.jm.com.
- C. Knauf Insulation, www.knaufinsulation.us.
- D. Owens-Corning Fiberglass Corporation, www.owenscorning.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Thermal Batt Insulation, Concealed Wall and Roof: ASTM C665 Preformed fiber glass batt, Type II Kraft Faced, Class C, Category 1 "SmartBatt", with stapling flange for attachment to applicable construction. Equivalent continuous roll membrane facing of "MemBrain" Continuous Air Barrier and Smart Vapor Retarder may be utilized in lieu of individual glass fiber batts. Provide R30 at roofs, R19 at walls.
- B. Thermal Batt Insulation, Exposed Wall and Roof: ASTM C665 preformed glass fiber batt, Type III, Class A, with an FSK-25 reflective membrane faced surface that has a flame spread of 25 or less, and a smoke density of 50 or less when tested in accordance with ASTM E-84. Category 1 with stapling flanges for attachment of blanket to applicable construction. Equivalent continuous FSK-25 roll membrane facing may be utilized in lieu of individual faced glass fiber batts. Provide R30 at ceilings and roofs, R19 at walls.
- C. Acoustical Batt Sound Insulation, Concealed Wall and Ceiling: ASTM C665 preformed glass fiber batt, Type I unfaced, with flame spread of 25 or less, and a smoke density of 450 or less when tested in accordance with ASTM E84. Provide 3-1/2, 6-1/2 inch thickness pending wall thickness.
- D. Acoustical Batt Sound Insulation, Exposed Wall and Ceiling: ASTM C665 preformed glass fiber batt, Type III Class A with an FSK-25 reflective membrane faced surface that has a flame spread of 25 or less, and a smoke density of 50 or less when tested in accordance with ASTM E-84. Category 2. Provide 6-1/2 inch thickness.
- E. Insulation to be formaldehyde-free.
- F. Nails or Staples: Steel wire; electroplated; type and size to suit application.
- G. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- H. Support Wire: 16 gauge steel wire.
- I. Support Rods: 13 gauge, pointed spring steel length as required for stud spacing.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.
- B. Verify that enclosed spaces are ventilated to dissipate humidity.
- C. Maximum relative humidity level of less than 50 percent shall be maintained during installation of insulation.

3.2 INSTALLATION

- A. Install insulation in accordance with insulation manufacturer's instructions and ASTM C1320.
- B. Install batt insulation in exterior walls and roof spaces without gaps or voids.
- C. Fill any small spaces around door frames, window frames, skylight frames, and other wall or roof openings with insulation.
- D. Fill hollow space of steel door frame, steel window frame and other wall or roof frame with insulation.

- E. Fill hollow space created by wall or roof framed headers and jamb spaces with insulation.
- F. Install batt sound insulation in interior walls full height of wall.
- G. Install batt sound insulation above ceilings in areas as indicated. Extend a minimum of 4'-0" beyond face of vertical dividing partitions of space to be insulated where partition terminates at ceiling.
- H. Install batt sound insulation at underside of floor decking between adjacent floor levels.
- I. Trim insulation neatly to fit spaces.
- J. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- K. Install with factory applied membrane facing warm side of building spaces.
- L. Lap ends and side flanges of vapor barrier membrane over face of framing members.
- M. Extend vapor barrier on to any adjacent construction and tape seal edge of vapor barrier.
- N. Seal butt ends, lapped flanges, and tears or cuts in membrane with tape or another layer of membrane.
- O. Seal joints in vapor barrier caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier.
- P. Face staple flange over flange of adjacent blanket to wood studs at maximum 6 inches oc.
- Q. Tape stapling flange over flange of adjacent blanket to flange of metal stud.
- R. Friction fit sound insulation between studs and fill as required to completely fill space between the wall finishes.
- S. Retain unsupported roof insulation to metal or concrete substrate with spindle fasteners at 24 inches on center.

END OF SECTION

SECTION 07 31 13

ASPHALT SHINGLES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Asphalt shingle roofing.
- B. Moisture shedding underlayment, eave, valley, and ridge protection.

1.2 REFERENCES

- A. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- E. ASTM D249 - Asphalt Roll Roofing Surfaced with Mineral Granules.
- F. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.
- G. ASTM D3018 - Class A Asphalt Shingles Surfaced with Mineral Granules.
- H. ASTM D3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles.
- I. ASTM D3462 - Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules.
- J. NRCA - Roofing and Waterproofing Manual.
- K. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.
- B. Provide shop drawings indicating metal flashings, jointing methods, fastener types and spacing and installation details.
- C. Provide product data indicating material characteristics, performance criteria and that materials meet specified standards.
- D. Submit two samples of each shingle color indicating color range, finish texture and pattern.
- E. Provide manufacturers instructions indicating materials installation requirements and procedures.

1.4 QUALITY ASSURANCE

- A. Perform roofing in accordance with NRCA Steep Roofing Manual.
- B. Perform flashing in accordance with SMACNA Architectural Sheet Metal Manual.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ASTM D3018 for class A fire resistance for shingle type specified.
- B. Conform to ASTM D3161 for wind resistance rating when tested at a wind speed of 90 mph.

1.6 WARRANTY

- A. Provide manufacturer's warranty for labor and materials for repair or replacement of defective shingles as necessary to maintain roof water tight and free of wind damage up to and including 90 mph.
- B. Period of warranty to be for 30 years from date of substantial completion for water tightness and 5 years for wind damage.

2. PART 2 PRODUCTS

2.1 ASPHALT SHINGLE MANUFACTURERS

- A. Atlas Roofing Corp.-Glassmaster, www.atlasroofing.com.
- B. Certaineed, Independence, www.certaineed.com.
- C. GAF Corporation - Timberline Ultra, www.gaf.com.
- D. Georgia Pacific - Summit, www.gp.com.
- E. Owens Corning - Weather Guard HP, www.owenscorning.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 ROOFING MATERIALS

- A. Asphalt Shingles: Mineral-surfaced, self sealing, laminated multi-ply overlay construction fiberglass based strip shingle complying with ASTM D3018, Type I, self-sealing, bearing Class A external fire exposure label, ASTM D3462, and meeting ASTM D3161 for wind resistance. Color as selected by Architect.
- B. Hip and Ridge Shingles: Job-fabricated units cut from actual shingles used.
- C. Roll Roofing: ASTM D249, Type I; Asphalt saturated roll roofing, 90 lb/square surfaced on weather side with mineral granules.
- D. Underlayment: Spunbound reinforced polypropylene coated fabric sheet.
 - 1. Premium Grade Feltex as manufactured by SystemComponents Corp., www.systemcomponents.net.
 - 2. Premium Summit Synthetic Underlayment as manufactured by Atlas Roofing Corp., www.atlasroofing.com.
 - 3. Roof Top Guard II Underlayment as manufactured by Underlayment Specialties Plus, www.uspunderlayment.com.
 - 4. Substitutions: Under provisions of Section 01 25 13.

2.3 ACCESSORIES

- A. Nails: Standard round wire shingle type of hot-dipped zinc-coated steel; minimum 7/16 inch head diameter and 11 gauge inch shank diameter of sufficient length to penetrate 3/4 inch through roof sheathing.
- B. Plastic Cement: ASTM D4586, Type I.

2.4 FLASHING MATERIALS

- A. Type as specified in Section 07 62 00.
- B. Bituminous Paint: Acid and alkali resistant type; black color.
- C. Nails: Standard round wire roofing type of hot-dipped zinc-coated steel; minimum 19/64 inch head diameter and 0.104 inch shank diameter; of sufficient length to penetrate through roof sheathing.

2.5 FLASHING FABRICATION

- A. Form flashings to profiles indicated on Drawings, and to protect roof assembly and shed water.
- B. Form sections square, true, and accurate to profile, in maximum possible lengths, free from distortion and other defects detrimental to appearance or performance.
- C. Hem exposed edges of flashings minimum 1/4 inch on underside.
- D. Apply bituminous paint on concealed surfaces of flashings.

3. PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install asphalt shingle roofing over dry surfaces, free of ridges, warps, and voids.
- B. Coordinate installation of roof mounted components or work projecting through roof. Verify roof openings are framed, sized, and located prior to installing work of this Section.
- C. Completed installation to provide weathertight service.

3.2 PROTECTIVE UNDERLAYMENT INSTALLATION

- A. Install a 12 inch wide strip of underlayment over all seismic straps and plates.
- B. Place one ply of underlayment over area not protected by eave membrane, weatherlapped minimum 6 inches at vertical ends and 4 inches at horizontal edges.
- C. Stagger end laps of each consecutive layer. Nail protective underlayment to hold in place in accordance with manufacturer's recommendations.
- D. Install protective underlayment perpendicular to slope of roof.
- E. Weather lap and seal items projecting through or mounted on roof with plastic cement.

3.3 VALLEY PROTECTION INSTALLATION

- A. Place one ply of roll roofing, minimum 36 inches wide, centered over valley.
- B. Place with mineral surfaced side down. Weather lap joints 4 inches.
- C. Nail in place minimum 18 inches on center, 1 inch from edges.

3.4 FLASHING INSTALLATION

- A. Install flashings in accordance with SMACNA Architectural Sheet Metal Manual requirements.
- B. Weather lap joints minimum 2 inches and seal weathertight with plastic cement.
- C. Secure in place with nails at 12 inches oc. Conceal fastenings.

- D. Flash and seal work projecting through or mounted on roofing with plastic cement. Provide weathertight installation.

3.5 ASPHALT SHINGLES INSTALLATION

- A. Install starter strip of roll roofing or inverted shingles with tabs removed.
- B. Fasten shingles in pattern, weather exposure and number of fasteners per shingle as recommended by manufacturer.
- C. Comply with installation details and recommendation of shingle manufacturer and NRCA Steep Roofing Manual.
- D. Project first course of shingles 3/4 inch beyond fascia board.
- E. Extend shingles 1/2 inch beyond face of gable edge fascia board.
- F. Extend shingles on one slope across valley 12 inches and fasten. Trim shingles from other slope 2 inches from valley centerline to achieve closed-cut valley. Embed end of cut shingle in 3 inch wide strip of cement.
- G. Cap hips and ridges with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.
- H. Coordinate installation of roof mounted components of work projecting through roof with weather tight placement of counter flashing.

END OF SECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cleaning deck surface.
- B. Membrane roofing and base flashings.
- C. Spray applied elastomeric acrylic coating.
- D. Expansion joint covers.

1.2 REFERENCES

- A. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
- B. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- C. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM C728 - Perlite Thermal Insulation Board.
- E. ASTM D312 - Asphalt Used in Roofing.
- F. ASTM D412 - Rubber Properties in Tension.
- G. ASTM D2523 - Testing Load-Strain Properties of Roofing Membranes.
- H. ASTM D4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
- I. ASTM D6083 – Standard Specification for Liquid Applied Acrylic Coating Used in Roofing.
- J. ASTM D6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
- K. ASTM D6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
- L. ASTM D6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcement.
- M. ASTM D6221 - Standard Specification for Reinforced Bituminous Flashing Sheets on Roofing and Waterproofing.
- N. ASTM E408 – Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection – Meter Techniques.
- O. ASTM E903 – Standard Test Method for Solar Absorption, Reflectance, and Transmittance of Materials Using Inspection - Meter Techniques.
- P. CBC – California Building Code, (CRC) California Code of Regulations, Title 24, Part 6.
- Q. CRRC – Cool Roof Rating Council – Product Rating Program CRRC-1.
- R. FM (FM Global) - Roof Assembly Classifications.
- S. NRCA - National Roofing Contractors Association.

T. UL (Underwriters Laboratories) - Fire Hazard Classifications.

1.3 SYSTEM DESCRIPTION

A. Modified Bitumen Conventional Roofing System: Three layer SBS membrane system having a spray applied acrylic surfacing.

1.4 SUBMITTALS

A. Submit manufacturer's product data, summary of weights of materials and installation instructions under provisions of Section 01 33 00.

B. Submit documentation of conformance of roofing system with regulatory requirements specified under provisions of Section 01 33 00.

1.5 QUALITY ASSURANCE

A. Perform Work according to roofing system manufacturer's written instructions and applicable recommendations of the NRCA Roofing and Waterproofing Manual and the NRCA Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing.

B. Maintain a copy of the manufacturer's written instructions and the applicable recommendations of the referenced NRCA publications on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with five years documented experience.

B. Applicator: Company specializing in performing the Work of this Section with five years documented experience and approved by system manufacturer.

C. Work of this Section to conform to manufacturer's instructions.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable UL and FM requirements for roof assembly requirements.

B. Fire Hazard Classification: UL Class B.

C. Conform to CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 6 requirements for a Cool Roof under the Product Rating Program CRRC-1 of the Cool Roof Rating Council.

D. Windstorm Rating: FM I-90.

1.8 PRE-INSTALLATION CONFERENCE

A. Convene two weeks prior to commencing Work of this Section, under provisions of Section 01 31 00.

B. Review installation procedures and coordination required with related Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 61 00.

B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.

D. Store products in a manner to avoid significant or permanent deflection of roof deck.

- E. Stand roll materials on end.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply roofing membrane during inclement weather.
- B. Do not apply roofing membrane to damp or frozen deck surface.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate the work with installation of associated metal flashings as the work of this Section proceeds.
- C. Notify roofing manufacturer 72 hours prior to commencing work to arrange for inspection of roof application.

1.12 WARRANTY

- A. Provide 10 year manufacturer's warranty under provisions of Section 01 77 00.
- B. Manufacturer's Warranty: No Dollar Limit Warranty covering roof membrane, base flashings, and workmanship equivalent to Signature Series Guarantee offered by the Johns Manville Corporation. Warranty to include repair of roof membrane damage due to windstorms less than or equal to 64 mph.
- C. Provide 2 year roofing installers warranty under provisions of Section 01 77 00.
- D. Roofing Installers Warranty: Warranty shall cover the Work of this section, including installation of all components of roofing system to include roofing membrane, base flashings, fasteners, coatings, sealants, and all penetrations of roofing membrane.

1.13 INSPECTION SERVICE

- A. Manufacturer of the roofing materials shall provide the following services:
 - 1. Application start-up inspection.
 - 2. Periodic inspections during application.
 - 3. Certification of materials used and application.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - MEMBRANE MATERIALS

- A. Henry Company H4-NMC-MR, see attached cut sheet for District Standard.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MANUFACTURERS – ACRYLIC COATING

- A. National Coatings Corporation, Acryshield A503 Primer with Acryshield A420 Top Coat, CRRC Product ID No. 0626-0004, UL No. R11754 , www.nationalcoatings.com.
- B. Other acceptable manufacturers offering equivalent products:
 - 1. Henry Company, 291 Base Coat with HE 280 Top Coat, CRRC ID No. 0620-0004, UL No. R10185, www.henry.com.

- C. Substitutions: Under provisions of Section 01 25 13.

2.3 MEMBRANE MATERIALS

- A. See cut sheets.

2.4 BITUMINOUS MATERIALS

- A. See cut sheet.

2.5 ROOF SURFACING

- A. See cut sheets.

2.6 BASE FLASHINGS

- A. Base Flashing: Flexible sheet flashing, ASTM D6221, Type 1, modified bitumen, granule surfaced, equivalent to Dynaflex, as manufactured by the Johns Manville Corporation.

2.7 ACCESSORIES

- A. Roofing Nails: Galvanized or non-ferrous type, size as required to suit application.
- B. Expansion Joint Covers: Expand-O-Flash roof expansion joint covers as manufactured by the Johns Manville Corporation, size and type as detailed.
- C. Lead Sheet: ASTM B749, Type L51121, copper-bearing lead sheet, 2-1/2 to 4 lbs./sq. ft.
- D. Copper Sheet: ASTM B370, Temper H00 or H01, cold-rolled copper sheet, 16 oz./sq. ft.
- E. Slip Sheet: 0.05 lb/sq. ft. rosin sized building paper.
- F. Reflective Coating: See cut sheet.

2.8 SUMMARY OF MATERIALS PER 100 SQUARE FEET

- A. Base sheet (1 ply)
- B. Intermediate sheet (3 ply)
- C. Asphalt moppings (2 @ 23 lbs.) 46 lbs.
- D. Reflective Top Coat (1-1/2 gal @ 100 sf)]

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify that deck is supported and secured.
- C. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, or eaves.
- D. Verify that deck surfaces are dry and free of snow or ice.
- E. Confirm dry deck by moisture meter with 15 to 19 percent moisture maximum.
- F. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and reglets are in place.

- G. Beginning of installation means installer accepts existing surfaces.

3.2 PROTECTION

- A. Protect building surfaces against damage from roofing work.

3.3 PREPARATION

- A. Verify flatness and tight joints of wood decking. Fill knot holes with latex filler.
- B. Loose lay slip sheet.
- C. Prime metal flashings with asphalt primer.
- D. Install tapered edge strips, 1-1/2 inch thick x 24 inch wide, at all roof penetrations and at all intersections of roof with vertical surfaces.

3.4 ASPHALT

- A. Mop Application: Apply asphalt at a temperature range of between 400 degrees to 450 degrees F or per manufacturer's printed EVT range.
- B. Mechanical Spreader: Apply asphalt at a temperature range of between 425 degrees to 475 degrees F or per manufacturer's printed EVT range.
- C. Asphalt shall not be heated above maximum temperature. Asphalt which has been overheated shall be rejected.
- D. Kettle shall be equipped with an accurate thermostat and thermometer.

3.5 BASE SHEET APPLICATION

- A. Lay a strip of base sheet, 8 inches wide, over metal straps and mechanical anchors exposed on deck surface. Fasten in place.
- B. Lay base sheet; lap side edges 3 inches, end laps 4 inches. Nail laps 9 inches o.c. Nail the field area with two rows of nails at 11 inches o.c. staggered, on 18 inch centers.

3.6 MEMBRANE APPLICATION

- A. Temperature of Bitumen at Point of Application: Within 25 degrees F of bitumen rating labeled on bitumen container.
- B. Lap intermediate sheet edges 3 inches, cap sheet edges 4 inches.
- C. Apply membrane in bitumen; seal seams and ends permanently waterproof.
- D. Apply membrane smooth, free from air pockets, wrinkles, or tears.
- E. Reinforce valleys with an additional ply of base sheet 36 inches wide, center over valley. Apply in direction of slope of valley, lapping 4 inches on ends. Solid mop to base sheet.
- F. Extend membrane up cant strips.
- G. Install waterproof cut-off to membrane at end of day's operation. Remove cut-off before resuming roofing.
- H. Mop and seal membrane around roof penetrations.
- I. Repair edge seams of cap sheet with emulsion and granules where bitumen extends beyond seam.

3.7 FLASHINGS AND ACCESSORIES

- A. Coordinate installation of roof drains and related flashings.
- B. Set base sheet at roof drains in flashing compound 9 inches wide around ring and flange. Provide a minimum 30 inch square, lead or copper flashing set in flashing compound over base sheet. Strip in flashing with two plies of intermediate membrane extending 4 inches and 6 inches beyond the outside edge of flashing. Solid mop flashings, and while hot, embed cap sheet, install clamp ring and tighten entire assembly while membrane is hot.
- C. Seal flashings and flanges of items penetrating membrane.
- D. Install prefabricated roofing expansion joint covers to isolate roof areas as indicated on drawings and in accordance with manufacturer's recommendations.
- E. Apply granule surfaced membrane base flashings to seal membrane to vertical elements. Extend a minimum of 8 inches up vertical surfaces and 4 inches out onto field membrane.
- F. Secure to nailing strips at 6 inches o.c.
- G. Repair edge seams of membrane base flashing with emulsion and granules where bitumen extends beyond seam.

3.8 REFLECTIVE ROOF COATING

- A. Repair imperfections in roof field or flashing areas with sealant.
- B. Apply prime coat approximately 3'-10" wide at all valleys, waterways, drain areas, junctions of vertical wall surfaces, mechanical equipment and roof penetrations at the rate of 2 gallons per 100 square feet.
- C. Immediately embed a 3'-4" wide polyester reinforcing fabric into the wet prime coat.
- D. Lap joints in fabric a minimum of 3 inches. Extend fabric up vertical wall and curb surfaces a minimum of 6 inches.
- E. Apply a second prime coat immediately onto polyester fabric at the rate of 1 gallon per 100 square feet. Extend prime coat a minimum of 2 inches beyond edge of fabric.
- F. Allow prime coat to dry for 24 hours.
- G. Apply roof prime coat over entire roof surface at the rate of 1-1/2 gallons per 100 square feet.
- H. Extend prime coat up vertical wall surface 3 inches minimum above termination of base flashing.
- I. Allow prime coat to dry for 24 hours.
- J. Apply first application of roof top coating at the rate of 1-1/2 gallons per 100 square feet.
- K. Allow first application of roof top coating to dry for a minimum of 12 hours.
- L. Apply second application of roof top coating in a perpendicular pattern to first application at the rate of 1-1/2 gallons per 100 square feet.
- M. Cut edges of final roof top coating application evenly and uniformly.
- N. Contractor shall clean existing roof surface north 10'-0" beyond new roof scope, and blend new reflective coating into existing for Building A, Administration Building.

3.9 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 45 29.
- B. Correct identified defects or irregularities.
- C. Site attendance of roofing materials manufacturers during installation of the Work is required.

3.10 CLEANING

- A. Remove bituminous and reflective spray markings from finished surfaces.
- B. In areas where finished surfaces are soiled by Work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Protect building surfaces against damage from roofing work.
- B. Upon completing roofing, including associated work, institute appropriate procedures for surveillance and protection of roofing during remainder of construction period.
- C. Where traffic must continue over finished roof membrane, protect surfaces.
- D. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, inspect roofing and prepare a written report with copies to Architect describing nature and extent of deterioration or damage found.
- E. Repair or replace, as required, deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion according to requirements of specified warranty.

END OF SECTION

SECTION 07 54 23

THERMOPLASTIC-POLYOLEFIN ROOFING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Single-ply thermoplastic membrane roofing.
- B. Thermoplastic clad flashing metal.
- C. Flexible membrane base flashings.
- D. Roofing membrane expansion joints.
- E. Counter flashings.
- F. Walkway surface.
- G. Adhesive and accessories.

1.2 REFERENCES

- A. ASTM B370 – Standard Specification for Copper Sheet and Strip for Building Construction.
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
- C. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- D. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
- E. ASTM D822 - Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
- F. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
- G. ASTM D1079 – Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
- H. ASTM D6878 – Standard Specifications for Thermoplastic Polyolefin Based Sheet Roofing.
- I. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- J. ASTM E408 – Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
- K. ASTM E903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
- L. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 6.
- M. CRRC - Cool Roof Rating Council - Product Rating Program CRRC-1.
- N. FM - FM Global - FM 4470 - Approval Standard for Class 1 Roof Coverings.
- O. NRCA - National Roofing Contractors Association: The NRCA Roofing and Waterproofing Manual.
- P. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc., Architectural Sheet Metal Manual.

- Q. UL - Underwriters Laboratories Inc. - UL 790 - Tests for Fire Resistance of Roof Covering Materials.

1.3 DEFINITIONS

- A. Roofing Terminology: ASTM D1079 and the glossary of the NRCA Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.4 SYSTEM DESCRIPTION

- A. Thermoplastic Sheet Membrane Conventional Roofing System: Single-ply membrane roofing system, fully adhered, with heat welded seams and white surface color finish.

1.5 PERFORMANCE REQUIREMENTS

- A. Conform to UL and FM for roof assembly requirements.
- B. UL 790: Class B Fire Hazard Classification.
- C. FM 4470: Roof Assembly Classification, of Class 1 Construction, wind uplift requirement of 1-90, in accordance with FM Construction Bulletin 1-28.
- D. Provide an installed single-ply roofing membrane and base flashing system that does not permit the passage of water, and will withstand the wind uplift design pressures listed.

1.6 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 6 requirements for a Cool Roof under the Product Rating Program CRRC-1 of the Cool Roof Rating Council.

1.7 QUALITY ASSURANCE

- A. Perform roofing Work in accordance with NRCA Roofing and Waterproofing Manual and roofing materials manufacturers printed guidelines.
- B. Perform flashing Work in accordance with the SMACNA Architectural Sheet Metal Manual and roofing materials manufacturers printed guidelines.
- C. Final Inspection: Roofing materials manufacturer representative shall provide a comprehensive final inspection after completion of the roofing system. Provide inspection report to the Architect.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, factory trained and approved by manufacturer of roofing materials.

1.9 PRE-INSTALLATION MEETINGS

- A. Convene a conference two weeks prior to commencing Work of this section under the provisions of Section 01 31 00.
- B. Review preparation and installation procedures and coordinating and scheduling required with related Work.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect product under the provisions of Section 01 61 00.
- B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

- C. Store products in weather protected environment, clear of ground and moisture.
- D. Store products in a manner to avoid significant or permanent deflection of roof deck.

1.11 ENVIRONMENTAL REQUIREMENT

- A. Do not apply roofing membrane during inclement weather.
- B. Do not apply roofing membrane to damp deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.12 COORDINATION

- A. Coordinate work under the provisions of Section 01 31 00.
- B. Coordinate Work with installation of associated roof penetrations and metal flashings as Work of this section proceeds.
- C. Notify roofing materials manufacturer 72 hours prior to commencing Work to arrange for inspection of roof application.

1.13 WARRANTY

- A. Provide 20 year warranty under the provisions of Section 01 77 00.
- B. Warranty: Manufacturer's No Dollar Limit Warranty covering roof membrane, base flashings and workmanship for the roofing and installation resulting from failure to resist penetration of moisture. Roofing abuse, natural causes or improper maintenance excluded. Warranty to include repair of roof membrane damage due to windstorms less than or equal to 64 mph.
- C. Provide 2 year roofing installer's warranty under provisions of Section 01 77 00.
- D. Roofing Installer's Warranty: Warranty shall cover Work of this section, including installation of all components of roofing system to include roofing membrane, base flashings, fasteners, coatings, sealants, and all penetrations of roofing membrane.

1.14 INSPECTION SERVICE

- A. Manufacturer of the roofing materials shall provide the following services:
 - 1. Application start-up inspection.
 - 2. Periodic inspections during applications as required by manufacturer.
 - 3. Final roofing inspection.
 - 4. Certification of materials used and application.

2. PART 2 PRODUCTS

2.1 SINGLE PLY ROOFING - FULLY ADHERED

- A. Johns Manville Corp., TPO-1 Adhered Roofing System, ASTM D6878, consisting of a single – ply SRT 60 roofing membrane, CRRC Product ID No. 0662-0001, UL No. R13772, www.jm.com.
- B. Other acceptable manufacturers offering equivalent products:
 - 1. Carlisle SynTec Systems, SureWeld TPO, CRRC Product ID No. 0628-0002, UL No. R8103, www.carlisle-syntec.com.

2. Firestone Building Products, Ultra Ply TPO, CRRC Product ID No. 0608-0008, UL No. R9516, www.firestonebpco.com.
3. GAF Materilas Corp., Everguard TPO, CRRC Product ID No. 0676-0001, UL No. R1306, www.gaf.com
4. Gen Flex Roofing Systems, Gen Flex TPO, CRRC Product ID No. 0632-0002, UL No. R9334, www.genflex.com.

C. Substitutions: Under provisions of Section 01 25 13.

2.2 COMPONENTS

- A. Membrane: Smooth surface thermoplastic olefin (TPO) composite membrane; reinforced, 0.060 inch thick; white color; conforming to ASTM D6878 and the following criteria:

Properties	Test	Results
Elongation	ASTM D412	25 percent
Tear Strength	ASTM D751	150 lbf
Moisture Vapor Perms	ASTM E96	0.01 typical
Solar Reflectance (albedo X 100)	ASTM E903	0.70 min percent
Emissivity	ASTM E408	0.75 min percent

- B. Membrane Adhesive: As recommended by membrane manufacturer. Shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.
- C. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.
- D. Barrier Board: Glass matte gypsum protection board as specified in Section 07 22 00.
- E. Inside and Outside Corners: Premolded corners, 4 inch x 4 inch flange, same material as membrane; white color.
- F. Flexible Membrane Base Flashings: Same material as membrane; white color.
- G. Flashing Metal: TPO clad 0.0239 inch thick galvanized sheet metal.
- H. Counterflashings: Galvanized sheet metal, as specified in Section 07 62 00.
- I. Prefabricated Control or Expansion Joint Flashing: TPO membrane over polypropylene foam backing rod sized 1.5 x joint width. Seamed to roof membrane.

2.3 ACCESSORIES

- A. Tapered Edge Strips: As specified in Section 07 22 00.
- B. Membrane Primer: Synthetic rubber based primer.
- C. Roofing Nails and Screws: Galvanized or non-ferrous type, size as required to suit application with compatible plastic plates.
- D. Sealants: As recommended by membrane manufacturer. Shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.
- E. Sealing Mastic: One part, gun grade butyl sealant.

- F. Strip Reglet Devices: Galvanized sheet metal as specified in Section 07 62 00.
- G. Walkway Pads: TPO membrane with textured top surface finish, white color. 0.15 inch thick x 2'-6" wide x 50'-0" long.
- H. Stack Boots: Prefabricated flexible molded TPO boot and collar for pipe stack penetrations through membrane with stainless steel clamping bands. 0.075 inch thick. Size to accommodate round and square tube.
- I. Wood Nailers: Pressure treated wood nailers as specified in Section 06 10 00.
- J. Copper Sheet: ASTM B370, Temper H00 of H01, cold-rolled copper sheet, 16 oz./sq. ft.

3. PART EXECUTION

3.1 EXAMINATION

- A. Coordinate project conditions under the provisions of Section 01 31 00.
- B. Verify surfaces and site conditions are ready to receive Work.
- C. Verify deck is supported and secure.
- D. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains and suitable for installation of roof system.
- E. Verify deck surfaces are dry and free of snow or ice.
- F. Confirm dry deck by moisture meter with 19 percent moisture maximum.
- G. Verify that barrier board is butted tight together with no joints or gaps more than 1/8 inch wide.
- H. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood nailing strips and reglets are in place.
- I. Beginning of installation means applicator accepts existing conditions.

3.2 INSTALLATION

- A. Membrane Application:
 - 1. Roll out membrane and let relax for 30 minutes.
 - 2. Apply adhesive to roof substrate at a rate of one gallon per 60 square feet of membrane.
 - 3. Roll out membrane, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
 - 4. Roll membrane with weighted roller to ensure complete bonding between membrane and adhesive.
 - 5. Bond sheet to substrate except those areas directly over control or expansion joint.
 - 6. Overlap edges and ends a minimum of 3 inches.
 - 7. Shingle joints of membrane on sloped substrate in direction of drainage.
 - 8. Membrane laps shall be heat welded, continuous, without voids or partial welds. Minimum weld shall be 1-1/2 inches. Welds shall be free of scorch marks.
 - 9. Seal all exposed edges permanently waterproof. Apply uniform bead of sealant to joint edge with TPO caulk.

10. Mechanically attach edge of membrane at junction of vertical surfaces and at edge of roof penetrations with fasteners spaced 12 inches on center.
11. Extend membrane onto vertical surfaces.
12. Seal membrane around roof penetrations.
13. All exposed sheet corners shall be rounded a minimum of 1 inch.

B. Flashings And Accessories:

1. Apply flexible flashings to seal roof membrane to vertical elements.
2. Apply adhesive to vertical surfaces at a rate of one gallon per 60 square feet of membrane.
3. Secure top of flashing membrane to nailing strips at 6 inches on center.
4. Overlap all adjacent flashing sheets by 3 inches.
5. Heat weld all vertical and horizontal seams in flashing membrane, 1-1/2 inch minimum.
6. Extend flashing membrane a minimum of 6 inches onto field roofing membrane.
7. Install prefabricated roofing control and expansion joints to isolate roof into areas as indicated on Drawings. Make joints watertight.
8. Coated metal flashings shall be formed in accordance with construction details and SMACNA guidelines.
9. Coordinate installation of roof drains and related flashings.
10. Install a 30 inch square copper flashing pan at roof drain mechanically attached at 12 inches on center. Seal membrane to flashing pan. Seal flashing pan to roof drain with sealing mastic.
11. Seal flashings and flanges of items penetrating membrane.
12. Seal pipe and tube penetrations with prefabricated flexible boots.

C. Walkway Pads:

1. Install walkway pads at roof access points, roof mounted equipment and related rooftop traffic pathways.
2. Install walkway pads with 2 inch wide joints to permit drainage.
3. Place pads in maximum lengths between field seams of membrane.
4. Heat weld seams at all edges.
5. Apply seam sealant at all welded edges.

3.3 FIELD QUALITY CONTROL

- A. Require site attendance of roofing materials' manufacturers during installation of the Work at indicated intervals.
- B. Test heat welds a minimum of 3 times per day.
- C. Perform pull test on test strip to ensure full-width heat weld.

3.4 CLEANING

- A. Section 01 77 00 - Execution Requirements: Final cleaning.
- B. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or disfigured finishes caused by Work of this section.
- D. Clean and restore all damaged surfaces to their original condition.
- E. Dispose of all excess materials in a manner conforming to current EPA requirements.
- F. Clean finished roof surface after completion. Ensure drainage ways and roof drains are clear and unobstructed.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 77 00 - Execution Requirements: Protecting installed construction.
- B. Protect building surfaces against damage from roofing Work.
- C. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-coated coping, parapet, and cap flashings.
- B. Fascias and scuppers.
- C. Counter flashing at piping penetrations, vent pipes, and conduits.
- D. Counterflashings over bituminous base flashings.
- E. Counterflashings at roof mounted equipment, curbs and supports.
- F. Counterflashings for roof hatches.

1.2 REFERENCES

- A. ANSI / SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- B. ASTM A653 - Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- D. ASTM A792 – Steel Sheet, Aluminum-Zinc Alloy. Coated by the Hot-Dip Process, General Requirements.
- E. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM B32 - Solder Metal.
- G. ASTM B101 - Standard Specifications for Lead-Coated Copper Sheet and Strip for Building Construction.
- H. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.
- I. SMACNA - Architectural Sheet Metal Manual.

1.3 SYSTEM DESCRIPTION

- A. Work of this Section is to physically protect membrane roofing, built-up roofing and base flashings, from damage that would permit water leakage to building interior.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in sheet metal flashing work with five years minimum experience.
- B. Perform work in accordance with SMACNA standard details and requirements.
- C. Copings and roof edge flashings shall conform to SPRI ES-1 testing and shall be in compliance with SMACNA Technical Resource Bulletin #5-09.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings capable of resisting an ultimate design wind speed of 115 miles per hour.

1.5 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.
- B. Submit shop drawings of sheet metal items indicating profiles, jointing, terminations and installation details. Indicate type and spacing of fasteners.
- C. Submittal of specific plates from the SMACNA Architectural Sheet Metal Manual constitutes acceptable documentation of installation details.
- D. Submit product data for pre-coated galvanized steel.
- E. Submit two samples, 4 x 4 inch in size illustrating metal finish color for pre-coated steel.
- F. Submit product data for flashing accessories.
- G. Submit warranty for water tightness.
- H. Submit warranty for metal finish.

1.6 STORAGE AND HANDLING

- A. Store products under provisions of Section 01 61 00.
- B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 WARRANTY

- A. Provide warranty under provisions of Section 01 77 00.
- B. Provide 2-year warranty coverage for degradation of water tightness and integrity of seals.
- C. Provide 20-year warranty coverage for metal finish from all defects.

2. PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Pre-Coated Galvanized Steel: ASTM A755 on zinc-coated galvanized substrate, ASTM A653, Grade 33, G90 zinc coating in accordance with ASTM A924 or ASTM A792, Grade 50, AZ55 aluminum zinc coating; 0.0299 inch thick core steel.

2.2 ACCESSORIES

- A. Lead-Coated Copper: ASTM B101, Temper H00 and H01, cold-rolled copper sheet, coated both sides with lead weighing not less than 12 lb/100 sq. ft. or more than 15 lb./100 sq. ft. total weight of copper sheet with lead applied to both sides.
- B. Fastener: Galvanized steel or stainless steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as pre-coated metal.
- C. Underlayment: Spunbound reinforced polypropylene coated fabric sheet.
 - 1. Premium Grade Feltex as manufactured by SystemComponents Corp., www.systemcomponents.net.
 - 2. Premium Summit Synthetic Underlayment as manufactured by Atlas Roofing Corp., www.atlasroofing.com.

3. Roof Top Guard II Underlayment as manufactured by Underlayment Specialties Plus, www.uspunderlayment.com.

4. Substitutions: Under provisions of Section 01 25 13.

D. Slip Sheet: 0.05 lb./sq. ft., rosin sized building paper.

E. Sealant: Type specified in Section 07 92 00.

F. Bedding Compound: Rubber-asphalt type.

G. Plastic Cement: ASTM D4586, Type I.

H. Metal Flashing System: Two piece pre-coated galvanized steel similar to Springlok Flashing System, manufactured by Fry Reglet, www.fryreglet.com, type as indicated. Include fabricated end closures and mitered corners.

I. Solder for Lead-Coated Copper: ASTM B32, Grade SN 60 percent tin, 40 percent lead.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate concealed cleats of galvanized steel, ASTM A653, Grade 33, G90 zinc coating, 0.0478 inch thickness, interlockable with sheet.

C. Fabricate exposed cleats and coverplates of same material as sheet, interlockable with sheet.

D. Form pieces in longest practical lengths.

E. Hem exposed edges on underside 1/2 inch. Miter and seam corners.

F. Form material with flat lock seam.

G. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

J. Fabricate flashings to allow toe to extend 2 inches over bituminous base flashings and roofing surface. Return and brake edges.

K. Fabricate vent pipe and roof penetration flashings of lead-coated copper with clamping ring.

2.4 FINISH

A. Kynar 500 or Hylar 5000 shop pre-coated finish with 0.2 mil baked on primer and 0.8 mil baked on topcoat for a 1.0 mil dry film thickness. Color to be selected by Architect from manufacturer's entire range of standard and custom colors. Color to match sheet metal roofing, Section 07 61 00.

3. PART 3 EXECUTION

3.1 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Field measure site conditions prior to fabricating work.
- B. Install starter and edge strips, and cleats before starting installation.
- C. Install surface mounted reglets true to line and level. Seal top with sealant.
- D. Install underlayment with protective slip sheet over parapets, caps, copings, gravel stops and curbs.

3.3 INSTALLATION

- A. Conform to indicated details on the drawings and the recommendations included in the SMACNA Architectural Sheet Metal Manual.
- B. Provide for thermal expansion of exposed sheet metal work. Space movement joints at 10 feet - 0 inches o.c. maximum with no joints within 2 feet - 0 inches of corners.
- C. Form expansion joints of intermeshing hooked flanges filled with sealant.
- D. Insert flashings into reglets to form tight fit. Secure in place with lead wedges at maximum 12 inches on center. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- E. Secure flashings in place using concealed fasteners. Use exposed fasteners only where indicated.
- F. Lap, lock, seam and seal all joints.
- G. Apply plastic cement compound between metal flashings and felt flashings. Apply bituminous coating between dissimilar metals where occurs.
- H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- I. Roof-Penetration, Vent Pipe Flashing: Turn lead flashing down inside vent piping. Clamp flashing to other pipes penetrating roof except for vent piping. Seal with elastomeric sealant.
- J. Seal metal joints watertight.

3.4 FIELD QUALITY CONTROL

- A. Conform to SMACNA Architectural Sheet Metal Manual.
- B. Field observation will involve surveillance of Work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 71 23

MANUFACTURED GUTTERS AND DOWNSPOUTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel gutters and downspouts.
- B. Steel pipe downspouts.
- C. Precast concrete splash blocks.

1.2 REFERENCES

- A. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
- C. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- E. ASTM A792 - Steel Sheet, Aluminum-Zinc Alloy. Coated by the Hot-Dip Process, General Requirements.
- F. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.
- B. Submit shop drawings of metal items indicating profiles, jointing, terminations, and installation details. Indicate type and spacing of fasteners.
- C. Submittal of specific plates from the SMACNA Architectural Sheet Metal Manual constitutes acceptable documentation of installation details.
- D. Submit product data for pre-coated galvanized steel.
- E. Submit two samples 4 x 4 inch in size illustrating metal finish color for pre-coated steel.
- F. Submit warranty for metal finish.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in sheet metal work with five years minimum experience.
- B. Perform work in accordance with SMACNA standard details and requirements.

1.5 STORAGE AND HANDLING

- A. Store products under provisions of Section 01 61 00.
- B. Stack preformed material to prevent twisting, bending, or abrasion and to provide ventilation.
- C. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.6 WARRANTY

- A. Provide warranty under provisions of Section 01 77 00.
- B. Provide 20-year warranty coverage for metal finish from all defects.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Pre-coated Galvanized Steel: ASTM A755 on zinc-coated galvanized substrate, ASTM A653, Grade 33, G90 zinc coating in accordance with ASTM A924, or ASTM A792, Grade 50, AZ55 aluminum zinc coating, thickness as specified.

2.2 COMPONENTS

- A. Gutters and Downspouts: 0.0299 inch thick.
- B. Downspouts: ASTM A53, Grade B, Schedule 40 steel pipe, standard weight, Type S, one piece without joints, galvanized according to ASTM A53; 1.8 oz./sq. ft.
- C. Splash Blocks: Precast concrete type, of sizes and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- D. Splash Pans: Same metal as for gutters.

2.3 ACCESSORIES

- A. Anchorage Devices: Meet SMACNA requirements.
- B. End Caps, Downspout Outlets and Strainers, Rain Diverters, Straps, Support Brackets, Joint Fasteners. Profiled to suit gutters and downspouts.
- C. Sealant: Silicone type as specified in Section 07 92 00.

2.4 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Field measure site conditions prior to fabricating work.
- C. Fabricate with required connection pieces.
- D. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
- E. Hem exposed edges of metal.
- F. Seal metal joints.
- G. Fabricate gutter and downspout accessories; seal watertight.
- H. Form splash pans to size as detailed with rolled edges.

2.5 FINISHING

- A. Kynar 500 or Hylar 5000 shop pre-coated finish on flat sheet metal stock. Finish with 0.2 mil baked on primer and 0.80 mil baked on topcoat for a 1.0 mil dry film thickness. Color to be selected by Architect from manufacturer's entire range of standard and custom colors. Color to match sheet metal roofing, Section 07 61 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with SMACNA requirements.
- B. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Seal metal joints watertight.
- D. Set splash blocks under downspouts.

END OF SECTION

SECTION 07 72 33

ROOF HATCHES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prefabricated roof hatches with integral support curbs, operable hardware, and counterflashings.
- B. Roof hatch railing system.

1.2 REFERENCES

- A. FM - FM Global: Roof Assembly Classifications.
- B. OSHA - Standards of Occupational Safety and Health Administration.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide data on unit construction, sizes, configuration, jointing methods, attachment methods, operation and accessories.
- C. Manufacturer and/or fabricator shall submit a certificate of product compliance with OSHA Standards.

1.4 REGULATORY REQUIREMENTS

- A. OSHA regulations as applicable to roof access hatches, 29 CFR 1910.23.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acrylight International, www.acralight.com.
- B. Babcock-Davis Hatchways, Inc., www.babcockdavis.com.
- C. Bilco Co., www.bilco.com.
- D. Bristol Fiberlite Industries, www.bristolite.com.
- E. Dur-Red Products, www.dur-red.com.
- F. Lane-Aire, www.lane-aire.com.
- G. Milcor, Inc., www.milcorinc.com.
- H. Nystrom Building Products, www.nystrom.com.
- I. Precision Ladders, LLC, www.precisionladders.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.2 ROOF HATCHES

- A. Unit: 2'-6" x 3'-0" size, single leaf type.

- B. Curb: 0.090 inch thick aluminum curb with one inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting. Fabricate curbs to maintain a minimum 12 inches above roofing surface.
- C. Cover: 0.0747 inch thick galvanized prime painted steel with 1 inch rigid insulation retained by inner liner. Continuous gasket to provide weatherproof seal.
- D. Hardware: Manufacturer's standard manually operated type with compression spring operators, positive snap latch with turn handles inside and out and padlock hasp inside; automatic hold-open arm with vinyl covered grip handle for easy release; galvanized finish.
- E. Hinges: Manufacturer's recommended type.

2.3 HATCH FABRICATION

- A. Fabricate free of visual distortions and defects. Weld corners and joints.
- B. Provide for removal of condensation.
- C. Provide weathertight assembly.
- D. Sloped Roofs: Taper curbs to maintain top level.

2.4 FINISH

- A. Shop prime paint all exposed metal.
- B. Site paint metal surfaces under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Coordinate with installation of roofing system and related flashings. Provide weather tight installation.
- B. Install heat / smoke vent in compliance with U.L. 793 or FM 4430 listing.
- C. Install remote rigging system for manual winch operation at floor level for heat / smoke vent.
- D. Permanently bolt railing system to roof hatch curb in accordance with manufacturer's instructions.
- E. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.

3.2 ADJUSTING

- A. Adjust hinges for smooth operation.
- B. Adjust latching mechanisms for positive engagement.

END OF SECTION

SECTION 07 81 23**INTUMESCENT FIREPROOFING****1. PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Intumescent spray-on fireproofing.

1.2 REFERENCES

- A. ASTM D256 - Impact Resistance of Plastics and Electrical Insulating Materials.
- B. ASTM D695 - Compressive Properties of Rigid Plastics.
- C. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- D. ASTM D1002 - Test Method for Bond Strength.
- E. ASTM D1044 - Resistance of Transparent Plastics to Surface Abrasion.
- F. ASTM E84 - Surface Burning Characteristics of Building Materials.
- G. ASTM E119 - Fire Tests of Building Construction and Materials.
- H. CBC - California Building Code, Title 24, Part 2 of the California Code of Regulations (CCR).
- I. SSPC - The Society for Protective Coatings.
- J. UL - Underwriters' Laboratories, Inc.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00
- B. Submit product data for fireproofing and primer.
- C. Submit manufacturer's certificate under provisions of Section 01 33 00.
- D. Submit manufacturer's specifications and certification to show material compliance with Contract Documents. Include certification from manufacturer, stating that the proposed material is free of mineral fiber and all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.
- E. Application contractor to submit certification that primers applied to steel in shop or on job site are compatible with sprayed-on fireproofing.
- F. Submit laboratory test results for sprayed fireproofing under provisions of Section 01 45 29 for the following:
 - 1. Impact Resistance per ASTM 256.
 - 2. Compressive Strength per ASTM D695.
 - 3. Flexural Strength per ASTM D790.
 - 4. Bond Strength per ASTM D1002.
 - 5. Abrasion Resistance per ASTM D1044.
 - 6. Surface Burning Characteristics per ASTM E84.

- G. Submit laboratory test reports in accordance with ASTM E119, indicating fire resistance as required to satisfy code. Extracts of classified listings of tests performed by UL are acceptable.
- H. Submit samples under provisions of Section 01 33 00.
- I. Submit two samples 6 x 6 inches in size illustrating achievable job site finish.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with manufacturer's instructions and product listing by Underwriters Laboratories.
- B. Maintain one copy of document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Applicator: Company specializing in applying the Work of this Section with minimum three years documented experience and approved by manufacturer.

1.6 REGULATORY REQUIREMENT

- A. Conform to the CBC for fire resistance ratings.

1.7 FIELD SAMPLES

- A. Provide samples under provisions of Section 01 33 00.
- B. Construct field sample installation with materials specified.
- C. Locate where indicated.
- D. Adjust method of application to achieve specified results.
- E. Accepted sample may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Accept fireproofing on-site in unopened containers with manufacturer's labels and UL labels identifying product.
- C. Protect products from heat, sunlight, moisture, and freezing.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install fireproofing when temperature is lower than 40 degrees F or when temperature is 5 degrees F above dew point.
- B. Provide ventilation to allow for proper drying of fireproofing.
- C. Maintain temperature and ventilation during and for 30 days after installation of fireproofing.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule Work under the provisions of Section 01 31 00.
- B. Coordinate Work in conjunction with structural steel and other related sections.

- C. Coordinate Work to avoid delays in job progress.
- D. Schedule Work to allow time for inspection, testing and subsequent correction of deficiencies.

1.11 WARRANTY

- A. Provide 1 year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage for cracking, checking, dusting, flaking, spalling, separation and blistering. Reinstall or repair such defects or failures.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Albi Manufacturing, Albi Clad 800, www.albi.com.
- B. Carboline Co., THERMO-LAG 2000-P, www.carboline.com.
- C. Isolatek International, CAFCO® Spray Film WB4, www.cafco.com.
- D. PPG Industries, Inc., Product, Pittchar XP, www.ppg.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Intumescent Fireproofing: Factory mixed, asbestos free, material blended for uniform texture conforming to the following:
 - 1. Impact Resistance: ASTM D256, 0.54 ft. lbs./in.
 - 2. Compressive Strength: ASTM D695, 300 psi.
 - 3. Bond Strength: ASTM D1002, 53, 125 psf.
 - 4. Abrasion Resistance: ASTM D1044, 0.40 grams loss/1,000 cycles.
 - 5. Surface Burning Characteristics: In accordance with ASTM E84:

(a) Flame Spread:	15
(b) Fuel Contributed:	0
(c) Smoke Developed:	0

2.3 ACCESSORIES

- A. Primer: Albi 490W as manufactured by Albi Manufacturing or as recommended by fireproofing manufacturer.
- B. Reinforcing Mesh: Fiberglass mesh, 80 lbs./in. strength.
- C. Sealant: High heat silicone sealant equivalent to RTV 108 as manufactured by General Electric, Co., www.gesealants.com.
- D. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive Work.
- B. Verify that clips, hangers, supports and other items required to penetrate fireproofing are in place.
- C. Verify that required utilities are available, in proper locations, and ready for use.
- D. Beginning of installation means installer accepts existing surface conditions.

3.2 PREPARATION

- A. Surface Preparation: SSPC SP2 with solvent cleaning thereafter.
- B. Prime steel members at the rate of 2 to 3 mils dry film thickness.
- C. Cut back primer 3 inches for bolted connections and 6 inches for welded connections.
- D. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.3 APPLICATION

- A. Application shall not commence until applicator has submitted certification that surfaces are acceptable to receive sprayed fireproofing.
- B. Apply in accordance with manufacturer's instructions.
- C. Apply monolithic blanket of uniform hardness, texture and density to required UL thickness over entire surface.
- D. Open ended fireproofing shall be chamfered at a 45 degree angle and sealed with high silicone sealant.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Dry film thickness shall be measured according to CBC, Section 1705.15.
- C. Patch tested areas with fireproofing material.
- D. Reinspect the installed fireproofing for integrity of fire protection, prior to concealment of Work.
- E. Correct unacceptable work and provide further inspection to verify compliance with requirements.
- F. Trade responsible for any damage to fireproofing shall be held responsible for its replacement and/or repair.

3.5 CLEANING

- A. Clean Work under provisions of Section 01 77 00.
- B. Remove excess material, overspray, droppings, and debris.
- C. Remove fireproofing from materials and surfaces not specifically required to be fireproofed.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.

3.7 SCHEDULE

- A. Fire-Resistance Rating, unrestrained, (time in hours) shall be as follows:

<u>STRUCTURAL COMPONENT</u>	<u>HOURLY RATING REQUIREMENT</u>	<u>UL DESIGN NO.</u>
Columns	1 hr.	UL263

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
- B. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
- C. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
- D. Sealant joints in fire-resistance-rated construction.
- E. Fireproof firestopping and firesafing materials and accessories.

1.2 REFERENCES

- A. ASTM C920 - Elastomeric Joint Sealants.
- B. ASTM C1193 - Use of Joint Sealants.
- C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
- E. UL - Fire Hazard Classifications.
- F. UL 1479 - Fire Tests of Through-Penetration Firestops.
- G. 40 CFR Part 763, Subpart F (7-1-90 Edition) - Asbestos Hazardous Emergency Response Act, Friable Asbestos - Containing Materials in Schools.

1.3 DEFINITION

- A. Firestopping (Firesafing): A sealing or stuffing material or assembly placed in spaces between building materials to arrest the movement of smoke, heat, gases, or fire through wall or floor openings.

1.4 SYSTEM DESCRIPTION

- A. F-Rated Through Penetration Firestop Systems: F-ratings as required according to UL 1479, but not less than that equaling or exceeding fire resistance rating of assembly penetrated where the following conditions exist:
 - 1. Penetrations larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area.
- B. T-Rated Through Penetration Firestop Systems: T-ratings, in addition to F-ratings, as required according to UL 1479, where the following conditions exist:
 - 1. Through penetrations of fire rated walls above corridor ceilings which are not part of a fire-resistive assembly.
 - 2. Through penetrations of fire rated walls below any ceiling.
 - 3. Penetrations larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area.

- C. Penetrations not larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area shall have the annular space between the penetrating item and the wall/floor assembly filled with a material which will prevent passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 under a minimum positive pressure differential of 0.01 inch water column for the time period at least equal to the fire resistance rating of the wall/floor assembly.
- D. Surface Burning: ASTM E84 with a flame spread/smoke developed rating of 25/450.
- E. Firestop all interruptions and terminations of fire rated assemblies.
- F. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
- G. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
- H. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on product characteristics, performance and limitation criteria.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Certification: Submit firestopping manufacturer's certificate that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

1.6 QUALITY ASSURANCE

- A. Through penetration firestop systems to correspond to those penetration firestop system designations listed by UL in their Fire Resistance Directory.

1.7 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and UL requirements for fire resistance ratings and surface burning characteristics.
- B. Firestopping products shall contain no detectable asbestos as determined by 40 CFR, Part 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate Work under provisions of Section 01 31 00.
- B. Coordinate construction of openings and penetrating items to ensure that through penetration firestop systems are installed per manufacturer's instructions and regulatory requirements.
- C. Do not cover up installations that will become concealed behind other construction until District Inspector and authorities having jurisdiction, if required, have examined each installation.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.
- C. Provide ventilation in areas to receive solvent cured materials.

2. PART 2 PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Provide firestopping components that are compatible with each other, substrates of openings, and items penetrating firestopping.
- B. Provide accessories for each firestopping system that are needed to comply with designated fire-resistance-rated systems specified by firestopping manufacturer.

2.2 ACCEPTABLE MANUFACTURERS

- A. AD Fire Protection Systems, Inc., www.adfire.com.
- B. Hilti Construction Chemicals, Inc., www.us.hilti.com.
- C. Minnesota Mining and Mfg. Co., www.3m.com/firestop.
- D. Rector Seal Corporation, www.rectorseal.com.
- E. Specified Technologies, Inc., www.stifirestop.com.
- F. Tremco, www.tremcosealants.com.
- G. United States Gypsum Co., www.usg.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.3 FILL MATERIALS

- A. Intumescent Wrap: Single-component, elastomeric sheet.
- B. Vinyl Compound: Vinyl-based powder product mixed on site with water to produce a paintable compound with flame-spread and smoke-developed rating of 0 per ASTM E84.
- C. Silicone Foam: Two-component, silicone based liquid elastomer that, when mixed, expands and cures in place to produce a flexible nonshrinking foam.
- D. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant either in a self-leveling or non-sag grade for opening condition.
- E. Fiber Stuffing: Mineral fiber stuffing with a minimum density of 3.5 lbs./cu. ft.

2.4 JOINT SEALANTS

- A. Manufacturer's standard chemically curing elastomeric sealant that complies with ASTM C920.
- B. Provide selections from manufacturer's full range of colors.
- C. Single-Component, Neutral Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related use NT; and joint substrate related uses M, G, A, and O, as applicable to substrate assembly condition.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify openings are ready to receive the work of this Section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove laitance and form release agents from concrete.
- C. Remove incompatible materials which may affect bond.
- D. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION OF THROUGH-PENETRATION FIRESTOPS

- A. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Comply with through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications required.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce shapes and depths required to achieve fire ratings.
- D. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop system.
- E. Apply primer and materials in accordance with manufacturer's instructions.
- F. Apply firestopping material in sufficient thickness to achieve rating.

3.4 APPLICATION OF FIRE-RESISTIVE JOINT SEALANT

- A. Comply with ASTM C1193 and manufacturer's installation instructions and drawings pertaining to products and applications required.
- B. Install joint fillers to provide support and at a position required to produce depth to joint widths that allow development of fire-resistance rating required.
- C. Install sealant to completely fill recesses provided. Install sealant at same time as joint filler.
- D. Tool non-sag sealants after application to form smooth uniform bead to configuration required to produce fire-resistance rating.

3.5 FIELD QUALITY CONTROL

- A. Do not cover up installations that will become concealed behind other construction until District Inspector and authorities having jurisdiction if required, have examined each installation.
- B. Where deficiencies are found, repair or replace firestopping to required condition.

3.6 CLEANING

- A. Clean Work under provisions of Section 01 77 00.
- B. Clean adjacent surfaces of firestopping materials.

3.7 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 61 00.
- B. Protect adjacent surfaces from damage by material installation.

3.8 SCHEDULES

	LOCATION	F RATING
A.	Stud wall, metallic pipe, and conduit.	1, 2 hour
B.	Stud wall, non-metallic pipe, and conduit.	1, 2 hour
C.	Concrete and masonry wall, metallic pipe, and conduit.	1, 2 hour
D.	Concrete and masonry wall, non-metallic pipe, and conduit.	1, 2 hour
E.	Floors, metallic pipe, and conduit.	1, 2 hour
F.	Floors, non-metallic pipe, and conduit.	1, 2 hour
G.	Floor ceiling assembly, metallic pipe, and conduit.	1, 2 hour
H.	Floor ceiling assembly, non-metallic pipe, and conduit.	1, 2 hour

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and backing.

1.2 SUMMARY OF SEALANT LOCATIONS

A. Joints in horizontal surfaces.

- 1. Expansion and isolation joints in cast-in-place concrete slabs.
- 2. Expansion and isolation joints in masonry paving.
- 3. Joints in precast concrete paving units.
- 4. Joints in stone paving units.
- 5. Control and expansion joints in ceramic and quarry tile.
- 6. Control and expansion joints in soffits, ceilings and overhead surfaces.
- 7. Joints on underside of precast beams and planks.
- 8. Perimeter joints in exterior openings.
- 9. Joints between ceiling surfaces and frames for doors and windows.
- 10. Joints in flashing and sheet metal.
- 11. Perimeter joints of plumbing fixtures.
- 12. Acoustical isolation joints between head and sill of walls and floor and ceiling surfaces.
- 13. Joints between countertops and wall surfaces.
- 14. Joints in skylights and framing.
- 15. Joints between thresholds and floors.
- 16. Isolation joints in plaster soffits and ceilings.
- 17. Joints between dissimilar materials and those listed above.
- 18. Other joints as indicated.

B. Joints in vertical surfaces:

- 1. Expansion and isolation joints in cast-in-place concrete.
- 2. Expansion and isolation joints in masonry.
- 3. Joints in precast concrete.
- 4. Expansion and isolation joints in stonework.

5. Control and expansion joints in ceramic and quarry tile.
6. Perimeter joints in exterior openings.
7. Joints in flashing and sheet metal.
8. Perimeter joints of plumbing fixtures.
9. Acoustical isolation joints of walls.
10. Joints between cabinets and walls.
11. Joints between wall surfaces and door and window frames.
12. Joints in skylights and framing.
13. Isolation joints in plaster walls.
14. Joints between dissimilar materials and those listed above.
15. Other joints as indicated.

1.3 REFERENCES

- A. ASTM C834 - Latex Sealing Compounds.
- B. ASTM C919 - Practices for Use of Sealants in Acoustical Applications.
- C. ASTM C920 - Elastomeric Joint Sealants.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- E. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- F. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type.
- G. SWRI - (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 4 inches long in size illustrating colors selected.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
- B. Applicator: Company specializing in applying the Work of this Section with minimum three years documented experience, approved by sealant manufacturer.
- C. Conform to Sealant, Waterproofing, and Restoration Institute (SWRI) requirements for materials and installation.
- D. Perform Work in accordance with ASTM C1193.

- E. Perform acoustical sealant application work to provide maximum STC values in accordance with ASTM C919.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install solvent curing sealants in enclosed building spaces.
- B. Do not install sealant when temperature is less than 40 degrees F.
- C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under the provisions of Section 01 77 00.
- B. Submit recommended inspection intervals for sealant joints.
- C. Submit instructions for repairing and replacing failed sealant joints.

1.8 WARRANTY

- A. Provide 5 year warranty under provisions of Section 01 77 00.
- B. Include coverage for installed sealants and accessories which fail to achieve air and water seal and exhibit loss of adhesion or cohesion or do not cure.

2. PART 2 PRODUCTS

2.1 MATERIALS

- 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 sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content limits when calculated according to South Coast Air Quality Management District (SCAQMD) Rule 1168, and must meet or exceed the requirements for the Bay Area Quality Management District Regulation 8, Rule 5.
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 MANUFACTURERS

- A. Manufacturers and their products are listed for each type of sealant. Acceptable manufacturers include the following:
 - 1. Dow Consumer Solutions, www.consumer.dow.com.
 - 2. General Electric Co., www.gesealants.com.
 - 3. Pecora Corp., www.pecora.com.
 - 4. Sika Corp., www.sikausa.com.
 - 5. Sonneborn/ChemRex, www.chemrex.com.
 - 6. Tremco, Inc., www.tremcosealants.com.

7. United States Gypsum Co., www.usg.com.
8. W.R. Meadows, Inc., www.wrmeadows.com.

B. Substitutions: Under provisions of Section 01 25 13.

2.3 SEALANTS

- A. Type A - Acrylic Latex: One-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C834, Type S, Grade NS, formulated to be paintable.
 1. Tremco, Inc., Acrylic Latex Caulk.
 2. Pecora Corporation, AC-20.
 3. Sonneborn, Chemrex, Sonolac.
- B. Type B - Butyl Sealant: One-part, non-sag solvent-release-curing sealant complying with FS TT-S-001657 for Type 1 and formulated with a minimum of 75 percent solids.
 1. Tremco, Inc., Tremco Butyl Sealant.
 2. Pecora Corporation, BC-158.
 3. Sonneborn, Chemrex, Multi-Purpose Sealant.
- C. Type D - Non-Sag Polyurethane Sealant: Single component sealant complying with ASTM C920, Type S, Grade NS, Class 25:
 1. Pecora Corp., Dynatrol I-XL.
 2. Tremco, Inc., Vulkem 921.
 3. Sika Corp., Sikaflex 1a.
 4. Sonneborn/ChemRex, Sonolastic NP-1.
- D. Type E - Neutral-Curing Silicone Sealant: One part medium modulus neutral-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
 1. Dow Consumer Solutions, Dowsil 795.
 2. General Electric Co., Ultraglaze 4000.
 3. Tremco, Inc., Spectrum 3.
 4. Pecora Corp., 895.
- E. Type F - One-Part Mildew-Resistant Silicone Sealant: Complying with ASTM C920, Type S, Grade NS, Class 25.
 1. Dow Consumer Solutions, Dowsil 786.
 2. General Electric Co., Sanitary 1700.
 3. Tremco, Inc., Tremsil 200.
 4. Pecora Corp., 863 or 898 White.

- F. Type G - Multi-Part Pourable Sealant: Complying with ASTM C920, Type M, Grade P, Class 25. Shore A hardness +40.
 - 1. Tremco, Inc., THC900/901.
 - 2. Pecora Corp., Dynatred or Urexpan NR-200.
 - 3. Sika Corporation, Sikaflex 2c NS TG.
 - 4. W.R. Meadows, Pourthane NS/SL.
- G. Type H - Acoustical Sealant: Nondrying, nonhardening permanently flexible conforming to ASTM C834.
 - 1. Pecora Corp., AIS-919 Acoustical Sealant.
 - 2. Tremco, Inc., Tremco Acoustical Sealant.
 - 3. United States Gypsum Co., Sheetrock Acoustical Sealant.

2.4 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joint openings are ready to receive Work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions. Prime if recommended by manufacturer.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with ASTM C1193.
- E. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

- D. Install bond breaker where joint backing is not used.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Tool joints concave unless otherwise detailed.

3.4 CLEANING AND REPAIRING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean adjacent soiled surfaces.
- C. Repair or replace defaced or disfigured finishes caused by Work of this Section.

3.5 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.
- B. Sprinkler fine silica sand on sealant of exterior concrete paving joints to reduce tracking of sealant.

3.6 SCHEDULE

<u>Type</u>	<u>Location</u>	<u>Color</u>
A. Type A - Acrylic Latex Cure	All interior joints not otherwise scheduled	To match adjacent surfaces
B. Type B - Butyl	Under thresholds	Black
C. Type D - Non-Sag Polyurethane Sealant	Exterior door, entrance and window frames. Exterior and Interior vertical joints in painted concrete and masonry painted metal flashing.	To match adjacent surface.
D. Type E - Neutral-Curing Silicone	Joints within aluminum entrance system glass and glazing.	Black Aluminum
E. Type F - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures.	White
F. Type G - Multi-part Pourable Urethane	Exterior and interior joints in horizontal surfaces of concrete.	To match adjacent material
G. Type H - Acoustical Sealant	Interior walls between stud track/runner and adjacent construction. Between outlet boxes and gypsum board.	White

END OF SECTION

SECTION 07 95 13

EXPANSION JOINT COVER ASSEMBLIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Floor expansion joint cover assemblies.
- B. Wall expansion joint cover assemblies.
- C. Ceiling/soffit expansion joint cover assemblies.
- D. Roof expansion joint cover assemblies.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A167 - Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- C. ASTM A283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
- D. ASTM A786 - Rolled Steel Floor Plates.
- E. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- G. ASTM C920 - Elastomeric Joint Sealants.
- H. ASTM D2000 - Rubber Properties in Automotive Applications.
- I. ASTM E119 - Fire Tests of Building Construction and Materials.
- J. ASTM E814 - Fire Tests of Through Penetration Fire Stops.
- K. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- L. NAAMM - National Association of Architectural Metal Manufacturers.
- M. UL - Underwriters Laboratories.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction, and anchorage locations.
- C. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, and available colors and finish.

1.4 REGULATORY REQUIREMENTS

- A. Fire Performance - Determined by ASTM E119 and ASTM E814 including hose stream test of full-rated period by UL 263.
- B. Fire-Resistive Joint Systems - Shall have been tested in accordance with CBC California Building Code, CCR, Title 24, Section 713.

- C. Loading Characteristics - Floor covers capable of withstanding a minimum point load of 500 lbs. without damage or permanent deformation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Deliver materials to site in as large as possible sections and assemblies.
- C. Provide temporary protective cover for finished metal surfaces.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Balco Metalines, www.balcousa.com.
- B. Conspec Systems, Inc., www.c-sgroup.com.
- C. Nystrom Building Products, www.nystrom.com.
- D. JointMaster, www.inprocop.com.
- E. M.H. Powell Co., www.seismicjoints.com.
- F. MM Systems Corporation, www.mmsystemscorp.com.
- G. Watson Bowman Acme, www.wbacorp.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Structural Steel Shapes: ASTM A36.
- B. Steel Plates: ASTM A283, Grade C.
- C. Rolled Steel Plates: ASTM A786.
- D. Aluminum Extrusions: ASTM B221, 6063-T5 alloy.
- E. Aluminum Sheet and Plate: ASTM B209, 6061-T6 alloy.
- F. Stainless Steel: ASTM A167, Type 304.
- G. Extruded Preformed Seals: ASTM D2000, formed to fit frames.
- H. Elastomeric Sealant: ASTM C920.
- I. Water Barrier: PVC and thermoplastic rubber classified under ASTM D2000.
- J. Fire Barrier: High temperature insulation with metallic cover tested for required dynamic structural movement without fatigue. Component of joint cover tested in accordance with ASTM E119, CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Section 713, and ASTM E814 including hose stream test.
- K. Abrasive Grit: Two component epoxy combined with aluminum oxide grit.
- L. Threaded Fasteners: Stainless steel.
- M. Backing Paint: Asphaltic type.

2.3 FABRICATION

- A. Aluminum cover plate, aluminum frame construction, with resilient elastomeric filler strip, designed to permit plus or minus 50 percent joint movement with full recovery, flush and recess mounted.
- B. Back paint components in contact with cementitious materials.
- C. Galvanize embedded ferrous metal anchors and fastening devices.
- D. Shop assemble components and package with anchors and fittings.
- E. Provide joint components in single length wherever practical. Minimize site splicing.
- F. Miter corners and changes in direction with hairline joints.
- G. Fabricate fire barrier and provide fire-resistant sealant required for fire-resistant installation in accordance with UL listing.

2.4 FINISHES

- A. Comply with NAAM Metal Finishes Manual.
- B. Clear Anodized Finish: AA-C22A41; medium matte etched finish with 0.7 mil thick anodic coating.
- C. Painted Finish: Thermocured fluorocarbon coating of Kynar 500 or Hylar 5000 resin. Color as selected from manufacturer's entire range of available colors.
- D. Preformed Seals: As selected from manufacturer's entire range of available colors.
- E. Elastomeric Sealant: Match adjacent material.
- F. Stainless Steel: NAAMM-M32, mechanical finish, medium satin.
- G. Abrasive Grit: As selected from manufacturer's entire range of available colors.
- H. Factory Primed Concealed Surfaces: Shop coat of manufacturer's standard primer, minimum 2.0 mils thick.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions under provisions of Section 01 31 00.
- B. Verify that joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

- A. Provide anchoring devices for installation and embedding.
- B. Provide templates and rough-in measurements.

3.3 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment. Locate not less than 3 inches from ends and at no more than 24 inches on center.
- D. Allow adequate free movement for thermal expansion and contraction of metal.

- E. Install preformed seals with minimum number of end joints.
- F. Heat seal field splice of preformed seals to watertight condition.
- G. Install secondary seals in continuous lengths without field splices.
- H. Install fire barrier in accordance with manufacturer's instructions and UL listing.

3.4 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 61 00.
- B. Do not permit traffic over unprotected floor joint surfaces.
- C. Provide removable stripable coating to protect finish surface.

3.5 JOINT COVER SCHEDULE

	<u>JOINT LOCATION</u>	<u>MANUFACTURER</u>	<u>MODEL NUMBER</u>
A.	Interior Floor Joint	Balco	EXF-4
B.	Interior Floor/Wall Joint	Balco	EXFL-4
C.	Interior Wall Joint	Balco	CML-4
D.	Interior Wall/Ceiling Joint	Balco	CML-4
E.	Exterior Wall Joint	Balco	FCVS-4
F.	Ceiling Joint	Balco	CML-4
G.	Exterior Soffit Joint	Balco	9WC-4
H.	Roof Joint	Balco	9WC-4
I.	Roof/Wall Joint	Balco	9WC-4

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Non-rated and fire rated rolled steel doors and frames.
- B. Interior and exterior light frames.
- C. LouverS.

1.2 REFERENCES

- A. ANSI A250.8 - Recommended Specification for Standard Steel Doors and Frames.
- B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- D. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation.
- F. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace.
- H. CEC - California Energy Commission.
- I. NFPA 80 - Fire Doors and Windows.
- J. SDI-105 - Recommended Erection Instructions for Steel Frames.
- K. DHI - Door and Hardware Institute.
- L. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.
- M. UL 9 - Fire Tests of Window Assemblies.
- N. UL 10C - Fire Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of ANSI A250.8.
- B. Fire rated door and frame construction to conform to UL 9 and UL 10C.
- C. Installed frame and door assembly to conform to NFPA 80 for fire rated class indicated on Drawings.
- D. Installed exterior frame and door assembly to be weather tight.
- E. Manufacturer shall have both fabrication and assembly plant located within the continental United States or Canada. Products that are either fabricated or assembled outside the continental United States or Canada are not acceptable.

1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Performance: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall minimum U-value of 0.71 as rated in accordance with the default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-A.
- B. Solar Heat Gain Coefficient: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall maximum solar heat gain coefficient of 0.73 as rated in accordance with default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-B.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 for fire rated frames and doors.
- B. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, for U-value and solar heat gain coefficient.

1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.
- C. Indicate door elevations, internal reinforcement, closure method, and cut outs for glazing and louvers.
- D. Submit two samples of exterior frame profile at mullion intersection.
- E. Submit Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-A and 110.6-B.

1.7 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect, and handle products under provisions of Section 01 61 00.
- B. Store products on site under cover.
- C. Place products on at least 4 inch wood sills to prevent rust and damage.
- D. Protect doors and frames with resilient packaging.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence Work under the provisions of Section 01 11 00.
- B. Schedule Work under the provisions of Section 01 32 16.
- C. Schedule delivery of all doors and frames so as not to delay progress of other trades.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Curries Mfg., Inc., www.curries.com.

- B. DCI Hollow Metal, www.dcihollowmetal.com.
- C. Fleming, www.flemingdoor.com.
- D. Krieger Steel Products Company, www.kriegersteel.com.
- E. Republic Builders Products Corporation, www.republicdoor.com.
- F. Security Metal Products, www.secmet.com.
- G. Steelcraft, www.steelcraft.com.
- H. Stiles Custom Metal, Inc., www.hollowmetal.com.
- I. Titan Metal Products, Inc., www.titanmetalinc.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.2 DOORS AND FRAMES

- A. Provide reinforcing steel with a minimum post-consumer recycled content of 50 percent.
- B. Exterior Doors: ANSI A250.8, Level 3, extra heavy-duty, Model 2, continuous welded seam, beveled edges, minimum 0.053 inch thick faces.
- C. Interior Doors: ANSI A250.8, Level 2 heavy duty, Model 1, beveled edges, minimum 0.042 inch thick faces.
- D. Exterior Frames: ANSI A250.8, Level 3, 0.067 inch thick material, core thickness.
- E. Interior Frames: ANSI A250.8, Level 2, 0.053 inch thick material, core thickness.

2.3 DOOR CORE

- A. Exterior Core: Polystyrene insulation.
- B. Interior Door Core: Impregnated cardboard honeycomb.

2.4 ACCESSORIES

- A. Louvers: Roll formed steel, prime coated, inverted 'Y' blade, sightproof, with countersink, tamperproof fasteners.
- B. Rubber Silencers: Resilient rubber as supplied by Section 08 71 00.
- C. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws at door installations, square butt at light frames.
- D. Mineral-Fiber Insulation: ASTM C665, Type 1, without membrane facing; slag or rock wool fibers; with maximum flame spread and smoke developed indexes of 25 and 50; passing ASTM E136 for combustion characteristics.

2.5 FRAME ANCHORS

- A. Wood Stud Anchor: U-shaped anchor, welded to frame, 1 inch wide, 0.053 inch thick steel, with 2 pre-punched holes in nailing flange. UL listed as required for fire rating.
- B. Existing Wall Anchor: 0.053 inch thick pipe spacer with 2 inch x 0.053 inch thick steel plate sized to accommodate a 3/8 diameter countersunk flathead expansion anchor. UL listed as required for fire rating.
- C. Floor Clip: Angle anchor, full width of frame, 0.067 inch thick steel.

- D. Masonry Anchors: Adjustable T-strap, 0.053 inch thick steel, corrugated, 2 inch x 10 inch size. Fire rated frames to have UL listed perforated strap anchor permanently anchored to frame.

2.6 PROTECTIVE COATINGS

- A. Rubberized Coating: Corrosion proofing and sound deadener compound. Equivalent to Rust-Oleum Professional Grade Rubberized Undercoating, www.rustoleum.com.
- B. Primer: Clean and treat with three stage iron phosphate process. Provide baked-on shop coat of EPA compliant gray synthetic rust - inhibitive enamel primer meeting acceptance criteria of ANSI 250.10.
- C. The frame underneath the glazing stops and the inside of the glazing stop area shall be treated for maximum paint adhesion and prime painted with a rust inhibitive primer prior to installation of the frame.

2.7 HARDWARE REINFORCEMENT

- A. Fabricate frames and doors with hardware reinforcement plates welded in place.
- B. Hinge reinforcing shall be full width of frame profile.
- C. Provide spacers for all thru-bolted hardware.
- D. Reinforcement components shall be the following minimum thickness:

1. Hinge (door and frame)	3/16 inch
2. Mortise Lock or Deadbolt	0.093 inch
3. Bored Lock or Deadbolt	0.093 inch
4. Auto Flush Bolt	0.093 inch
5. Surface Bolt	0.093 inch
6. Surface Applied Closer	0.093 inch
7. Hold Open Arm	0.093 inch
8. Pull Plates and Bars	0.067 inch
9. Surface Exit Device	0.093 inch
10. Floor Checking Hinge	0.167 inch
11. Pivot Hinge	0.167 inch

2.8 FABRICATION

- A. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing.
- B. All spliced joints shall occur on the interior side of exterior frames.
- C. Fabricate frames as full profile welded units.
- D. All face, rabbet and soffit joints between abutting members shall be continuously welded and finished smooth when exposed to exterior.
- E. Corner joints shall have all contact edges closed tight, with faces mitered and continuously welded.

- F. Frames with multiple openings shall have mullion members fabricated with no visible seams or joints. All face, rabbet and soffit joints between abutted members shall be continuously welded and finished smooth when exposed to exterior.
- G. Provide 3/8 inch back bend return on frames where gypsum board wall material occurs whether on one or both sides.
- H. Mullions for Double Doors: Removable type supplied by Section 08 71 00.
- I. Dust cover boxes or mortar guards of 0.016 inch thick steel shall be provided at all hardware mortises on frames.
- J. Reinforce frames wider than 48 inches with roll formed, 0.093 inch thick steel channels fitted tightly and welded into frame head, inverted U-shape profile.
- K. Prepare frame for silencers except for frames which receive weatherstripping. Provide three single rubber silencers for single doors on strike side, and two single silencers on frame head at double doors without mullions.
- L. Provide steel spreader temporarily attached to feet of both jambs as a brace during shipping and handling. Spreader is not to be used for installation purposes.
- M. Attach fire rated label to each frame and door unit.
- N. Close top edge of exterior door flush with inverted steel channel closure. Weld all joints watertight.

2.9 MANUFACTURING TOLERANCE

- A. Manufacturing tolerance shall be maintained within the following limits:

1. Frame width	+1/16 inch -1/32 inch
2. Frame height	+3/64 inch
3. Frame face	+1/32 inch
4. Frame stop	+1/32 inch
5. Frame rabbet	+1/64 inch
6. Frame depth	+1/32 inch
7. Frame throat	+1/16 inch
8. Door width and height	+3/64 inch
9. Door thickness	+1/16 inch
10. Hardware location	+1/32 inch
11. Door flatness	+1/16 inch

2.10 FINISH

- A. Primer: Baked on rust-inhibitive enamel.
- B. Finish: Site paint under provisions of Section 09 90 00.
- C. Coat inside of frame profile for frames installed in masonry construction with rubberized undercoating to a thickness of 1/16 inch. Coating may be factory or site applied. Do not apply coating to fire rated frames.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.
- C. Install fire doors and frames in accordance with NFPA 80, their listing, and manufacturer's recommendations.
- D. Installation of exterior doors and frames to be weathertight and waterproof.
- E. Seal penetration of all surface applied screws on exterior face of frames at glass stops and hardware attachments.
- F. Coordinate installation with electrically controlled locks.
- G. Coordinate with wall construction and details for anchor placement. Provide anchors as follows:
 - 1. Frames up to 7'-6" height - 4 anchors each jamb.
 - 2. Frames 7'-6" to 8'-0" height - 5 anchors each jamb. Plus an additional anchor for each 2' or fraction thereof over 8'-0".
 - 3. Frames for Double Doors: Minimum of 2 anchors in head approximately 12 inches from each jamb.
 - 4. Borrowed Lite Frames: 2 anchors each jamb plus 1 for each 18 inches or fraction thereof over 3'-0". Minimum 2 anchors in head and sill approximately 12 inches from each jamb plus 1 for each 30 inches of length or fraction thereof.
 - 5. Floor anchors - 1 anchor each jamb for interior doors. Where wall construction will not allow placement of floor anchor, provide one additional jamb anchor as close to floor as possible. At exterior doors set frames 2 inches into blocked out recess and grout flush with floor.
 - 6. Existing wall anchors shall be welded to provide non-removable condition. Welded bolt head to be ground, dressed and finished smooth.
- H. Frames installed in masonry walls to be fully grouted with masonry grout.
- I. Exposed field welds to be finished smooth and touched up.
- J. Primed or painted surfaces which are scratched or marred shall be touched up.
- K. Hardware to be applied in accordance with hardware manufacturer's templates and instructions.
- L. Coordinate installation of glass and glazing.
- M. Install door louvers.
- N. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- O. Solidly pack mineral-fiber insulation into frames installed in exterior walls that are not solid grouted. For vertical and horizontal frame mullions that are inaccessible after frame assembly place insulation into frame before joining members together.

3.2 INSTALLATION TOLERANCES

A. Edge clearance for swinging doors shall not exceed the following:

- | | |
|--|----------|
| 1. Between door and frame at head and jamb | 1/8 inch |
| 2. Between edge of pair of doors | 1/8 inch |
| 3. At door sill with threshold (From bottom of door to top of threshold) | 3/8 inch |
| 4. At door sill with no threshold | 1/2 inch |
| 5. At door bottom and rigid floor covering per NFPA 80 | 1/2 inch |
| 6. At door bottom and nominal floor covering per NFPA 80 | 5/8 inch |

B. Frame installation tolerance shall not exceed the following:

- | | |
|------------------------|--------------|
| 1. Squareness | + -1/16 inch |
| 2. Alignment | + -1/16 inch |
| 3. Plumbness | + -1/16 inch |
| 4. Diagonal Distortion | + -1/32 inch |

END OF SECTION

SECTION 08 11 16

INTERIOR ALUMINUM DOORS AND FRAMES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum door frames for interior use. Non-rated.
- B. Aluminum doors for interior use, non-rated.
- C. Aluminum light frames for interior use, non-rated.
- D. Anchors, brackets and attachments.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessibility Design.
- B. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- C. AAMA 607.1 - Guide Specification and Inspection Methods for Clear Anodized Finishes for Architectural Aluminum.
- D. AAMA 608.1 - Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
- E. AAMA 609 & 610-02 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- G. NAAMM - Metal Finishes Manual for Architectural Metal Products.
- H. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- I. NFPA 80: Standard for Fire Doors and Fire Windows.
- J. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00.
 - 1. Submit shop drawings showing frame layouts, profiles, anchor types and spacings and product components.
 - 2. Indicate door elevations, internal reinforcing, closure method.
 - 3. Submit 2 samples of framing for finish, color and texture.
 - 4. Technical Information: Submit product data providing description, technical data and installation instructions.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include recommended repair and replacement procedures for trim and finishes.

1.5 QUALITY ASSURANCE

- A. Systems manufacturer shall maintain a current listing or certification.
- B. Assemblies shall be labeled in accordance with limits of listings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver store and protect products under provisions of Section 01 61 00.
- B. Ordering: Order products and materials in sufficient time to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's packaging, undamaged, complete with installation instructions.
- D. Storage and Protection:
 - 1. Store off ground, under cover, protected from weather, direct sunlight, and construction activities.
 - 2. Frame units must be separated by nonabrasive pads such as cloth or cork.
 - 3. Place frames upright, no less than 6 degrees from vertical. Do not store horizontally.
 - 4. Repair damage to finish of frames as recommended by manufacturer.
- E. Handling: Protect materials and finish during handling and installation to prevent damage.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual measurements for openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- B. Coordinate work of this section with others affected including but not limited to: Door hardware provided by Section 08 71 00 and Glazing provided under Section 08 80 00.

1.8 QUALIFICATIONS

- A. Manufacturer: A firm with a minimum of 5 years' experience manufacturing interior aluminum framing and doors.
- B. Installer: A firm with a minimum of 5 years' experience with the installation of aluminum doors and frames similar to those specified in this section.

1.9 REGULATORY REQUIREMENTS

- A. Conform to the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design.

1.10 WARRANTY

- A. Provide one year manufacturer's standard warranty for doors and framing under provisions of Section 01 77 00.

2. PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Western Integrated Materials www.aluminumdoorframes.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221 alloy of 6063-T5.

2.3 ALUMINUM FRAMING

- A. Western Integrated Material Series 300 framing system.
- B. Rectilinear design.
- C. 1-1/2 inch face profile with 1 inch x 3/8 inch trim.

2.4 ALUMINUM DOORS

- A. 1-3/4-inch-thick doors of types and design indicated.
- B. Aluminum stile and rail swinging doors.
- C. Stiles: Medium stile, 3-1/2 inch wide.
- D. Rails: Medium rail, 3-1/2 inch high. 10-inch-high bottom rail with smooth surface.
- E. Aluminum glazing channels with wrap around black PVC glazing beads.

2.5 GLAZING

- A. Interior Glazing: As specified in Section 08 80 00 - Glazing and as indicated on drawings.

2.6 HARDWARE

- A. Interior Hardware: As specified in Section 08 71 00 - Door Hardware.

2.7 FABRICATION

- A. Factory pre-engineered and pre-cut components to the greatest extent possible.
- B. Conceal corner reinforcements and alignment clips.
- C. Prepare for hardware. Include cutouts, reinforcement, mortising, drilling and tapping.
- D. Fabricate all components without exposed fasteners.
- E. Provide internal reinforcement for all door frame / sidelight jamb configurations.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying designated finishes.

- B. Finish framing after assembly and before shipping.
- C. Protect finishes on exposed surfaces from damage by applying a removable, temporary protective cladding before shipping.
- D. Appearance of Finished Work: Minor variations in appearance of adjacent frame sections are acceptable. Noticeable variations in the same piece are not acceptable.
- E. Finish to match that as specified in Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

2.9 ACCESSORIES

- A. Fasteners: Aluminum, non-magnetic, stainless-steel compatible with frames.
- B. Silencers: Manufacturer's standard wool pile seals.
- C. Glazing Gaskets: Manufacturer's standard extruded plastic.

2.10 SEALANT MATERIALS

- A. Sealant and Backing Materials: Types as specified in Section 07 92 00- Joint Sealants.

3. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area to receive framing and door system. Openings shall be plumb, square and within allowable tolerances.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Attach frame around the perimeter using #10 screws x appropriate length to achieve 1-3/8 inch embedment in wood framing through factory prepared access holes in aluminum frame.
- B. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.
- C. Install glass in accordance with Section 08 80 00, using interior dry method.
- D. Install reveal trim.
- E. Seal perimeter of framing system with sealant materials as specified in Section 07 92 00.

3.3 TOLERANCES

- A. Not more than 1/8 inch at jambs and heads, 1/4 inch between pairs of doors. and not more than 3/4 inch at threshold of door.

3.4 ADJUSTING

- A. Adjust operating hardware and check each door to ensure proper operation. Replace units that cannot be adjusted to operate freely.
- B. Instruct Owner's personnel in proper maintenance of hardware and finishes.

3.5 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas.
- B. Glass and frame should be cleaned using soft clean cloth, chamois leathers, sponges or soft paper. Use clean warm water with a mild detergent. Do not use detergent that contains either alkaline, acids or fluoride. Clean prior to date of Substantial Completion.
- C. Remove construction debris from project site and legally dispose of debris.

3.6 REPAIR AND TOUCH UP

- A. Limited to minor repair of small scratches. Use only manufacturer's recommended products.
 - 1. Repairs shall match original finish for quality of material.
 - 2. Repair and touch-up scratches when visible from a distance of 5 feet.

END OF SECTION

SECTION 08 12 13

HOLLOW METAL FRAMES

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Non-rated rolled steel knock-down drywall slip-on frames.
- B. Interior light frames.

1.2 REFERENCES

- A. ANSI A250.8 - Recommended Specification for Standard Steel Doors and Frames.
- B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- D. ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low Alloy with Improved Formability.
- E. NFPA 80 - Fire Doors and Windows.
- F. SDI - Steel Door Institute.
- G. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of ANSI A250.8.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, for fire rated frames.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.
- C. Indicate elevations, internal reinforcement and closure method.

1.6 DELIVERY, STORAGE AND PROTECTION

- A. Protect frames with resilient packaging.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Curries Mfg., Inc., www.curries.com.
- B. DCI Hollow Metal, www.dcihollowmetal.com.

- C. Fleming, www.flemingdoor.com.
- D. Republic Builders Products Corporation, www.republicdoor.com.
- E. Steelcraft, www.steelcraft.com.
- F. Stiles Custom Metal Inc., www.hollowmetal.com.
- G. Titan Metal Products, Inc., www.titanmetalinc.com.
- H. Timely Industries, Inc., www.timelyframes.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.2 FRAMES

- A. Interior Frames: Commercial quality cold-rolled steel conforming to ASTM A1008, 0.053 inch thick material, core thickness.

2.3 ACCESSORIES

- A. Rubber Silencers: Resilient rubber.
- B. Glazing Stops: Rolled steel channel shape; prepared for countersunk style tamperproof screws.

2.4 PROTECTIVE COATINGS

- A. Primer: Clean and treat with three stage iron phosphate process. Provide baked-on shop coat of EPA compliant gray synthetic rust - inhibitive enamel primer meeting acceptance criteria of ANSI 250.10.

2.5 FABRICATION

- A. Fabricate frames as knock-down drywall slip-on type.
- B. Provide 3/8 inch back bend return typical on all frames.
- C. Mullions for Double Doors: Removable type supplied by Section 08 71 00.
- D. Fabricate frames with hardware reinforcement plates fillet welded in place. Reinforcement gages to be in accordance with ANSI A250.8, Table IV.
- E. Reinforce frames wider than 48 inches with roll formed, 0.093 inch thick steel channels fitted tightly and welded into frame head, inverted U-shape profile.
- F. Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.
- G. Attach fire rated label to each frame unit.

2.6 FINISH

- A. Primer: Baked on rust-inhibitive enamel.
- B. Finish: Field painted in accordance with Section 09 90 00. Comply with ANSI A250.3 criteria for acceptance of finish.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install frames in accordance with SDI recommendations.
- B. Install fire rated frames in accordance with NFPA 80, their listing, and manufacturer's recommendations.
- C. Coordinate installation of glass and glazing.
- D. Coordinate with wall construction and details for compression anchor placement. At minimum, provide anchors at hinge, strike and base plate levels, and two in head of double doors.

3.2 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

END OF SECTION

SECTION 08 14 23

CLAD WOOD DOORS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Plastic faced wood doors non-rated.
- B. Door louvers.

1.2 REFERENCES

- A. ANSI/WDMA - Wood Door Manufacturers Association - I.S.1-A-04-Architectural Wood Flush Doors.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- C. NFPA 80 - Fire Doors and Windows.
- D. NEMA LD-3 - High Pressure Decorative Laminates.
- E. WI - Woodwork Institute: North American Architectural Woodwork Standards 3.0.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of the WI North American Architectural Woodwork Standards, Section 9, Custom Grade.
- B. All plastic faced wood doors and their installation shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- C. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.
- D. After completion, issue a WI Certified Compliance Certificate for Installation.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code for fire rated doors.
- B. Installed Doors: Conform to NFPA 80 for fire rated class indicated.

1.5 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01330. Shop drawings shall bear the WI Certified Compliance Label on the first page of each set.
- B. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 12 x 12 inch in size illustrating color, finish, and texture.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of Section 01 61 00.
- B. Package, deliver, and store doors in accordance with WI requirements as set forth in Section 2 of the WI North American Architectural Woodwork Standards.

1.7 WARRANTY

- A. Provide manufacturer's standard lifetime warranty under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Eggers Industries, www.eggindustries.com.
- B. Haley Architectural Doors, www.haleybros.com.
- C. Oskosh Door Co., www.oshkoshdoor.com.
- D. Marshfield Door Systems, Inc., www.marshfelddoors.com.
- E. V.T. Industries, www.vtindustries.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 DOOR CONSTRUCTION

- A. Core (Solid, Non-Rated): Solid wood block, framed block glued, or solid particle board.
- B. Core (Solid, Fire Rated): Labeled fire performance type.
- C. Construction; WI custom grade, ANSI/WDMA, extra heavy duty, 5 ply.
- D. Vertical Edge: Plastic laminate same as door facing.

2.3 FACING

- A. Plastic Laminate (Non-Rated): NEMA LD-3, special purpose type, 0.050 inch thick, color and finish selected from laminate manufacturer's entire range of products.

2.4 ADHESIVES

- A. WI Type I.

2.5 ACCESSORIES

- A. Glass Stops: Plastic laminate to match face veneer.

2.6 FABRICATION

- A. Fabricate non-rated doors in accordance with the WI North American Architectural Woodwork Standard, Section 9.
- B. Fabricate fire rated doors in accordance with manufacturer's standard construction and labeling agency requirements.
- C. Premachine doors for finish hardware.

- D. For fire rated doors with mineral cores, provide solid wood blocks for hardware reinforcement at lock edge and at top of door for closer.
- E. For fire rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with the WI North American Architectural Woodwork Standards, Section 9.
- B. Conform to WI and NFPA requirements for fit tolerances.
- C. Coordinate installation of glass and glazing.
- D. Install door louvers.
- E. Adjust doors for smooth and balanced movement.
- F. Install fire doors in accordance with NFPA 80, their listing, and manufacturer's recommendations.

3.2 INSTALLATION TOLERANCES

- A. Edge clearance for swinging doors shall not exceed the following as required by WI and NFPA 80:

1. Between door and frame at head and jamb	1/8 inch
2. Between edge of pair of doors	1/8 inch
3. Diagonal distortion	1/8 inch
4. At door sill with threshold. (From bottom of door to top of threshold)	3/8 inch
5. At door sill with no threshold	1/2 inch
6. At door bottom and rigid floor covering per NFPA 80	1/2 inch
7. At door bottom and nominal floor covering per NFPA 80	5/8 inch

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND FRAMES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-rated access doors and frames.
- B. Wall and ceiling locations.
- C. Installation schedule.

1.2 REFERENCES

- A. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

- A. Manufacture fire rated access doors and frames to conform to UL requirements.
- B. Provide labels indicating rating.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Include sizes, types, finishes, scheduled locations, and details of adjoining work.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Elmdor Manufacturing Co., www.elmdorstoneman.com.
- B. Karp Associates Inc., www.karpinc.com.
- C. J.L. Industries, www.jlindustries.com.
- D. MIFAB, www.mifab.com.
- E. Milcor Incorporated, www.milcorinc.com.
- F. Nystrom Incorporated, www.nystrom.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCESS UNITS

- A. Fire Rated Wall and Ceiling Units: Equivalent to Milcor Flush Panel Universal Fire Rated access door, Model UFR, with sandwich type door panel with 1-1/2 hour B label fire rating.
- B. Non-Rated Wall Units: Equivalent to Milcor Flush Panel Style M and MS.
- C. Non-Rated Gypsum Board Ceiling Units: Equivalent to Milcor recessed panel Style ATR.
- D. Non-Rated Plaster Ceiling and Wall Units: Equivalent to Milcor flush panel Style K.
- E. Non-Rated Applied Acoustic Tile Ceiling Units: Equivalent to Milcor recessed panel Style AT.

- F. Size: As required for proper access.

2.3 FABRICATION

- A. Fire Rated Units: Fabricate frame of 0.0538 inch thick steel and door panels 0.0329 inch thick steel pans insulated with non-combustible filler.
- B. Non-Rated Units: Fabricate frames of 0.0538 inch thick steel and door panels of 0.0329 inch thick steel.
- C. Weld, fill, and grind joints to assure flush and square unit.
- D. Hardware: Continuous type steel hinges with stainless steel pin, screw driver slot, quarter turn cam lock.
- E. Anchors: Provide masonry anchors where required for wall construction.

2.4 FINISH

- A. Prime coat units with baked on electrostatic primer.
- B. Stainless steel.
- C. Site paint primed metal surfaces under provision of Section 09 90 00.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify rough openings for door and frame are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install frame plumb, level, and flush in wall and ceiling openings.
- B. Position to provide convenient access to concealed work requiring access.
- C. Secure rigidly in place in accordance with manufacturer's instructions.
- D. Install sealant material around units as specified in Section 07 92 00.

3.3 INSTALLATION SCHEDULE

- A. Provide access doors in locations and in sizes required for all mechanical, plumbing and electrical equipment for proper adjustment, maintenance and general access required by code.
- B. Provide access doors in the following quantities:
 - 1. 10 non-rated, flush panel, prime painted wall access doors.
 - 2. 10 non-fire rated, flush panel, stainless steel wall access doors.
 - 3. 10 non-fire rated, recessed panel, gypsum board ceiling access doors.
- C. Install prime painted units at all locations except at toilets, kitchens, showers and similar spaces.
- D. Install stainless steel units at all toilets, kitchens, showers, and similar spaces.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Standard overhead coiling doors; non-fire rated manual operated; pre-finished finish.
- B. Non-fire rated overhead coiling counter service doors, manual operation, stainless steel finish with integral frame and sill.

1.2 REFERENCES

- A. ASTM A480 - Flat Rolled Stainless Heat Resisting Steel Plate, Sheet, and Strip.
- B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. UL - Underwriters' Laboratories, Inc.
- E. NFPA 80 - Fire Doors and Windows.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide pertinent dimensioning, general construction, component connections and details, anchorage methods, hardware location, and installation details.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 REGULATORY REQUIREMENTS

- A. Fire-Rated Door Assemblies: Shall comply with NFPA 80 and be listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.
- B. Smoke Control: In corridors and smoke barriers, doors shall be listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784. Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - OVERHEAD COILING DOORS

- A. Atlas Door Corp./Cornell Iron Works, www.cornelliron.com.
- B. The Cookson Company, www.cooksondoor.com.
- C. Lawrence Roll-Up Doors, Inc., www.lawrencedoors.com.
- D. Overhead Door Corp., www.overheaddoor.com.
- E. Raynor, www.raynor.com.
- F. Wayne Dalton Corp., www.wayne-dalton.com.
- G. Windsor Door, www.windsordoor.com.

H. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS - COUNTER SERVICE DOORS

A. Atlas Door Corp./Cornell Iron Works, www.cornelliron.com.

B. The Cookson Co., www.cooksondoor.com.

C. Lawrence Roll-Up Doors, Inc., www.lawrencedoors.com.

D. Overhead Door Corp., www.overheaddoor.com.

E. Raynor, www.raynor.com.

F. The Peelle Co., www.peelldoor.com.

G. Wayne Dalton Corp., www.wayne-dalton.com.

H. Substitutions: Under provisions of Section 01 25 13.

2.3 MATERIALS - OVERHEAD COILING DOORS

A. Curtain: Minimum 0.0269 inch thick flat slats of steel, ASTM A653, Commercial Steel, Type A, G60 galvanized coating in accordance with ASTM A924; 2-1/4 inches nominal width x required length; ends of alternate slats fitted with endlocks to act as wearing surface in guides and to prevent lateral movement; bottom fitted with angles to provide reinforcement and positive contact with floor in closed position.

B. Chain Hoist Operation: Continuous hand chain hoist with gear reduction.

2.4 MATERIALS - COUNTER SERVICE DOORS

A. Curtain: ASTM A480, 0.031 inch thick Type 304 stainless steel flat slats fitted with endlocks to maintain proper alignment; stainless steel angle bottom bar with lift handles and slide bolts to lock curtain closed at each jamb.

B. Frame: ASTM A480, 0.063 inch thick Type 304 stainless steel frame, hood and fascia with grooves formed into jambs for retaining curtain.

2.5 FINISH

A. Overhead Coiling Doors: Galvanized steel factory primed and pre-finished in powder-coat paint finish in color selected by Architect.

3. PART 3 EXECUTION

3.1 INSTALLATION

A. Install overhead coiling doors, and counter service doors in accordance with manufacturer's instructions.

B. Fit, align, and adjust door assemblies level and plumb; provide smooth operation.

C. Install fire-rated doors in compliance with NFPA 80.

D. Test door closing when activated by smoke-detector fire-release system. Reset door-closing mechanism after successful test.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum doors, frames and glazed lights.
- B. Glass.
- C. Anchors, brackets, and attachments.
- D. Perimeter sealant.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- C. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
- D. ASTM D2000 - Classification System for Rubber Products.
- E. ASTM D2287 - Nonrigid Vinyl Chloride Polymer and Copolymer molding and Extrusion Compounds.
- F. AAMA TIR-A8 - Structural Performance of Composite Thermal Barrier Framing System.
- G. AAMA 505 - Dry Shrinkage and Composite Performance Thermal Cycling Test Procedure.
- H. AAMA 701.2 - Voluntary Specification for Pile Weatherstripping.
- I. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
- J. NAAMM - Metal Finishes Manual.
- K. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.
- L. CEC - California Energy Commission.

1.3 PERFORMANCE

- A. System to provide for expansion and contraction within system components caused by a cycling temperature range of 120 degrees F without causing detrimental effects to system or components.
- B. Thermal break to be provided in accordance with AAMA TIR-A8 and be tested by AAMA 505.
- C. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with the CBC, California Building Code.
- D. Limit mullion deflection to 1/175, or flexure limit of glass with full recovery of glazing materials, whichever is less for spans up to 13'-6" with a deflection of 1/240 for spans greater than 13'-6".
- E. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.
- F. Limit air infiltration through assembly to 0.06 cu. ft./min./sq. ft. as measured in accordance with ASTM E283.

- G. System to Accommodate, without Damage to System or Components, or Deterioration of Perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
- H. Thermal Performance: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall minimum U-value of 0.71 as rated in accordance with the default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-A.
- I. Solar Heat Gain Coefficient: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall maximum solar heat gain coefficient of 0.73 as rated in accordance with default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-B.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; door hardware requirements; and affected related work.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples, 12 x 12 inches in size, illustrating prefinished aluminum surface.
- F. Submit Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-A and 116-B.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, for U-value and solar heat gain coefficient.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, for loads, seismic zoning and other governing criteria.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with AMA SFM-1.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle system components under provisions of Section 01 61 00.

1.8 WARRANTY

- A. Provide a lifetime warranty for door corners under provisions of Section 01 77 00.
- B. Warranty shall include coverage for distortion, dislocation and deformation.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Arcadia, www.arcadiainc.com.
- B. EFCO Corporation, www.efcocorp.com.
- C. Kawneer Company, Inc., www.kawneer.com.
- D. Old Castle Building Envelope, www.oldcastlebe.com.
- E. United States Aluminum, www.usalum.com.
- F. YKK AP America, Inc. www.ykkap.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221; Alloy G.S. 10A-T5.
- B. Brackets and Reinforcements: High strength aluminum.
- C. Steel Sections: ASTM A36; shapes to suit mullion sections.
- D. Fasteners: Stainless steel, aluminum.
- E. Compression Weatherstripping: Replaceable gaskets of molded neoprene that are silicone compatible and comply with ASTM D2000 or molded PVC; complying with ASTM D 2287.
- F. Sliding Weatherstripping: Replaceable wool, polypropylene or nylon woven pile; nylon fabric or aluminum strip backing; comply with AAMA 701.2.

2.3 FABRICATED COMPONENTS

- A. Frames: 2 x 4-1/2 inch profile, flush glazing stops.
- B. Wide Stile Doors: 1-3/4 inches thick, 5 inch wide top rail, 5 inch wide vertical stiles, 10 inch wide bottom rail (nominal dimensions); square glazing strips.

2.4 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: As specified in Section 08 80 00 and as indicated on drawings.

2.5 HARDWARE

- A. Door Hardware: As specified in Section 08 71 00.
- B. Provide door hardware as scheduled for doors and applications indicated.

2.6 FABRICATION

- A. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.
- B. Rigidly fit and secure joints and corners with internal reinforcement. Weld top and bottom rails of doors to reinforcement clips. Make joints and connections flush, hairline, and weatherproof.
- C. Develop drainage holes with moisture pattern to exterior.

- D. Prepare components to receive anchor devices. Fabricate anchorage items.
- E. Arrange fasteners, attachments, and jointing to ensure concealment from view.
- F. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.
- G. Reinforce framing members for imposed loads.

2.7 FINISHES

- A. Natural Anodized Finish: NAAMM AA-M12-C22 A41, Class I clear anodic coating.
- B. Color Anodized Finish: NAAMM AA-M12-C22 A42/44, colored anodic coating, black.

2.8 SEALANT MATERIALS

- A. Sealant and Backing Materials: As specified in Section 07 92 00.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify wall openings and adjoining materials are ready to receive Work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install doors, frames, glazing and hardware in accordance with manufacturer's instructions and AAMA SFM-1.
- B. Use anchorage devices to securely attach frame assembly to structure.
- C. Attach to structure to permit adjustment to accommodate construction tolerances and other irregularities.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Install sill flashings.
- F. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install sealant and backing materials as specified in Section 07 92 00.
- H. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.
- I. Install glass in accordance with Section 08 80 00, using exterior dry method of glazing.
- J. Adjust operating hardware.

3.3 TOLERANCES

- A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.
- B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

3.4 CLEANING

- A. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- B. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Extruded aluminum windows with fixed and operating sash.
- B. Glass and glazing.
- C. Operating hardware and insect screens.
- D. Perimeter sealant.

1.2 REFERENCES

- A. AAMA 101 - Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Door.
- B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- C. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
- D. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- E. ASTM E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- F. ASTM E547 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
- G. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 6.
- H. CEC - California Energy Commission.
- I. FS RR-W-365A - Wire Fabric (Insect Screening).
- J. NFRC - National Fenestration Rating Council.
- K. NAAMM - National Association of Architectural Metal Manufacturers.
- L. SIGMA - Sealed Insulating Glass Manufacturers Association.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with air infiltration, water penetration and structural performance requirements indicated in AAMA 101 for the type, grade and performance class of window units required.
- B. Provide current certified AAMA test report that reflects the window configuration and type specified.
- C. Test each type and size of required window unit through a recognized testing laboratory or agency, in accordance with ASTM E330 for structural performance, with ASTM E283 for air infiltration and with both ASTM E331 and ASTM E547 for water penetration. Provide certified test results.
- D. Thermal Performance: Overall U-value of .073 as rated in accordance with the National Fenestration Rating Council's (NFRC) 100 Rating Procedure or in accordance with default table method approved by the California Energy Commission (CEC). Provide certified test results.

- E. Air Leakage: Infiltration rates shall not exceed 0.3 cfm/ft. squared of window area when tested according to The National Fenestration Rating Council's (NFRC) 400 Rating Procedure or ASTM E283 at a pressure differential of 6.24 pounds/ft. squared. Provide certified test results.
- F. Solar Heat Gain Coefficient (SHGC): The SHGC shall be rated in accordance with The National Fenestration Rating Council's (NFRC) 200 Rating Procedure or in accordance with the default table method approved by the California Energy Commission (CEC). Provide certified test results.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; affected related work; installation requirements.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit manufacturer's certificate under provisions of 01 33 00 that window units meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Label to be permanently affixed to frame listing certified U-value, certifying organization and rating procedure.
- B. Label to be temporarily affixed to frame certifying that U-value, SHGC, and air infiltration requirements of California Building Code (CBC), California Code of Regulations (CCR), Title 24, Part 6, Section 110 have been met.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect window units under provisions of Section 01 61 00.
- B. Provide wrapping or strippable coating to protect prefinished aluminum surfaces.

1.7 WARRANTY

- A. Provide five year manufacturer's and SIGMA warranty under provisions of Section 01 77 00.
- B. SIGMA Warranty: Include coverage of insulated glass units from seal failure, interpane dusting or misting, and replacement of same.
- C. Manufacturers Warranty: Include coverage for materials and finish.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Casement Windows: CW-PG30-C, class, grade, type.
 - 1. All Weather Architectural Aluminum, 3000 Series, www.allweathersweb.com.
 - 2. EFCO Corporation, 2600 Series, www.efcocorp.com.
 - 3. Kawneer Company, Inc., 7200 Series, www.kawneer.com.
 - 4. Graham Architectural Products, 6500 Series, www.grahamwindows.com.
 - 5. Wausau Windows, 2000 Series, www.wausauwindow.com.

- B. Horizontal Sliding Windows: CW-PG30-HS class, grade, type.
 - 1. EFCO Corporation, 3500 Series, www.efcocorp.com.
 - 2. Graham Architectural Products, 200 Series, www.grahamwindows.com.
 - 3. Kawneer Company, Inc., 8400 Series, www.kawneer.com.
 - 4. Wausau Windows, 410 Series, www.wausauwindow.com.
- C. Projected Windows: CW-PG30-AP, class, grade, type.
 - 1. All Weather Architectural Aluminum, 3000 Series, www.allweathersweb.com.
 - 2. EFCO Corporation, 2600 Series, www.efcocorp.com.
 - 3. Graham Architectural Products, 6700 Series, www.grahamwindows.com.
 - 4. Kawneer Company, Inc., 7200 Series, www.kawneer.com.
 - 5. Wausau Windows, 2000 Series, www.wausauwindow.com.
- D. Single or Double Hung Windows: CW-PG30-H, class, grade, type.
 - 1. EFCO Corporation; 3410 Series, www.efcocorp.com.
 - 2. Graham Architectural Products, 2200 Series, www.grahamwindows.com.
 - 3. Kawneer Company, Inc., 8400 Series, www.kawneer.com.
 - 4. Wausau Windows, 310 Series, www.wausawindow.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221, 6063 alloy, T5 or T6 temper.

2.3 FABRICATED COMPONENTS

- A. Frames: Nominal 2 inches wide x 4 inches deep profile, of non- thermally broken, flush glass stops of snap-on type with capped sill ends.
- B. Casement Window: Construct main frames of mortised and tenoned corners. Construct vent frames of tubular section that is mitered, angle reinforced, crimped, and cold epoxy welded. Aluminum extrusion wall thickness for frame and vent sections; 0.125 inch.
- C. Horizontal Sliding Window: Sash verticals to telescope into sash horizontals; corners to be of screw spline construction. Aluminum extrusion wall thickness for frame sections; 0.062 inch, sill; 0.094 inch. Locking device; Continuous interlock at meeting rail.
- D. Operable Sash Weatherstripping: Window manufacturer's standard, permanently resilient, profiled to effect weatherseal.
- E. Operable Sash Hardware: Corrosion resistant; pivot bearings; positive position stop.
- F. Fasteners: Stainless steel.

2.4 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: Specified in Section 08 80 00.
- B. Glass: Clear, tinted, single pane, sealed insulated units of laminated glass.

2.5 SEALANT MATERIALS

- A. Sealant and Backing Material: As specified in Section 07 92 00.

2.6 FABRICATION

- A. Fabricate windows allowing for minimum installation clearances and shim spacing around perimeter of assembly, yet enabling installation.
- B. Rigidly fit joints and corners. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant.
- C. Develop drainage holes with moisture pattern to exterior.
- D. Prepare components to receive anchor devices. Fabricate anchorage items.
- E. Prepare components with internal reinforcement for operating hardware.
- F. Provide internal reinforcement in mullions to maintain rigidity.
- G. Shop glaze window units in accordance with manufacturer's instructions.

2.7 FINISHES

- A. Clear Anodized Finish: NAAMM AA-M12-C22-A41.
- B. Color Anodized Finish: NAAMM AA-M12-C22-A42/44. Color to be light black.
- C. Apply one coat of rubberized paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials. Rust-Oleum Professional Grade Rubberized Undercoating www.rustoleum.com.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify wall openings are ready to receive Work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install window frames, glass, glazing, and hardware in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely attach frame to structure.
- C. Align window frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
- D. Pack fibrous insulation in shim spaces at perimeter to maintain continuity of thermal barrier.
- E. Install sealant and backing materials as specified in Section 07 92 00.
- F. Adjust operable hardware for smooth operation and tight fit of sash.

3.3 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.
- B. Wash down exposed surfaces using a solution of mild detergent in warm water. Rinse with clean water, and wipe dry with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hardware for doors.
- B. Thresholds.
- C. Gasketting.
- D. Keying.

1.2 REFERENCES

- A. ADA - Americans with Disabilities Act Standards for Accessible Design.
- B. ANSI - American National Standards Institute.
- C. BHMA - Builders' Hardware Manufacturers Association.
- D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- E. DHI - Door and Hardware Institute.
- F. DSA - Division of the State Architect.
- G. NFPA 80 - Fire Doors and Windows.
- H. UL - Underwriters Laboratories.

1.3 COORDINATION

- A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.4 QUALITY ASSURANCE

- A. Manufacturers: Companies specializing in manufacturing door hardware with minimum five years experience. Obtain each kind of hardware from only one manufacturer.
- B. Hardware Supplier: Company specializing in supplying commercial door hardware with five years documented experience.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section.

1.5 REGULATORY REQUIREMENTS

- A. Fire-Rated Openings: Comply with CBC Section 716 and NFPA Standard No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.
 - 1. Where exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide UL Label on exit device indicating "Fire Exit Hardware".
 - 2. Exit device shall be compliant with State Fire Marshall Standard 12-10-3, Section 12-10-302.
- B. Conform to applicable requirements of the Americans with Disabilities Act Standards for Accessible Design regarding accessibility requirements for door and entrance hardware.
- C. Doors and doorways that are part of an accessible route shall comply with CBC Sections 11B-404.
- D. The clear opening width for a door shall be 32 inches minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into the opening below 34 inches and 4 inches maximum projections into the opening between 34 inches and 80 inches above the finish floor or ground. Door closers and stops shall be permitted to be 78 inches minimum above the finish floor or ground. CBC Section 11B-404.2.3.
- E. 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 not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34 inches minimum and 44 inches maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC Section 11B-404.2.7.
- F. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.
 - 1. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 lbs. (22.2N) maximum.
 - 2. Required fire doors: the minimum opening force allowable by the DSA Authority, not to exceed 15 lbs. (66.7N) maximum. 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.
 - 3. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 lbs. (22.2N) maximum to comply with CBC Section 11B-309.4.
- G. Door closing speeds shall be as follows: CBC Section 11B-404.2.8.
 - 1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum.
 - 2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
- H. Thresholds shall comply with CBC Section 11B-404.2.5.
- I. Floor stops shall not be located in the path of travel and 4 inches maximum from walls.
- J. Hardware (including exit devices) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met: (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).

- K. Pair of doors: Limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. CBC Section 11B-703.4.2.
- L. Doors shall be capable of locking from the inside of the room when there are 5 or more occupants, as per DSA Bulletin 11-05.

1.6 SUBMITTALS

- A. Submit schedule under provisions of Section 01 33 00.
- B. Submit schedule at earliest possible date along with essential product data where acceptance of hardware schedule must precede fabrication of other work.
- C. Organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following:
 - 1. Type, style, function, size and finish of each hardware item. Use BHMA finish codes as per ANSI A156.18.
 - 2. Name and manufacturer of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - 5. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
 - 6. Mounting locations for hardware.
 - 7. Door and frame sizes and materials.
- D. Provide product data on specified hardware.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- F. Furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.
- B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and to other Sections under provisions of Section 01 61 00.
- B. Store and protect products under provisions of Section 01 61 00.
- C. Package hardware items individually; label and identify package with door opening code to match hardware schedule.
- D. Deliver keys to Owner by security shipment direct from hardware supplier.

1.9 WARRANTY

- A. Provide five year warranty for closers, two year warranty for all other hardware under provisions of Section 01 77 00.

1.10 MAINTENANCE MATERIALS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitute</u>
A. Continuous Hinges	McKinney	Stanley Ives
B. Butt Hinges	McKinney	Stanley Ives
C. Locksets	Marks	Owners standard
D. Cylinders	Sargent	Owners standard
E. Exit Devices	Sargent	Owners standard
F. Surface Closers	Sargent	LCN 4040XP series
G. Vandal Pulls	Trimco	Rockwood Ives
H. Protection Plates	Trimco	Rockwood Ives
I. Stops and Holders	Trimco	Rockwood Ives
J. Overhead Stops	Glynn Johnson	Rixson ABH
K. Door Wrap Plates	Don-Jo	Or equal
L. Armor Collars	Keedex	Or equal
M. Gate Closers	Locinox	Or equal
N. Thresholds/Sweeps/Seals	Pemko	Reese NGP

2.2 MATERIALS

- A. Locksets: Cylindrical type. 16 gage curved steel, bronze or brass strikes with 2 inch deep box construction, with curved lips of sufficient length to clear trim and protect clothing.
1. Comply with requirements of local security ordinances.
 2. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
 3. Lock series and design: Marks 195 series American lever and Sargent 8200 series LNL lever.
- B. Butt Hinges: Outswinging exterior doors shall have non-removable (NRP) pin. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Furnish hinges with stainless steel pins and ball bearings.
1. Furnish 3 hinges per leaf to 7'-5" height. Add one for each additional 2 foot height.

2. Provide 5 inch heavy weight hinges on doors over 3'-4" width.
- C. Continuous Hinges: Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals and similar conditions, furnish wide throw hinges as approved by the Architect. Where door is indicated as having fire resistance rating, provide UL listed and labeled hardware.
- D. Panic Hardware: Furnish exit devices with sex bolts at wood doors. Lever handle trim shall match locksets. Device shall bear UL label for fire and or panic as may be required.
 1. Provide glass bead kits of proper thickness where the rail assembly of the exit device crosses a lite.
- E. Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide closers with sex bolts and grommets at wood doors. Place closers inside building, stairs, rooms, etc. Closers shall be non-handed, non-sized and adjustable. Closers shall be installed to permit door to swing 180 degrees.
 1. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
 2. Provide drop brackets, shoe supports, and blade stop spacers as required at narrow top rails.
- F. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges, height called for in schedule by width of door less 2 inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.
- G. Floor Stops: Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface.
- H. Seals: Solid neoprene to be MIL Spec. R6855-CL III, Grade 40. Sponge neoprene to be MIL Spec. R6130, Type II, Group C. UL label shall be applied on all rated doors.
- I. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occur, or for fire-resistive-rated door assemblies.
- J. Thresholds: Change in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater than 1 unit vertical to 2 units horizontal (50 percent slope). The floor or landing shall not be more than 1/2 inch lower than the threshold of the doorway.

2.3 KEYING

- A. Contact the District Locksmith with San Bernardino City Unified School District for keying requirements. Keying system shall be coordinated with the District and approved by District's representative in writing. Furnish construction key system in accordance with lock manufacturers' standard.
- B. Key system shall be Sargent 'A' series keyway.
- C. For protection of the District, cylinders shall be keyed at the factory of the cylinder manufacturer where permanent records are maintained. Permanently inscribe each key with number that identifies cylinder manufacturer key symbol, and notation "DO NOT DUPLICATE".
- D. Deliver permanent keys and cylinder cores directly to District by registered security shipment direct from hardware manufacturer. Hardware supplier shall not cut keys.

2.4 LOCK BOX

- A. Model No. 3200 lock box manufactured by the Knox Company, www.knoxbox.com.
- B. Surface or recess mounted as required.
- C. Polyester powder coated finish in black color.

- D. UL listed tamper switch.

2.5 FINISHES

- A. Generally to be BHMA 626 Satin Chromium.
- B. Areas using BHMA 626 shall have push, pulls and kick plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.
- C. Factory paint door closers to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished AL unless otherwise noted.

2.6 FASTENERS

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

2.7 OTHER MATERIAL

- A. All other materials not specifically described, but required for a complete and proper finish hardware installation shall be selected by Architect as required at no additional cost.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.
- B. Verify that power supply is available to power operated devices.
- C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Pre-Installation Meetings: Initiate and conduct with supplier, installer, and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware, and door closers in the meetings. Convene at least one week prior to commencement of related work.
- B. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- C. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in Division 9. Do not install surface-mounted items until finishes have been completed on the substrate.

- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor, providing a continuous weather seal. Anchor thresholds with stainless steel countersunk screws.
- G. If handle of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Mount lock box in accordance with manufacturers' instructions. Connect to building security system. Mount at 4'-0" from finished grade to center of box.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor, accompanied by the Finish Hardware Installer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

- A. Lockset: 34 to 44 inches above finished floor. Verify manufacturers' template with door design.
- B. Panic Device: 36 to 44 inches above finished floor. Verify manufacturers' template with door design.
- C. Door Pull: 40 inches from bottom of door to center of pull.
- D. Floor Stop: 4 inches maximum distance from any adjacent wall surface.
- E. Conform to CBC, CCR, Title 24, Part 2, and ADA regarding positioning requirements for accessibility.

3.5 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

3.6 SCHEDULE

- A. Legend of listed manufacturers. The last column in the Schedule of Door Hardware refers to the manufacturer listed in the following schedule:

DJO	Don-Jo
GLY	Glynn Johnson
KEE	Keedex
LOC	Locinox
MCK	McKinney
MRK	Marks
PEM	Pemko
SAR	Sargent
TRM	Trimco

- B. The items listed in the following schedule shall conform to the requirements of the foregoing specification.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.
- D. Schedule of Door Hardware:

HW-1

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	SURFACE CLOSER	351-P10 x 125-V	689	SAR
1	FLOOR STOP	1209	626	TRM
1 SET	DOOR SEALS	BY FRAME MFR	-----	-----
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-2

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	EXIT DEVICE	5BL-5CH-49-12-8816 x ETL	630	SAR
1	MORTISE CYLINDER	44	626	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	SURFACE CLOSER	351-CPS	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-3

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	LOCKSET	195S-F8-SL9-S1	626	MRK
1	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-H	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-4

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	LOCKSET	195S-F8-SL9-S1	626	MRK
1	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-PH10	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-5

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	LOCKSET	195S-F8-SL9-S1	626	MRK
1	LEVER CYLINDER	13-3266	626	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-6

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	LOCKSET	195DB-F8-SL9-S1	626	MRK
2	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-CPSH	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-7

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	PRIVACY	195L-S1	626	MRK
1	SURFACE CLOSER	351-O	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-8

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	LOCKSET	50-LB-8250 x LNL x WBS	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	SURFACE CLOSER	351-O	689	SAR
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
1	COAT HOOK	3071	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR BOTTOM	222PK	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-9

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	PRIVACY	195L-S1	626	MRK
1	SURFACE CLOSER	351-O	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900S	630	GLY
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-10

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	SURFACE CLOSER	351-P10	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1209	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-11

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	LOCKSET	195DB-F8-SL9-S1	626	MRK
2	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-H	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-12

Each single door to have

3	HINGE	T4A3786 - 4.5 x 4.5	652	MCK
1	LOCKSET	195DB-F8-SL9-S1	626	MRK
2	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-CPSH	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-13

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	LOCKSET	50-LB-8225 x LNL x WBS	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	351-P10	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1209	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-14

Each opening to have

1	PADLOCK	758-2-HS	626	SAR
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Note: Balance of material provided by Overhead Roll-Up Door Manufacturer

HW-15

Each single door to have

3	HINGE	T4A3786 - 5.0 x 4.5	652	MCK
1	LOCKSET	195DB-F8-SL9-S1	626	MRK
2	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-CPSH	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-16

Each single door to have

3	HINGE	TA2714 - 4.5 x 4.5	652	MCK
1	LOCKSET	195S-F8-SL9-S1	626	MRK
1	LEVER CYLINDER	13-3266	626	SAR
1	SURFACE CLOSER	351-H	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-17

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	SURFACE CLOSER	351-PH10	689	SAR
1	ARMOR PLATE	KA050-2 - 34 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1209	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-18

All material provided by Freezer/Cooler Door Manufacturer

HW-19

Each pair door to have

2	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	REMOVABLE MULLION	L980S	689	SAR
1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	EXIT DEVICE	5BL-5CH-8810 x L/TRIM	630	SAR
1	MORTISE CYLINDER	42	626	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	ANTI VANDAL PULL	1097HA-SP-NC	630	TRM
2	SURFACE CLOSER	351-P10	689	SAR
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
2	FLOOR STOP	1209	626	TRM
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-20

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	EXIT DEVICE	3828-04 x L/TRIM	689	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	900F	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before overhead stop and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-21

Each single door to have

3	HINGE	T4A3786 - 4.5 x 4.5	652	MCK
1	EXIT DEVICE	5BL-5CH-49-LD-8816 x ETL	630	SAR
1	MORTISE CYLINDER	44	626	SAR
1	RIM CYLINDER	34	626	SAR
1	SURFACE CLOSER	351-CPSH	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-22

Each single door to have

1	CONTINUOUS HINGE	MCK-25HD	628	MCK
1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	DOOR WRAP PLATE	90-CW	630	DJO
1	SURFACE CLOSER	351-CPSH	689	SAR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	REUSE EXISTING	-----	-----

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to compensate for strike jamb seal

Note: Field verify existing door and frame preps and rework as required for new hardware

HW-SG1

Each single gate to have

1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	GATE BOX	K-BX4152	600	KEE
1	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC

Note: Balance of material provided by Tube Steel Gate Manufacturer

HW-SG2

Each pair gate to have

6	GATE HINGE	PER GATE DETAIL	-----	-----
1	PADLOCK	758-2-HS-C	626	SAR

Note: Balance of material provided by Tube Steel Gate Manufacturer

HW-SG3

Each opening to have

1	PADLOCK	758-2-HS-C	626	SAR
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Note: Balance of material provided by Rolling Gate Manufacturer

HW-SG4

Each single gate to have

1	EXIT DEVICE	5BL-5CH-8804 x L/TRIM	630	SAR
1	RIM CYLINDER	34	626	SAR
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	GATE BOX	K-BX4152	600	KEE
1	GATE HINGE/CLOSER	MAMMOTH-180 x CLB	ALU	LOC
Note: Balance of material provided by Chain Link Gate Manufacturer				

END OF SECTION

SECTION 08 80 00

GLAZING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass and glazing for hollow metal work, windows, storefronts, and doors.

1.2 REFERENCES

- A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- B. ASTM C920 - Elastomeric Joint Sealants.
- C. ASTM C1036 - Flat Glass.
- D. ASTM C1048 - Heat-Treated Flat Glass.
- E. ASTM C1172 - Specification for Laminated Architectural Flat Glass.
- F. ASTM C1651 - Measurement of Roll Wave Optical Distortion in Heat-Treated Flat Glass.
- G. ASTM E774 - Sealed Insulating Glass Units.
- H. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- I. CPSC - Consumer Product Safety Council.
- J. GANA - Glazing Manual.
- K. UL - Underwriters' Laboratories, Inc., Building Materials Directory.

1.3 QUALITY ASSURANCE

- A. Conform to The Glass Association of North America (GANA) Glazing Manual and Sealant Manual for glazing installation methods.

1.4 REGULATORY REQUIREMENTS

- A. Conform to all glass labeling requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2403.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Provide data on glazing sealant. Identify colors available.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples, 12 x 12 inches in size, illustrating each glass coloration.
- F. Submit 12 inch long bead of glazing sealant in color selected.
- G. Submit sealed glass unit manufacturer's certificate under provisions of Section 01 33 00 indicating units meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store and protect products under provisions of Section 01 61 00.

1.7 WARRANTY

- A. Provide five year manufacturer's warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of sealed insulating glass units from seal failure, interpane dusting or misting, and replacement of same.
- C. Warranty: Include coverage for reflective coating on mirrors and replacement of same.
- D. Warranty: Include coverage for delamination of laminated glass and replacement of same.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE GLASS MANUFACTURERS

C. Laminated Glass:

1. AGC Industries, Inc., www.agc.com.
2. Guardian Industries Corp., www.guardianglass.com.
3. Interpane, www.interpane.com.
4. Oldcastle Glass Co., www.obe.com.
5. Pilkington Glass HA, www.pilkington.com.
6. Vitro Architectural Glass, www.vitroglazings.com.
7. Zeledyne Versalux Architectural Glass, www.hartung-glass.com.
8. Viracon, Inc., www.viracon.com.

A. Fire-Resistive Glazing:

1. AGC Interedge Technologies, UL No. R19261, www.firesafe-glass.com.
2. Nippon Electric Glass, Co., UL No. R13849, www.fireglass.com.
3. Pilkington Glass NA, UL No. R16644, www.pilkington.com.
4. Saint-Gobain, UL No. R14515, www.vetrotech.com.
5. Technical Glass Products, UL No. R13377, www.fireglass.com.
6. SAFTI, UL No. R14212, www.safti.com.

D. Sealed Insulating Glass:

1. AGC Industries, Inc., www.agc.com.
2. Guardian Industries Corp., www.guardianglass.com.
3. Interpane, www.interpane.com.
4. Oldcastle Glass Co., www.obe.com.
5. Pilkington Glass NA, www.pilkington.com.
6. Vitro Architectural Glass, www.vitroglazings.com.
7. Zeledyne Versalux Architectural Glass, www.hartung-glass.com.
8. Viracon, Inc., www.viracon.com.

B. Fire-Resistive Safety Glazing:

1. AGC Interedge Technologies, UL No. R19261, www.firesafe-glass.com.
2. Nippon Electric Glass, Co., UL No. R13849, www.fireglass.com.
3. Pilkington Glass NA, UL No. R16644, www.pilkington.com.
4. Saint-Gobain, UL No. R14515, www.vetrotech.com.
5. Technical Glass Products, UL No. R13377, www.fireglass.com.
6. SAFTI, UL No. R14212, www.safti.com.

- E. Substitutions: Under provisions of Section 01 25 13.

2.2 GLASS MATERIALS, GENERAL

- A. Primary Glass Standard: Comply with ASTM C1036 requirements, including reference to type, class, quality, and, if applicable, form, finish, and pattern.

- B. Tempered Glass Standard: Comply with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Laminated Glass Standard: Comply with ASTM C1172 requirements including reference to type, class, quality, and if applicable, form, finish and pattern.
- D. Sizes: Fabricate glass to sizes required for glazing openings, with edge clearances and tolerances complying with recommendations of glass manufacturer and GANA.
- E. Provide thicknesses indicated or, if not indicated, as recommended by glass manufacturer for application indicated.
- F. Roller wave distortion shall not exceed 0.003 inch as measured peak to valley at the center of the glass, and 0.008 inch at the leading and trailing edge of the lite of glass as measured by ASTM C1651.

2.3 PRIMARY GLASS PRODUCTS

- A. Mirror Glass: ASTM C1036, Type I Transparent Glass, Flat; Class 1, Clear; q1 mirror select; 1/4 inch thick with pressure-sensitive adhesive coated scrim-impregnated film tape safety backing.

2.4 LAMINATED GLASS PRODUCTS

- A. Laminated Safety Glass: Two plies of float glass of equal thickness, ASTM C1172, kind LHS (heat-strengthened), laminated with 0.060 inch thick plastic interlayer; conforming to ANSI Z97.1, and CPSC 16 CFR 1201, Category II. Unit to have the following characteristics:
 - 1. Glass: Class 1 - clear for inner ply only. Class 2, gray tint outer ply only.
 - 2. Glass Thickness (each pane): 1/8 inch.
 - 3. Color of Plastic Interlayer: Clear
- B. Plastic Interlayer:
 - 1. Saflex (Solutia); Monsanto Co., www.saflex.com.
 - 2. Butacite; E.I. DuPont DeNemours & Co., Inc., www.dupont.com.
 - 3. Eastman Chemical Company, Vantage, www.vantage.com.
 - 4. Kuraray America, Inc., www.trosifol.com.

2.5 SEALED INSULATING GLASS UNITS

- A. Comply with ASTM E774, Class A.
- B. Thickness of Exterior Pane: 1/4 inch.
- C. Thickness of Interior Pane: 1/4 inch.
- D. Air Space Thickness: 1/2 inch.
- E. Exterior Pane: Laminated safety glass.
- F. Interior Pane: Tinted float glass, Laminated safety glass.
- G. Coating: Low E coating on No. 2 surface. Low E coating to be similar to Vitro Solarban 60.
- H. Spacer Material: Stainless steel warm edge spacer.
- I. Dessicant: Molecular sieve or silica gel or blend of both.

2.6 SILICONE COATED SPANDREL GLASS

- A. ASTM C1048, Type I, Condition C, Quality - Q3.
- B. Type: Heat-strengthened.
- C. Condition: C, opacifier coated.
- D. Opacity: To match adjacent non-spandrel glazing.
- E. Minimum Thickness: 1/4 inch.
- F. Coating Color: As selected by Architect.

2.7 POLYCARBONATE MIRROR

- A. General: Comply with ANSI Z97.1.
- B. Material: Clear plastic compound in sheet size required to minimize vertical joints, 1/4 inch thick.
- C. Mirror Coating: Vacuum applied metalized premium aluminum mirror grade coating applied to back surface.
- D. Protective Coating: Silicone abrasion and chemical resistant coating applied to face of unit. Prime paint protective coating applied to back of mirrored surface.

2.8 GLAZING SEALANTS AND PREFORMED GLAZING TABS

- A. General: Comply with ASTM C920, and sealant and glass manufacturers recommendations for suitability and compatibility.
- B. One-Part Butyl Glazing Sealant:
 - 1. Chem-Calk 300; Bostik Construction Products Div., www.bostik-findley-us.com.
 - 2. BC 158; Pecora Corp., www.pecora.com.
- C. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25:
 - 1. Dowsil 999; Dow Consumer Solutions, www.consumer.dow.com.
 - 2. SCS 1200; General Electric Corp., www.gesealants.com.
 - 3. 863; Pecora Corp., www.pecora.com.
 - 4. Omniglaze; Sonneborn Building Products Div.; ChemRex Products, Inc., www.chemrex.com.
 - 5. Proglaze; Tremco, www.tremcosealants.com.
- D. Preformed Butyl-Polyisobutylene Glazing Tape:
 - 1. 3M Glazing Tape, 3M Corporation, www.3m.com.
 - 2. Norseal V990 Tape: Saint-Gobain North America, www.foams.saint-gobain.com.
 - 3. Tremco Polyshim II Tape; Tremco, Inc., www.tremcosealants.com.
 - 4. Sika Glazing Tape, Sika Corporation, www.usa.sika.com.

2.9 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene; EPDM or silicone blocks, 80-90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene; EPDM or silicone blocks, Shore A durometer hardness; self adhesive one face.
- C. Glazing Gasket: Resilient polyvinylchloride extruded shape to suit glazing channel retaining slot with prefabricated molded corners. Black color.
- D. Glazing Clips: Manufacturer's standard type.

2.10 FIRE RESISTIVE GLAZING

- A. Fire Resistant Glazing: Clear flat ceramic glazing sheet of 3/16 or 1/4 inch nominal thickness weighing 2.5 to 3 psf, permanently labeled with appropriate testing and inspection marks, standard polish with visible light transmission of 76.9 to 89 percent; listed by UL.
- B. Fire-Resistant Safety Glazing: 1/4 inch thick tempered or 3/8 inch thick laminated glazing unit. Unit to comply with ANSI Z97.1, CPSC 16 CFR 1201, Category II, and be listed by UL. Laminated unit to have the following characteristics:
 - 1. First Ply: Single pane of clear, flat, fire-resistant ceramic glazing, 3/16 inch thick, standard polish.
 - 2. Interlayer: Clear calcium silicate interlayer.
 - 3. Second Ply: Single pane of clear, flat, fire-resistant ceramic glazing, 3/16 inch thick, standard polish.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.
- B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses.
- C. Prime surfaces scheduled to receive sealant.

3.3 EXTERIOR DRY METHOD (PREFORMED GLAZING)

- A. Cut glazing tape to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.
- B. Place setting blocks at 1/4 inch points with edge block no more than 6 inches from corners.
- C. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.
- D. Install removable stops without displacement of glazing gasket. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.
- F. Use for all aluminum windows and aluminum framed storefronts.

3.4 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sightline. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bed of butyl sealant along intersection of removable stop with frame ensuring full seal between glass and frame.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glass on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane.
- E. Install removable stops with spacer strips inserted between glass, and applied stops at 24 inch intervals, 1/4 inch below sightline.
- F. Fill gap between pane and removable stop with silicone sealant to depth equal to bite of frame on pane, but not more than 3/8 inch below sightline.
- G. Apply cap bead of silicone sealant along exterior void, to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.
- H. Use for all exterior steel frames.

3.5 INTERIOR - DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.
- G. Use for all interior steel frames.

3.6 CLEANING

- A. After installation, mark pane with an "X" by using plastic tape or removable paste.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after Work is completed.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Gypsum board.
- B. Glass mat gypsum sheathing.
- C. Shaft wall coreboard.
- D. Gypsum soffit board.
- E. Abuse/Impact resistant gypsum board.
- F. Acoustically enhanced gypsum board.
- G. Taped and sanded joint treatment.
- H. Surface primer.
- I. Texture finish.
- J. Resilient furring channels.
- K. Metal channel ceiling framing.

1.2 REFERENCES

- A. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- B. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.
- C. ASTM C79 - Standard Specification for Treated Core and Nontreated Core Gypsum Sheathing Board.
- D. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- E. ASTM C514 - Nails for the Application of Gypsum Wallboard.
- F. ASTM C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- G. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- H. ASTM C840 - Application and Finishing of Gypsum Board.
- I. ASTM C919 - Use of Sealants in Acoustical Applications.
- J. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.
- K. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- L. ASTM C1396 - Standard Specification for Gypsum Board.
- M. ASTM C1629 - Standard Specification for the Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- N. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.

- O. ASTM D1037 - Test Methods for Evaluating Properties of Wood-Based Fiber and Particle Panel Materials.
 - P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - Q. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfiguration of Paint Films in Fungal or Algal Growth, or Soil and Dirt Accumulation.
 - R. ASTM D4977 - Standard Test Method for Granular Adhesion to Mineral Surfaced Roofing by abrasion (modified).
 - S. ASTM D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
 - T. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - U. ASTM E695 - Standard Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.
 - V. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
 - W. GA 201 - Using Gypsum Board for Walls and Ceilings.
 - X. GA 214 - Levels of Gypsum Board Finish.
 - Y. GA 216 - Application and Finishing of Gypsum Board.
 - Z. GA 253 - Application of Gypsum Sheathing.
 - AA. GA 600 - Fire Resistance Design Manual.
 - BB. ISO 14040 - Environmental Management - Life cycle assessment - Principals and Framework.
 - CC. UL - Underwriters Laboratories.
- 1.3 QUALITY ASSURANCE
- A. Applicator: Company specializing in gypsum board systems work with five years documented experience.
- 1.4 REGULATORY REQUIREMENTS
- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 7, and UL and GA requirements for fire rated assemblies as indicated on the drawings
 - B. Conform to UL No. 2079 for cyclical design at head of fire rated walls.
- 1.5 ACOUSTICAL PERFORMANCE
- A. Acoustical Attenuation for Identified Interior Partitions: 55 STC in accordance with ASTM E90.
- 1.6 ENVIRONMENTAL REQUIREMENTS
- A. Maintain uniform temperature of minimum 60 degrees F and humidity of 30 to 50 percent prior to, during, and after installation of the Work of this Section.
- 1.7 DEFINITIONS
- A. Refer to ASTM C11 for definitions of terms related to gypsum board assemblies.

1.8 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 33 00.
- B. On wall and ceiling surface duplicate specified texture finish on at least 100 sq.ft. of surface area.
- C. Provide complete finish including surface primer.
- D. Simulate finished lighting conditions for review of field sample.
- E. After surface texture is accepted, the accepted surface will remain as part of the Work and will be used to evaluate subsequent applications of finish texture.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GYPSUM BOARD SYSTEM

- A. American Gypsum Corp., www.americangypsum.com.
- B. Certainteed, www.certainteed.com.
- C. Georgia Pacific Corp., www.gp.com.
- D. National Gypsum Co., www.nationalgypsum.com.
- E. PABCO Gypsum, www.pabco gypsum.com.
- F. United States Gypsum Co., www.usg.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 FRAMING MATERIALS

- A. Metal Furring: ASTM C645, hat-shaped, 7/8 inch deep, 0.0329 inch thick.
- B. Resilient Furring Channel: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C645 for material, finish and widths of face and fastening flange; 1/2 inch deep x 0.0179 inch thick asymmetric-shaped channel with face connected to single flange by slotted leg (web).
- C. Furring Channel: ASTM C754, 1-1/2 inch x 0.475 lb./ft. channel.
- D. Fasteners: ASTM C514 and C1002.
- E. Hanger Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 9 gauge.
- F. Tie Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 16 and 18 gauge.
- G. Adhesive: ASTM C557.

2.3 GYPSUM BOARD MATERIALS

- A. Standard Gypsum Board: ASTM C1396; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges. Similar to Sheetrock Brand EcoSmart Panels manufactured by United States Gypsum Company.
- B. Fire Rated Gypsum Board: ASTM C1396; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges. Similar to Sheetrock Brand EcoSmart Panels manufactured by United States Gypsum Company

- C. Mold and Mildew Resistant Gypsum Board: ASTM C1396; 5/8 inches thick unless otherwise indicated, maximum length; ends square cut, tapered and beveled edges. Mold and mildew resistant core and paper facing, meeting ASTM D3273, with a score of 10 as rated according to ASTM D3274. Similar to Sheetrock Brand EcoSmart Mold Tough Panels manufactured by United States Gypsum Company.
- D. Fire Rated Mold and Mildew Resistant Gypsum Board: ASTM C1396; fire resistive type, UL rated 5/8 inches thick unless otherwise indicated, maximum length; ends square cut, tapered and beveled edges. Mold and mildew resistant core and paper facing, meeting ASTM D3273, with a score of 10 as rated according to ASTM D3274. Similar to Sheetrock Brand EcoSmart Mold Tough Firecode X Panels manufactured by United States Gypsum Company.
- E. Moisture Resistant Gypsum Board: ASTM C1396 with a score of 10 as rated according to ASTM D3274; 5/8 inch thick unless otherwise indicated, water resistant core; water resistant paper on front, back, and long edges; maximum permissible length; ends square cut, tapered and beveled edges.
- F. Acoustically Enhanced Gypsum Board: ASTM C1396, 5/8 inch thick multilayer product constructed of two layers of gypsum board sandwiching a viscoelastic sound-absorbing polymer core; maximum permissible length; ends square cut, tapered and beveled edges, similar to Sound Break as manufactured by National Gypsum Company.
- G. Exterior Gypsum Soffit Board: ASTM C1396; fire resistive type, UL rated; 5/8 inch thick unless otherwise noted, maximum permissible lengths; enhanced sag resistant core; water resistant paper on front, back and long edges; beveled tongue and groove edges.
- H. Glass-Mat Gypsum Sheathing Board: ASTM C1177; 1/2 inch thick, similar to Dens-Glass Gold manufactured by Georgia Pacific Corp.
- I. Abuse/Impact Resistant Gypsum Board: ASTM C1629 ; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered and beveled edges; with additives and fiberglass mat facings to enhance indentation resistance, abrasion, and impact resistance. Similar to Sheetrock Brand VHI Panels manufactured by United States Gypsum Company meeting the following characteristics:
 - 1. Surface Abrasion: ASTM C1629 / D 4977, Level 2.
 - 2. Indentation Resistance: ASTM C1629 / D5420, Level 1.
 - 3. Soft-Body Impact: ASTM C1629 / E695, Level 3.
 - 4. Hard-Body Impact: ASTM C1629, Level 3.
 - 5. Mold / Mildew Resistance: ASTM D3273, with a score of 10.
- J. Fire Rated Abuse/Impact Resistant Gypsum Board: ASTM C1629; fire resistive type, UL rated; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered and beveled edges; with additives and fiberglass mat facings to enhance indentation resistance, abrasion, and impact resistance. Similar to Sheetrock Brand VHI Firecode X Panels manufactured by United States Gypsum Company meeting the following characteristics:
 - 1. Surface Abrasion: ASTM C1629 / D 4977, Level 2.
 - 2. Indentation Resistance: ASTM C1629 / D5420, Level 1.
 - 3. Soft-Body Impact: ASTM C1629 / E695, Level 3.
 - 4. Hard-Body Impact: ASTM C1629, Level 3.
 - 5. Mold / Mildew Resistance: ASTM D3273, with a score of 10.

2.4 ACCESSORIES

- A. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board: As specified in Section 07 92 00.
- B. Corner Beads: Metal, hot dip galvanized.
- C. Edge Trim: GA 201 and GA 216; Type LC bead, unless otherwise indicated.
- D. Control Joints: Roll-formed zinc, Type USG No. 093.
- E. Curved-Edge Cornerbead: Vinyl type with notched or flexible flanges.
- F. Spot Grout: ASTM C475, setting-type joint compound.
- G. Joint Materials Interior: ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners. Use tapes and compound recommended by gypsum board manufacturer for the use intended. Use ready mixed, drying type compounds. Use taping compound for embedding tape and first coat over fasteners and flanges of corner beads and trim. Use topping compound for fill and finish coats.
- H. Joint Materials, Exterior:
 - 1. Gypsum Soffit Board: Setting-type taping and setting-type, sandable topping compound.
 - 2. Glass-Mat Gypsum Sheathing: 2 inch wide 10 x 10 self-adhering fiberglass joint tape recommended by manufacturer.
- I. Primer: Flat latex basecoat paint equivalent to First Coat manufactured by United States Gypsum Company.
- J. Primer-Surfacer: Vinyl acrylic latex-based primer and surfacer equivalent to Tuff-Hide manufactured by United States Gypsum Company.
- K. Spray Texture Finish: Equivalent to USG Spray Texture Finish, orange peel texture, manufactured by United States Gypsum Company.
- L. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that site conditions are ready to receive Work.
- B. Beginning of installation means acceptance of substrate.

3.2 WALL FURRING INSTALLATION

- A. Erect wall furring for direct attachment to masonry and concrete walls.
- B. Erect metal furring vertically at 16 inches o.c. Secure in place on alternate channel flanges at maximum 24 inches o.c.

3.3 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Space resilient furring channels horizontally at maximum 16 inches o.c., not more than 2 inches from floor and ceiling lines.
- B. Locate nested joints over framing members.
- C. Install acoustical sealant within partitions in accordance with manufacturer's instructions and ASTM C919.

- D. Seal perimeter, joints, openings and penetrations on each face of partition.

3.4 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C754 and CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 25.
- B. Coordinate locations of hangers with other Work.
- C. Install ceiling framing independent of walls and columns.
- D. Space 9 gauge hanger wires 3'-0" o.c. along 1-1/2 inch furring channels and within 6 inches of end of furring channel.
- E. Install 1-1/2 inch furring channels at 4'-0" o.c. and within 6 inches of parallel walls. Provide 1 inch clearance between end of channels and abutting walls.
- F. Position furring channels for proper ceiling height, level, and secure with hanger wire saddle-tied along channel.
- G. At channel splices, interlock flanges, overlap ends 12 inches and secure each end with double-strand of 16 gauge tie wire.
- H. Erect metal furring at right angles to 1-1/2 inch furring channels. Space metal furring 16 inches o.c.
- I. Install metal furring within 6 inches of parallel walls. Provide 1 inch clearance between end of furring and abutting wall.
- J. Secure metal furring to furring channel with clips or saddle tie with double strand of 18 gauge tie wire.
- K. At splices of metal furring nest furring at least 8 inches and securely wire-tie each end with double strand of 16 gauge tie-wire.
- L. Reinforce openings in ceiling suspension system which interrupt main furring channels or metal furring with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.

3.5 MEMBRANE INSTALLATION

- A. Install membrane over wall studding where moisture resistant gypsum board is to be installed.

3.6 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with ASTM C840 and manufacturer's instructions.
- B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing except those ends and edges which are perpendicular to framing.
- C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing except those ends and edges which are perpendicular to framing members. Comply with required UL, CBC, or GA fire rated assembly.
- D. Erect double layer gypsum board with standard gypsum board for first layer placed in most economical direction with second layer placed parallel to face layer with adhesive and supplementary fasteners. Off-set joints of second layer from joints of first layer by at least 12 inches.
- E. Erect double layer fire rated gypsum board in accordance with required UL, CBC, or GA fire rated assembly.
- F. Use screws when fastening gypsum board to metal furring.
- G. Use screws when fastening gypsum board to wood furring or framing except where nails are required for UL or UBC fire rated assembly.

- H. Install fire stop sealant and fiber stuffing at wall penetrations and terminations in accordance with required UL, CBC, or GA fire rated assembly in accordance with Section 07 84 00.
- I. Install acoustical sealant at wall penetrations and terminations as specified in this section and in accordance with Section 07 92 00.
- J. Isolate perimeter of gypsum board applied to non-load bearing partitions at structural abutments. Provide ½ inch wide space and trim with metal edge. Seal joint between metal edge and structural surface with acoustical sealant.
- K. Where partitions intersect structural members projecting below underside of floor / roof slabs and decks, cut gypsum panels to fit profile formed by structural member. Allow ½ inch wide space and install acoustical sealant.
- L. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- M. Install gypsum board with mold and mildew-resistant core and paper facing at exterior locations on the interior face of all exterior walls.
- N. Place control joints as indicated on the drawings and not to exceed 30 feet maximum in either direction for partitions and ceilings. Provide adequate seal or safig insulation behind control joints to maintain sound or fire ratings.
- O. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- P. Spot grout metal door frames. Apply spot grout at each jamb anchor clip just before inserting board into frame.

3.7 CURVED PARTITIONS

- A. Install panels horizontally and unbroken across curved surface.
- B. Wet gypsum panels on surface that will become compressed.
- C. On convex side of partition, begin installation at one end of curved surface and fasten panels to studs as they are wrapped around curve.

3.8 EXTERIOR SOFFIT AND CEILING INSTALLATION

- A. Apply gypsum soffit board panels perpendicular to supports with end joints staggered and located over supports.
- B. Install panels with 1/4 inch open space where panels abut other construction or penetrations.
- C. Fasten with corrosion-resistant screws.

3.9 GLASS MAT GYPSUM SHEATHING INSTALLATION

- A. Install glass mat gypsum sheathing in accordance with manufacturer's instructions and in accordance with GA-253.
- B. Install glass mat gypsum sheathing with gold side out.
- C. Install glass mat gypsum parapet sheathing with blue low-perm side out.
- D. Install glass mat gypsum sheathing with long dimension parallel to framing members.
- E. Fasten with corrosion-resistant screws.

- F. Install fire rated glass mat gypsum sheathing in accordance with listed assembly indicated from UL, CBC or GA.

3.10 JOINT TREATMENT

- A. Tape, fill, and sand joints, edges, and corners in accordance with GA-214.
- B. Feather successive coats a minimum of 2 inches onto adjoining surfaces for each coat.
- C. Where fire resistance rating is required, detail of joint treatment shall meet fire rating requirement.
- D. Level 1 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound.
 - 2. Surface shall be free of excess joint compound.
 - 3. Tool marks and ridges are acceptable.
 - 4. Use for plenum areas above ceiling, in areas that are generally concealed and other areas not normally open to view.
- E. Level 2 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound and one separate coat of joint compound shall be applied over all fastener heads and accessories.
 - 2. Surface shall be free of excess joint compound.
 - 3. Tool marks and ridges are acceptable.
 - 4. Use where surface is substrate to ceramic tile, acoustic tile, or tackable wallboard system.
- F. Level 5 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, fasteners, and accessories.
 - 2. Apply two thin skim coats of topping compound over entire surface.
 - 3. All compound shall be smooth and free of tool marks and ridges.
 - 4. Sand lightly between coats.
 - 5. Use for all surfaces that are scheduled to receive a painted finish.
- G. Glass-Mat Gypsum Sheathing Board: Apply self-adhering fiberglass joint tape over joints and embed in bead of acrylic latex sealant applied into board joint.
- H. Gypsum Board Soffit Board: Apply joint tape over joints and embed in setting type joint compound. Skim joint surface with setting type joint compound for smooth finish.

3.11 FINISHING

- A. Roller apply surface primer to all gypsum board surfaces scheduled to receive a painted and textured finish prior to application of paint or texture finish.
- B. Spray apply textured finish to all surfaces scheduled to receive a paint finish except surfaces of food service and preparation areas.
- C. Remove any overspray of texture finish from door frames, windows, and other adjoining construction.

3.12 TOLERANCES

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

3.13 PROTECTION

- A. Protect adjacent surfaces from joint compound. Promptly remove from floors and other surfaces. Repair stained and marred surfaces damaged during gypsum board application.
- B. Protect work of this section from weather, condensation, direct sunlight, and other detrimental causes during the construction period.
- C. Remove and replace gypsum panels that become wet, moisture damaged and mold damaged.

3.14 FASTENERS

- A. Fasteners for use with tile backer
 - 1. Fasteners for 1/2 inch thick panels:
 - a. Wood Framing: 1-1/2" minimum corrosion resistant course thread bugle head at 12" on center typical on each stud typical. Provide min. 1" embedment into stud or joist, typical.
 - b. Metal Framing: 1" minimum corrosion resistant sharp point or drill point bugle head screw at 12" on center typical on each stud typical.
 - 2. Fasteners for 5/8 inch thick panels:
 - a. Wood Framing: 1-5/8" L. inch minimum corrosion resistant course thread bugle head at 12" on center typical on each stud typical. Provide min. 1" embedment into stud or joist, typical.
 - b. Metal Framing: 1" L. minimum corrosion resistant sharp point or drill point bugle head screw at 12" on center typical on each stud typical.
 - 3. Fasteners for use with cement board:
 - a. (No 8) 1-1/4" L. - Wafer head, corrosion-resistant at 12" oc. and each stud typical

END OF SECTION

SECTION 09 24 00

CEMENT PLASTERING

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Metal lathing.
- B. Portland cement plaster system.
- C. Machine applied surface finish with integral color coat.

1.2 REFERENCES

- A. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- B. ASTM C150 - Portland Cement.
- C. ASTM C206 - Finishing Hydrated Lime.
- D. ASTM C847 - Standard Specifications for Metal Lath.
- E. ASTM C897 - Aggregate for Job-Mixed Portland Cement-Based Plasters.
- F. ASTM C926 - Application of Portland Cement-Based Plaster.
- G. ASTM C932 - Surface-Applied Bonding Agents for Exterior Plaster.
- H. ASTM C933 - Welded Wire Lath.
- I. ASTM C954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inches to 0.112 inches in thickness.
- J. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
- K. ASTM C1063 - Installation of Lathing and Furring for Portland Cement Based Plaster.
- L. NAAMM Standard ML/SFA 920 - Guide Specifications for Metal Lathing and Furring.
- M. Lathing and Plaster Systems Manual - Third Edition.
- N. Military Specification MIL-B-19235 - Bonding Agents.
- O. PCA (Portland Cement Association) - Portland Cement Plaster (Stucco) Manual.
- P. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- Q. IAPMO - International Association of Plumbing and Mechanical Officials, Uniform Evaluation Service (UES) Reports.
- R. ICC - International Code Council.
- S. TSIB - Technical Services Information Bureau.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in cement plaster work with five years documented experience.

- B. At the completion of lathing and prior to the application of scratch coat of plaster, contact the Technical Services Information Bureau, www.tsib.org, and arrange for inspection of lathing and accessories installation. Provide Architect a written report of the results of the inspection.
- C. Installation of underlayment and penetration flashing shall be in accordance with manufacturer's installation guidelines and recommendations. Provide site reports from manufacturer's field service representative, indicating observation of underlayment and flashing installation.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 25 for materials and their installation.
- B. Obtain approval of enforcement agency for installation of self furring metal lath.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on plaster materials, characteristics and limitations of products specified.
- C. Submit samples of integral color and texture for plaster finish.
- D. Provide underlayment manufacturer's written installation instructions.

1.6 FIELD SAMPLES

- A. Provide sample panel under provisions of Section 01 33 00.
- B. Construct field sample panel, minimum 96 inches long by 96 inches wide, illustrating lath installation, base coat installation, surface texture, and color of finish coat.
- C. Locate where directed.
- D. Accepted sample may remain as part of the Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work of this Section under the provisions of Section 01 31 00.
- B. Require the attendance of parties directly affecting the Work of this Section.
- C. Review requirements for installation of all materials specified in this Section for sequencing, proper installation, integration and protection.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply plaster when substrate or ambient air temperature is less than 40 degrees F or more than 90 degrees F.
- B. Maintain minimum ambient temperature of 40 degrees F during and after installation of plaster.
- C. Protect portland cement plaster from uneven and excessive evaporation during dry weather and from strong blasts of dry air.

1.9 WARRANTY

- A. Provide ten year warranty for underlayment and flashings under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lathing Materials:

1. Amico-West, www.amico-lath.com.
2. ClarkDietrich Building Systems, www.clarkdietrich.com.
3. CEMCO, www.cemcosteel.com.
4. Structa Wire Corp., www.structawire.com.

B. Accessories:

1. ClarkDietrich Building Systems, www.clarkdietrich.com.
2. Flannery, Inc., www.flannerytrim.com.
3. Fry Reglet Corp., www.fryreglet.com.
4. Metalex Corp., www.metlx.com.
5. CEMCO, www.cemcosteel.com.
6. Amico-West, www.amico-lath.com.
7. Stockton Wire Products, www.stocktonproducts.com.
8. Structa Wire Corp., www.structawire.com.

C. Integral Color Portland Cement Finish:

1. La Habra Products, Inc., www.lahabrastucco.com.
2. Merlex Stucco, Inc., www.merlex.com.
3. Omega Products Corp., www.omega-products.com.

D. Underlayment:

1. Underlayment: Tyvek as manufactured by E.I. DuPont de Nemours, www.tyvek.com
 - (a) First layer: Commercial Wrap D.
 - (b) Second layer: Commercial Wrap.

E. Substitutions: Under provisions of Section 01 25 13.

2.2 PLASTER BASE COAT MATERIALS

- A. Cement: ASTM C150, Normal - Type I, Portland.
- B. Lime: ASTM C206, Type S.
- C. Aggregate: In accordance with ASTM C897 and PCA Plaster (Stucco) Manual.
- D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

- E. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete and concrete masonry surfaces. Larsen Products Corp. - Weld-Crete, www.larsenproducts.com.
- F. Plaster Mix Reinforcement: Glass fibers, 1/2 inch nominal length, alkali resistant.
- G. Substitutions: Under provisions of Section 01 25 13.

2.3 PLASTER FINISH COAT MATERIALS

- A. Premixed Finishing Coat: Exterior Color Coat manufactured by La Habra Products, Inc., or other listed manufacturer, color selected by Architect.
- B. Finish: Site paint under provisions of Section 09 90 00.

2.4 METAL LATHING

- A. Metal Lath for Vertical Surfaces: ASTM C847, 3.4 lb/sq.yd. expanded metal, galvanized, self furring type with "V" shaped continuous groove or self-furring welded wire lath, ASTM C933 1.95 lb/sq. yd. galvanized according to ASTM A641 equal to Mega Lath as manufactured by Structa Wire Corp., IAPMO UES Report No. 2017.
- B. Metal Lath for Horizontal Surfaces: ASTM C847, 3.4 lb./sq.yd. expanded metal, galvanized, with factory applied kraft paper backing or self-furring welded wire lath, ASTM C933 1.95 lb/sq. yd. galvanized according to ASTM A641, with factory applied kraft paper equal to Mega Lath as manufactured by Structa Wire Corp., IAPMO UES Report No. 2017.

2.5 ACCESSORIES

- A. Corner Mesh: Formed steel, minimum 0.0179 inch thick; expanded flanges shaped to permit complete embedding in plaster; minimum 2 inches wide; galvanized finish. Equivalent to ClarkDietrich, CEMCO, or Cornerite.
- B. Corner Reinforcement: Equivalent to Western Metal, 0.0179 inch Stucco-Lok or 18 gage Stockton Corneraid for straight corners. Stockton Bullnose Regular for rounded corners, galvanized finish.
- C. Strip Mesh: Metal lath, 3.4 lb/sq. yd. expanded metal, galvanized, 6 inches wide x 18 inches long.
- D. Vent Screed: Equivalent to Stockton SVR, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 4 inch width, double "V" profile with perforated expanse between "V's" of longest possible lengths; galvanized finish.
- E. Casing Bead: Formed steel; minimum 0.0179 inch thick; thickness governed by plaster thickness; maximum possible lengths; with square edges; galvanized finish.
- F. Curved Casing Bead: Square-edged style fabricated from aluminum, preformed into curve or radius indicated.
- G. Weep Screed: Equivalent to Stockton W-S#7, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, "V" shaped, of longest possible lengths; galvanized finish.
- H. Drip Screed: Equivalent to Stockton SDC or BSS No. 10 drip mould as indicated on drawings, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, of longest possible lengths; galvanized finish.
- I. Window/Door Drip Screed: Equivalent to Stockton WTP, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, of longest possible lengths; galvanized finish.
- J. Control and Expansion Joints: Equivalent to Western XJ 15-3, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.

- K. Single Point Screed: Equivalent to Stockton PBS, minimum 0.0179 inch thick; depth governed by plaster thickness, maximum practical lengths; galvanized finish.
- L. Interior Corner Joints: Equivalent to Western No. 30, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.
- M. Anchorages: Nails, staples, or other approved metal supports, of type and size to suit application, galvanized to rigidly secure lath and associated metal accessories in place.
- N. Screws: ASTM C954 or ASTM C1002, self drilling.
- O. Penetration Flashing: Tyvek flashing system. Straight flash for jambs and heads, FlexWrap for sills. Equivalent as manufactured by The Polymer Group, Inc. or National Shelter Products, Inc.
- P. Polyethylene Sheet: Clear, 6 mil thick.
- Q. Wire: ASTM A641, Class 1 coating (galvanized), soft temper.
- R. Powder Activated Fastener: 0.157 inch diameter X-U premium nail with washer as manufactured by Hilti, Inc., www.us.hilti.com, ICC/ES Report No. ESR-2269.
- S. Tape: Acrylic adhesive backed oriented polypropylene, 3 inch in width.

2.6 CEMENT PLASTER MIXES

- A. Mix and proportion cement plaster in accordance with ASTM C926 and PCA Plaster (Stucco) Manual.
- B. Scratch Coat and Brown Coat: One part cement, minimum 3-1/2 and maximum 5 parts aggregate, and 0-3/4 parts hydrated lime. Alkali resistant glass fibers at a rate of 1 lb. per sack of cement. When expanded lath is used fibers shall only be used in brown coat. When welded wire lath is used, fibers shall be used in both scratch and brown coat.
- C. Factory-Prepared Portland Cement Finish Coats: Add water only; comply with finish coat manufacturer's directions.
- D. Mix only as much plaster as can be used in 1 hour.
- E. Mix materials dry, to uniform color and consistency, before adding water.
- F. Protect mixtures from frost, contamination, and evaporation.
- G. Do not retemper mixes after initial set has occurred.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces and site conditions are ready to receive Work. Notify Architect in writing of all unsatisfactory surfaces and conditions.
- B. Masonry: Verify joints are cut flush and surface is ready to receive Work of this Section. Verify no bituminous or water repellent coatings exist on masonry surface.
- C. Concrete: Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive work of this Section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster.
- D. Grounds and Blocking: Verify items within walls for other Sections of Work have been installed.
- E. Mechanical and Electrical: Verify services within walls have been tested and approved.

- F. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Remove existing plaster as necessary to install metal lathing and accessories as specified herein and as per manufacturer's instructions.
- B. Protect surfaces near the Work of this Section from damage, disfiguration, and overspray. Mask off all ventilation screeds occurring in plastered areas.
- C. Clean concrete and masonry surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- D. Roughen smooth concrete surfaces.
- E. Apply bonding agent in accordance with manufacturer's instructions.

3.3 INSTALLATION - LATHING MATERIALS

- A. Install metal lathing in accordance with ML/SFA 920, ASTM C1063 and as specified herein.
- B. On vertical surfaces apply 1 layers of underlayment over substrate; weatherlap horizontal edges 6 inches, vertical edges 6 inches. Fasten in place at 12 inches on center vertically over stud. Tape seal all joints and penetrations on base layer. Installation to conform to Single "Separate" Layer Method in accordance with TSIB Bulletin 60.220.
- C. Install penetration flashing around all openings and penetrations in exterior walls in compliance with underlayment manufacturer's recommendations and in conformance with recommendations contained in Plaster and Lathing Systems Manual and ML/SFA 920. Turn sill flashing up 6 inches at jambs. Extend flashing back onto sill, jamb, and head of all openings.
- D. Apply metal lath taut, with long dimension perpendicular to supports.
- E. Lap ends of expanded metal lath a minimum of 1 inch. Secure end laps with tie wire where they occur between supports.
- F. Lap sides of expanded metal lath a minimum of 1-1/2 inches.
- G. Lap sides of welded wire lath a minimum of 1 mesh opening spacing at sides and ends. End laps shall occur over supports.
- H. Furr out metal lath from vertical supports or backing not less than 1/4 inch. Furring of metal lath on vertical supports having a bearing surface width of 1-5/8 inches or less is not required.
- I. Attach metal lath to wood supports using 1-1/2 inch No. 11 galvanized nails with 7/16 inch diameter heads at maximum 6 inches on center. In addition, at horizontal wood supports, secure lath to each support with 1/2 inch wide, 1-1/2 inch long No. 9 W & M gage ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath at 27 inches o.c. and not more than 3 inches from the edge of each sheet.
- J. Attach metal lath to vertical metal supports with tie wires or No. 8 self drilling screws with 3/8 inch diameter wafer head capable of penetrating metal supports by not less than 1/4 inch or 3 full threads. Maximum spacing 6 inches on center.
- K. Attach metal lath to horizontal metal supports with tie wires or No. 8 self drilling screws with 3/8 inch diameter wafer head fitted with 1 inch O.D. x 1/4 inch I.D. x 16 gage galvanized cut washers capable of penetrating metal supports by not less than 1/4 inch or 3 full threads.
- L. Attach metal lath to concrete and masonry using powder actuated fastener with washers with minimum 1 inch penetration into substrate. Space at maximum 16 inches on center horizontally and 6 inches on center vertically. Securely wire tie side laps.

- M. Continuously reinforce internal angles with corner mesh, except where corner joint No. 30 is shown. Fasten at perimeter edges only.
- N. Place beaded external angle with mesh at corners. Fasten at outer edges only.
- O. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- P. Place 6 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
- Q. Place window/door drip screed at head of all windows and door openings in exterior walls.
- R. Place weep screed at base of all vertical plaster applications at foundation line not less than 4 inches above earth or 2 inches above paved surfaces. Underlayment and lath shall cover and terminate on the attachment flange of the screed.
- S. Place drip screed at base of all vertical plaster applications which do not terminate at framed wall openings or at foundation line.
- T. Place vent screed in soffit areas indicated.
- U. Place casing beads at all terminations of plaster finish not otherwise indicated to have screeds installed and at all intersections with dissimilar materials. Butt and align ends. Secure rigidly in place.
- V. Install accessories to lines and levels.

3.4 CONTROL AND EXPANSION JOINTS

- A. Locate interior control and expansion joints as indicated on the drawings, but not to exceed 20'-0" o.c. horizontally or vertically.
- B. Locate exterior control and expansion joints as indicated on drawings but not to exceed 12'-0" o.c. horizontally or vertically.
- C. Establish control and expansion joints with specified joint device.
- D. Attach control and expansion joints to metal lath with wire ties.
- E. Install expansion joint over 3 inch wide strip of polypropylene tape to assist with air seal continuity.
- F. Cut metal lath behind expansion joints.
- G. Coordinate joint placement with other related Work.

3.5 COATED FOAM SHAPES INSTALLATION

- A. Cover both brown coat of plaster and foam shape with adhesive.
- B. Press foam shape onto brown coat and secure in place until adhesive has set.
- C. Apply 2 inch wide fiberglass mesh set in adhesive at all joints of foam.
- D. Apply 4 inch wide fiberglass mesh set in adhesive at all joints between foam and brown coat. Extend mesh 2 inches onto surface of brown coat.

3.6 PLASTERING

- A. Apply plaster in accordance with ASTM C926 and PCA Portland Cement Plaster (Stucco) Manual.
- B. Three Coat Application: At metal lathed surfaces, apply scratch coat to a nominal thickness of 3/8 inch, brown coat to a nominal thickness of 3/8 inch, and finish coat to a nominal thickness of 1/8 inch.

- C. Two Coat Application: At concrete and masonry surfaces, apply 1/2 inch thick leveling coat and then 1/8 inch finish coat.
- D. Moisture Curing: Moist cure plaster surfaces using a fine fog spray to assure continuous hydration of cementitious materials. Where hot, dry and windy conditions exist, plaster surfaces shall be moistened and covered with a single sheet of polyethylene plastic to prevent water loss thru evaporation.
- E. Moist cure scratch and brown coats. Do not apply brown coat sooner than 48 hours following scratch coat.
- F. After curing, dampen base coat prior to applying finish coat. Do not apply finish coat sooner than 7 days following brown coat.
- G. Trowel apply finish plaster in two coats evenly and uniformly. Apply first coat to provide texture pattern; Second coat to obtain uniformity in color and texture.
- H. Moist cure finish coat for minimum period of 48 hours only when strong dry wind conditions exist.

3.7 FINISH COAT TEXTURE

- A. Fine Sand Float as defined by photographs and application procedures in the Plaster Texture Brochure published by the Technical Services and Information Bureau, www.tsib.org.

3.8 TOLERANCES

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

3.9 CLEANING

- A. Remove protective maskings.
- B. Remove any overspray from surrounding materials.
- C. Clean adjacent affected surfaces.

3.10 PLASTER TEXTURE SCHEDULE

- A. Exterior Vertical Surfaces: Fine Sand Float.
- B. Exterior Horizontal Surfaces: Fine Sand Float.

3.11 PLASTER APPLICATION SCHEDULE

- A. Exterior Vertical Surface of Concrete and Masonry Building and Yard Walls: Two coat plaster over bonding agent.
- B. Exterior Vertical Surface of Framed Walls: Three coat plaster over metal lath and underlayment.

END OF SECTION

SECTION 09 30 12

CERAMIC TILE WALL FINISHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Ceramic tile wall and wainscot finish using the thinset application method.
- B. Cementitious backing board.

1.2 REFERENCES

- A. ANSI/TCA A108.5 - Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- B. ANSI/TCA A108.11 - Interior Installation of Cementitious Backer Units.
- C. ANSI/TCA A118.1 - Dry-Set Portland Cement Mortar.
- D. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- E. ANSI/TCA A118.7 - Polymer Modified Ceramic Tile Grouts.
- F. ANSI/TCA A118.9 - Test Methods and Specifications for Cementitious Backer Units.
- G. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- H. ASTM C847 - Standard Specifications for Metal Lath.
- I. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.
- J. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating tile layout, patterns, color arrangement, perimeter conditions, and junctions with dissimilar materials.
- C. Submit samples under provisions of Section 01 33 00.
- D. Mount tile and apply grout on two 24 x 24 inch plywood panels, representative of pattern, color variations, and grout joint size variations.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- F. Submit maintenance data under provisions of Section 01 77 00.
- G. Include recommended cleaning and stain removal methods, and cleaning materials.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - TILE

- A. American Olean Tile Co., Inc., www.aotile.com.
- B. Ceramic Tile International, www.ceramictileintl.com.

- C. Crossville Ceramics, www.crossvilleinc.com.
- D. DSA (Buchtal), www.dsa-ceramics.com.
- E. Dal-Tile Corp., www.daltile.com.
- F. Florida Tile Industries, Inc., www.floridatile.com.
- G. Interceramic, www.interceramic.com.
- H. Shaw Commercial, www.shawinc.com.
- I. Summitville Tiles, Inc., www.summitville.com.
- J. United States Ceramic Tile Co., www.usctco.com.
- K. Substitutions: Under provisions of Section 01 25 13.

2.2 TILE MATERIAL

- A. Ceramic Wall Tile: ANSI/TCA A137.1, conforming to the following:

Moisture Absorption:	0.5 to 3.0 percent
Manufacturer and Product:	Equivalent to Dal Tile
Size:	12 x 24 x 3/8 inch
Edge:	Square, Cushioned
Surface Finish:	Mottle glazed
Color:	As selected
Recycled Content:	10 to 50 percent

- B. Wainscot Cap: Match wall tile for moisture absorption, surface finish, and color, tile size 24 inch long x 12 inch high, bullnosed top edge.

2.3 MANUFACTURERS - MORTAR AND GROUT

- A. American Olean Tile Co., Inc., www.aotile.com.
- B. C-Cure, www.c-cure.com.
- C. Custom Building Products, www.custombuildingproducts.com.
- D. Dal-Tile Corp., www.daltile.com.
- E. H.B. Fuller Company, www.hbfuller.com.
- F. Hydromet, www.bostikfindley-usa.com.
- G. Laticrete International, Inc., www.laticrete.com.
- H. MAPEI, www.mapei.com.
- I. W.R. Bonsal Company, www.bonsal.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR MATERIALS

A. Latex-Portland Cement Mortar: ANSI/TCA A118.4 and the following:

1. Acrylic resin latex additive.
2. Dry mortar mix supplied by latex manufacturer.

2.5 GROUT MATERIALS

A. Portland Cement Grout Materials: ANSI/TCA A118.7.

B. Latex-Portland Cement Grout: ANSI/TCA A118.7 of color selected and the following:

1. Acrylic resin latex additive.
2. Microban antimicrobial additive, www.microban.com.
3. Dry mortar mix supplied by latex manufacturer.

2.6 MORTAR MIX AND GROUT MIX

A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions and referenced standards.

2.7 SEALER

A. Tile and Grout Sealer: Aqua Mix Penetrating Sealer manufactured by Aqua Mix, Inc., www.aquamix.com.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean existing surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.3 INSTALLATION - THINSET METHOD

- A. Install mortar, tile, and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCA Handbook.
- B. Lay tile to pattern indicated. If not indicated, request from Architect. Do not interrupt tile pattern around openings.
- C. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align wall, base, and floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.
- E. Form internal angles square and external angles square.

- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep control joints free of mortar or grout. Apply sealant to joints.
- H. Allow tile to set for a minimum of 48 hours prior to grouting.
- I. Grout tile joints.
- J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING

- A. Clean work under provisions of 01 77 00.
- B. Clean tile surfaces.

3.5 SEALING

- A. Install sealer on all surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical panels.
- C. Non-fire rated assembly.
- D. Perimeter trim.

1.2 REFERENCES

- A. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- B. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- C. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- D. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- F. ASTM E84 - Test Methods for Surface Burning Characteristics of Building Materials.
- G. ASTM E580 - Application of Ceiling Suspension Systems for Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- H. ASTM E1264 - Classification of Acoustical Ceiling Products.
- I. DSA - Division of the State Architect.
- J. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- K. ICC - ES - International Code Council Evaluation Service, Inc.
- L. UL - Underwriters' Laboratories Building Material Directory.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of ceiling suspension system and ceiling panels with five years minimum experience.
- B. Installer: Company with five years minimum documented experience, approved by manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code (CCR) California Code of Regulations, Title 24, Part 2, Chapter 16A for suspension system requirements and DSA IR 25-2.13.
- B. Conform to applicable UL and CBC combustibility requirements for materials.

1.5 SUBMITTALS

- A. Provide product data on metal grid system components and acoustic units.
- B. Submit samples under provisions of Section 01 33 00.
- C. Submit two samples 6 x 6 inch in size, illustrating material and finish of acoustic units.
- D. Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and edge trim.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and humidity of 50 percent prior to, during, and after installation.

1.7 SEQUENCING/SCHEDULING

- A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Schedule installation of acoustic units after interior wet work is dry.

1.8 EXTRA STOCK

- A. Provide extra quantity of acoustic units to Owner under provisions of Section 01 77 00.
- B. Provide quantity equal to 2 percent of units installed.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - SUSPENSION SYSTEM

- A. Armstrong Ceiling Systems, www.armstrongceilings.com. ICC-ES No. ESR-1308.
- B. Certainteed, www.certainteed.com ICC-ES No. ESR-3336.
- C. Chicago Metallic Corporation, www.chicagometallic.com. ICC-ES No. ESR-2631.
- D. USG Interior Systems, (DONN), www.usg.com. ICC-ES No. ESR-1222.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 SUSPENSION SYSTEM MATERIALS

- A. Grid: ASTM C635, heavy duty, non-fire rated, exposed T; components die cut and interlocking. Catalog numbers of acceptable manufacturer are indicated on drawings.
- B. Accessories: Stabilizer bars, clips, splices, and edge moldings required for suspended grid system.
- C. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- D. Grid Finish: Off-White color, baked enamel.
- E. Support Channels and Hangers: Galvanized steel; size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical and electrical components, as detailed on drawings.
- F. Compression Strut: ASTM A513, telescoping tube design, galvanized 3/4 inch diameter 14 gage rigid steel tubing with crimped end attached to roof framing and secured to 1/2 inch diameter 14 gage rigid steel tubing with crimped end to main runners. Equivalent pre-manufactured compression post supplied by ceiling grid manufacturer.

G. Hanger Wire: ASTM A641, Class 1 coating (galvanized), soft temper, No. 12 gage.

2.3 ACCEPTABLE MANUFACTURERS - ACOUSTIC UNITS

A. Armstrong Ceiling Systems, www.armstrongceilings.com.

B. Certainteed, www.certainteed.com.

C. USG Interiors, Inc., www.usg.com.

D. Substitutions: Under provisions of Section 01 25 13.

2.4 ACOUSTIC UNIT MATERIALS

A. Acoustic Panels: ASTM E1264, conforming to the following:

1. Type 1 Equivalent to Fine Fissured High NRC, manufactured by Armstrong, Products 1754 and 1755.

(a)	Type	:	IV
(b)	Form	:	2
(c)	Pattern Designation	:	CE
(d)	Size	:	24 x 48 and 24 x 24 inches
(e)	Thickness	:	7/8 inches
(f)	Composition	:	Mineral
(g)	Light Reflectance	:	86 percent
(h)	NRC Range	:	0.75
(i)	CAC Range	:	35
(j)	Edge	:	Square
(k)	Surface Color	:	White
(l)	Flame Spread	:	ASTM E-84 (0-25) Class A, UL 25 or under
(m)	Smoke Density	:	Not to exceed 450 when tested in accordance with CBC Standard No. 12-8-1
(n)	Mold/Mildew Inhibitor	:	Biocide treatment that inhibits mold and mildew when tested according to ASTM D3273.
(o)	Recycled Content	:	55 to 73 percent

3. PART 3 EXECUTION

3.1 INSPECTION

A. Verify that existing conditions are ready to receive work.

B. Verify that layout of hangers will not interfere with other work.

C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - GRID SYSTEM

A. Install system in accordance with ASTM C636 and ASTM E580 as supplemented in this Section and with notes on the drawing entitled Metal Suspension Systems for Lay In Panel Ceilings.

B. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

- C. Hang system independent of columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Compression struts to be installed at each main runner not exceeding 12'- 0" o.c. in both directions and not more than 8 inches from end of main runner. Insert main 3/4 inch tube over 1/2 inch tube with a minimum 6 inch lap. Secure crimped end of main 3/4 inch tube to structural framing with wood screws and 1/2 inch tube to main runner with metal screws. Secure tube sections together with 2 set screws. Install prefabricated compression post according to manufacturer's recommendations.
- F. Locate system on room axis according to reflected plan.
- G. Do not eccentrically load system, or produce rotation of runners.
- 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.

3.3 INSTALLATION - ACOUSTIC UNITS

- A. Field rabbet cut edge of perimeter tiles to match factory rabbeted edge. Paint cut surface if necessary to match surface of tile.
- B. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units one way in room. Fit border neatly against abutting surfaces.
- D. Install acoustic units level, in uniform plane, and free from twist, warp and dents.

3.4 TOLERANCES

- A. Maintain tolerances in accordance with Section 01 43 00.
- B. Variation from flat and level surface: 1/8 inch in 10 feet.
- C. Variation from plumb of grid members caused by eccentric loads: Two degrees maximum.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient top set and self coved base.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. CDH - California Department of Health Standard Practice Method V1.1-2010 for the Testing of Volatile Organic Emissions.
- D. ASTM D2047 - Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
- E. ASTM E648 - Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Energy Source.
- F. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- G. ASTM F710 - Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.
- H. ASTM F1066 - Specification for Vinyl Composition Floor Tile.
- I. ASTM F1303 - Specification for Sheet Vinyl Floor Covering
- J. ASTM F1344 - Specification for Rubber Floor Tile.
- K. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
- L. ASTM F1861 - Standard Specification for Resilient Wall Base.
- M. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- N. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probe.
- O. FS RR-T-650 - Treads, Metallic and Non-metallic, Non-skid.
- P. FS SS-T-312b - Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.

1.3 REGULATORY REQUIREMENTS

- A. Resilient flooring to comply with the following fire performance characteristics as determined by testing products per ASTM test method indicated below:
 - 1. Critical Radiant Flux: 0.45 watts per sq cm or more per ASTM E648.
 - 2. Smoke Density: Less than 450 per ASTM E662.

- B. Maximum volatile organic compound (VOC) emissions shall meet the CDPH test results obtained at the 14 day time period when tested by Method V1.1-2010.
- C. Resilient flooring products shall have a coefficient of friction when tested according to ASTM D2047 of 0.60 for flat floors and 0.80 for ramped surfaces.
- D. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- E. Resilient Flooring:
 - 1. Resilient Flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide seaming and pattern plan.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 3 x 3 inches in size, illustrating color and pattern for each floor material specified.
- E. Submit two 2 inch long samples of base material for each material specified.
- F. Submit manufacturer's written installation instructions.
- G. Submit Owner's written acceptance of final floor finish of vinyl composition tile to Architect under provisions of Section 01 77 00.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 77 00.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Concrete subfloor to be allowed to cure for a minimum of 90 days to achieve acceptable dryness.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- C. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.
- D. Moisture Testing: Perform tests as recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by the Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 - 2. Subfloor Humidity Conditions: Relative humidity level of no more than 75 percent when tested by in situ drilled probes according to ASTM F2170.
 - 3. Subfloor Alkalinity Conditions: pH range of between 5 to 9 when subfloor is wetted with potable water and pHdriion paper is applied.

1.7 EXTRA MATERIALS

- A. Provide 50 lineal feet of base of each material specified under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 LUXURY VINYL FLOOR TILE MANUFACTURERS

- A. Amtico, www.manningtoncommercial.com.
- B. Armstrong World Industries, www.armstrong.com.
- C. Forbo Industries, Inc., www.forbo.com.
- D. Harbinger, www.harbingerfloors.com.
- E. Interface Flor, LLC, www.interfaceflor.com.
- F. Johnsonite, www.johnsonite.com
- G. Mannington Commercial, www.manningtoncommercial.com
- H. Mohawk, www.mohawkflooring.com
- I. Parterre Flooring Systems, www.parterreflooring.com.
- J. Roppe Corporation, www.roppe.com.
- K. Tandus / Centiva. www.tandus-centiva.com.
- L. Shaw Industries, Inc., www.shawcontractgroup.com.
- M. Substitutions: Under provisions of Section 01 25 13.

2.2 LUXURY VINYL FLOOR TILE MATERIALS

- A. Solid vinyl floor tile (LVT) : ASTM F1700, Class; As indicated by material designation.
- B. Thickness: 0.120 inch.
- C. Size: 18 x 18 inches.
- D. Colors and Patterns: Pattern as selected by Architect from manufacturer's standard range for materials indicated. Color as selected by Architect from manufacturer's standard color range.

2.3 ACCEPTABLE MANUFACTURERS - BASE MATERIALS

- A. Allstate Rubber Corporation, www.allstaterubber.com.
- B. Armstrong World Industries, www.armstrong.com.
- C. Burke Flooring Products, www.burkeflooring.com.
- D. Flexco Company, www.flexcofloors.com.
- E. Roppe Corporation, www.roppe.com.
- F. VPI, LLC; www.vpiflooring.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.4 BASE MATERIALS

- A. Base: ASTM F1861, Type TS rubber; Group 1 solid; Style B coved; 4 inch high; 0.125 inch thick; top set, in maximum practical lengths.

2.5 ACCESSORIES

- A. Subfloor Filler: White premix Portland Cement latex type as recommended by flooring material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer for high moisture application. Shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168.
- C. Edge Strips: Rubber.
- D. Sealer and Wax: Types recommended by flooring manufacturer. Coordinate selection of floor wax with Owner's maintenance program.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that concrete slabs comply with ASTM F710 and are as specified herein.
- B. Verify concrete floors exhibit acceptable moisture emission rate and humidity level; and exhibit negative alkalinity, carbonization, or dusting.
- C. Verify that surfaces are smooth and flat and are ready to receive Work.
- D. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Prepare concrete substrate according to ASTM F710 and flooring manufacturer's recommendations..
- B. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
- D. Prohibit traffic from area until filler is cured.
- E. Vacuum clean substrate.
- F. Apply primer to concrete slab surfaces if recommended by flooring manufacturer.

3.3 INSTALLATION - [SHEET] [AND] [TILE] MATERIAL

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams [in accordance with seaming plan.] [at 45 degrees] [parallel][to building lines] [to produce minimum number of seams.]

- F. Install tile [to square grid pattern with all joints aligned.] [at 45 degrees to building lines] [to ashlar/staggered pattern.] [to pattern indicated on drawings.] [Allow for 25 percent accent color tile for pattern to be selected by Architect.]
- G. Pattern grain [parallel] [basket weave] for all units and [parallel] to [length] [width] of room. Allow minimum 1/2 full size tile width at room or area perimeter.
- H. Install sheet flooring parallel to [length] [width] of room. Provide minimum of 1/3 full roll width. Double cut sheet[.] [and continuously seal.] Install cap trim at top of self coved base where top of cove is exposed. Install wood radiused backing at wall and floor juncture where self coved base occurs.
- I. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- J. Install edge strips at unprotected or exposed edges, and where flooring terminates.
- K. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- L. Install flooring in pan type floor access covers. Maintain floor pattern.
- M. Install flooring under movable partitions and under cabinetry without interrupting floor pattern.
- N. Install flooring in open cabinet recesses.
- O. Install feature strips[,] [edge strips,] [and floor markings] where indicated. Fit joints tightly.

3.4 INSTALLATION - BASE MATERIAL

- A. Fit joints tight and vertical.
- B. Install material in maximum practical lengths.
- C. Maintain minimum measurement of 18 inches between joints.
- D. Miter internal corners.
- E. Field wrap external corners with longest practical lengths. "V" cut back surface to 2/3 its thickness.
- F. Install base on solid backing. Bond tight to wall and floor surfaces.
- G. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

- A. Remove excess adhesive from floor, base and wall surfaces without damage.
- B. Sweep or vacuum floor thoroughly.
- C. Damp mop with a neutral detergent solution.
- D. Carefully remove black marks with a scrubbing pad or brush.

3.6 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Protect floor finish until final completion with a non-asphaltic building paper.
- C. Maintain protective covering until final completion.

3.7 COMPLETION

- A. At final completion, remove floor protection and correct any damage.
- B. Each coat of sealer and wax to be thoroughly dry before installing subsequent coats.
- C. Final coat of wax to be burnished in accordance with manufacturer's recommendations.
- D. Submit copy of Owner's acceptance of floor finish to architect.

END OF SECTION

SECTION 09 67 26

QUARTZ FLOORING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fluid applied epoxy flooring and base with epoxy top coat.
- B. Quartz chip aggregate.
- C. Base cap edging and divider strips.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
- D. ASTM C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
- E. ASTM D413 - Standard Test Method for Rubber Property - Adhesion to Flexible Substrate.
- F. ASTM D579 - Standard Specification for Greige Woven Glass Fabrics.
- G. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- H. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
- I. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- J. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
- K. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
- L. ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness.
- M. ASTM F710 - Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.
- N. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- O. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probe.
- P. ACI Committee No. 503.1PP - Bond Strength.
- Q. MIL - D - 3134F - Indentation.
- R. UL - Underwriters' Laboratories.

1.3 QUALIFICATIONS

- A. Applicator: Company specializing in epoxy matrix floor applications with five years documented experience.
- B. Supervisor: Trained by product manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for flooring flame/fuel/smoke ratings in accordance with UL.
- B. Products supplied for flooring installation shall comply with regulations controlling use of volatile organic compounds (VOC).
- C. Flooring shall have a coefficient of friction when tested according to ASTM D2047 of 0.60 for flat floors and 0.80 for ramped surfaces.
- D. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data for base cap.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 4 x 4 inch in size illustrating color, chip size and variation, and matrix color.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 77 00.
- B. Include procedures for stain removal, repairing surface, and cleaning.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01 61 00.
- B. Store materials in a dry, secure area.
- C. Maintain temperature of 55 degrees F.
- D. Keep products away from fire or open flame.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install flooring when temperature is below 60 degrees F or above 90 degrees F.
- B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of flooring.
- C. Ventilate area where flooring is being installed. Post and enforce NO SMOKING or OPEN FLAME signs until flooring has cured.
- D. Provide uniform lighting of 50 fc in area of installation.
- E. Restrict traffic from area where flooring is being installed or is curing.

- F. Moisture Testing: Perform tests as recommended by flooring materials manufacturer and as follows. Proceed with installation only after substrates pass testing.
1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by the Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 2. Subfloor Humidity Conditions: Relative humidity level of no more than 75 percent when tested by in situ drilled probes according to ASTM F2170.
 3. Subfloor Alkalinity Conditions: pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.

1.9 WARRANTY

- A. Provide one year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage for delamination of floor and base materials from substrate, degradation of surface finish.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. General Polymers Corporation, TPM No. 115 Upgraded, www.generalpolymers.com.
- B. Crossfield Products Corp., (Dex-O-Tex) Cheminert CFS, K-D, www.dex-o-tex.com.
- C. Dudick, Inc., Steri-Quartz B, www.dudick.com.
- D. Dur-A-Flex, Inc., Dura-A-Quartz, www.dur-a-flex.com.
- E. RBC Industries, Inc., HE1484, www.rbcepoxy.com.
- F. Sunbelt Flooring, Inc., Flooring No. 1100, www.sunbeltflooring.com.
- G. Stonhard Inc., Stoneshield HRI, www.stonhard.com.
- H. Tenemec, Series 201-223-284, www.stratashield.com.
- I. Westcoat, EC Mortar Quartz, www.westcoat.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.2 PERFORMANCE REQUIREMENTS

- A. Conform to the following:

<u>Property</u>	<u>Test</u>	<u>Result</u>
Tensile Strength	ASTM C307	1,650 psi
Compressive Strength (7 days)	ASTM D579	10,000 psi
Flexural Strength	ASTM C580	4,300 psi
Flexural Modulus of Elasticity	ASTM D790	2.0 x 10 ⁶ psi
Hardness	ASTM D2240	85-90 Shore Durometer
Indentation	MIL-D3134F	No Indentation

<u>Property</u>	<u>Test</u>	<u>Result</u>
Coefficient of Friction	ASTM D2047	0.7
Heat Deflection Temperature	ASTM D648	100 degrees F/ 38 degrees C
Water Absorption	ASTM D413	0.10 percent
Fire Resistance	ASTM D635	Self Extinguishing. Extent of Burning, .25 inches maximum
Bond Strength	ACI 503.1	400 psi minimum
Abrasion Resistance	ASTM D1044	Maximum weight loss of 0.10 gm/1000 cycles

2.3 MATERIALS

- A. Primer: A two-component, penetrating, moisture tolerant, epoxy primer.
- B. Base: A three-component, integral troweled mortar base consisting of epoxy resin, curing agent and finely graded silica aggregate.
- C. Undercoat: A two-component, thixotropic epoxy undercoat sealer.
- D. Aggregate: Brightly colored, quartz aggregate broadcast onto the surface.
- E. Sealer: A high performance, two-component, clear UV resistant epoxy sealer.

2.4 ACCESSORIES

- A. Subfloor Filler: White premix Portland Cement latex type as recommended by flooring material manufacturer.
- B. Divider Strips: 0.0478 inch thick zinc T and L shaped strips with perforated flanges as manufactured by the Manhattan American Strip Company, www.ntma.com.
- C. Base Cap: 0.0478 inch thick zinc L shaped strip with perforated flange as manufactured by the Manhattan American Strip Company, www.ntma.com.

2.5 COLORS

- A. Resin and Aggregate: Color as selected by Architect from manufacturer's standard color range.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin work until concrete substrate has cured 90 days minimum.
- B. Verify that substrate is ready to receive work, and that subfloor surface is clean, dry, and free of substances which could affect bond.
- C. Verify that concrete slabs comply with ASTM F710 and are as specified herein.
- D. Verify concrete floors exhibit acceptable moisture emission rate and humidity level; and exhibit negative alkalinity, carbonization, or dusting.
- E. Verify that surfaces are smooth and flat and are ready to receive Work.
- F. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 PREPARATION

- A. Prepare concrete substrate according to ASTM F710.
- B. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
- D. Clean substrate surface free of foreign matter and scrub with manufacturer supplied detergent.
- E. Control, expansion joints and cracks in concrete floor substrate shall be routed out and filled with resilient sealant and reinforced with 20 x 20 fiberglass mesh.
- F. Prohibit traffic from area until filler is cured.
- G. Vacuum clean substrate.

3.4 INSTALLATION - ACCESSORIES

- A. Install strips straight and level to locations indicated.
- B. Install terminating cap strip at top of base; attach securely to wall substrate.

3.5 INSTALLATION - FLOORING

- A. Apply primer to concrete slab surfaces.
- B. Apply flooring in accordance with manufacturer's instructions.
- C. Apply to a minimum thickness of 1/4 inch.
- D. Finish to smooth level surface sloped to drains.
- E. Provide 3/8 inch cove fillet at vertical surfaces.
- F. Extend up vertical surface to form base.
- G. Apply final sealer in two coats.

3.6 TOLERANCES

- A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Do not permit traffic over finished floor surfaces.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Modular carpet tile installed by fully adhered method.
- B. Accessories.

1.2 REFERENCES

- A. ASTM D1335 - Tuft Bind of Pile Floor Coverings.
- B. ASTM E648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM E662 - Specific Optical Density of Smoke Generated by Solid Materials.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- E. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probe.
- F. CRI 104 - Carpet and Rug Institute Standard for Installation of Commercial Textile Floorcovering Materials.
- G. FTC - Federal Trade Commission Guides, Part 260, Guides for Use of Environmental Marketing Claims.
- H. NFPA - National Fire Protection Association.
- I. NSF / ANSI 140-2007e Sustainable Carpet Assessment.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on specified products, describing physical characteristics; sizes, patterns, colors available, and method of installation.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples minimum 18 x 18 inch in size illustrating color and pattern for each carpet material specified.

1.4 RECYCLED CONTENT

- A. Carpet must contain a minimum of 40 percent recycled content by weight.
- B. Recycled content to be calculated by the following formula:
$$(\text{Recycled Content Weight}) / (\text{Total Product Weight}) \times 100 = \text{Percent recycled content.}$$
- C. Carpet must contain a minimum of 10 percent post-consumer recycled content by weight from post-consumer carpet.
- D. Recycled content to be certified by Scientific Certification Systems (SCS) or National Sanitation Foundation International. Product must carry label certifying overall recycled content.
- E. Recycled content statements shall comply with FTC Part 260 Guidelines with respect to labeling, product inserts, and catalog representations.

1.5 RECYCLED PROGRAM

- A. Manufacturer shall have an existing established collection and recovery system for carpet in operation.
- B. Collection and recovery system shall be capable of reclaiming and recycling 100 percent of a vinyl backed carpet.
- C. Current recycling program to be in accordance with FTC Guides, Section 260.7(d).

1.6 PRODUCT CERTIFICATION

- A. Carpet must be certified with NSF 140-207(e) Sustainable Carpet Assessment Standards. Platinum level of certification.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning and shampooing.

1.8 QUALITY ASSURANCE

- A. Perform work in accordance with CRI 104.
- B. Maintain one copy of document on site.
- C. Carpet shall have an average tuft bind of 20 pounds when tested in accordance with ASTM D1335.
- D. Carpet shall bear CRI Indoor Air Quality Carpet Testing Program Green Label Plus.

1.9 REGULATORY REQUIREMENTS

- A. Floor covering to have an NFPA Class I rating with a minimum radiant flux of 0.45 watt per square centimeter when tested in accordance with ASTM E648.
- B. Floor covering to have a smoke developed rating of less than 450 when tested in accordance with ASTM E662.
- C. Carpet/Carpet Tile Flooring: CBC Section 11B-302.2
 - 1. Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. It shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be ½" maximum.
 - 2. 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.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Comply with requirements of CRI 104 Section 4.0.

1.11 PROJECT/SITE CONDITIONS

- A. Comply with requirements of CRI 104, Section 7.0.
- B. Concrete subfloor to be allowed to cure for a minimum of 90 days to achieve acceptable dryness.
- C. Store materials for three days prior to installation in area of installation to achieve temperature stability.

- D. Moisture Testing: Perform tests as recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by the Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 - 2. Subfloor Humidity Conditions: Relative humidity level of no more than 75 percent when tested by in situ drilled probes according to ASTM F2170.
 - 3. Subfloor Alkalinity Conditions: pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.

1.12 WARRANTY

- A. Provide manufacturer's standard lifetime or 20 year non-prorated warranty under provisions of Section 01 77 00.
- B. Performance Warranty: Manufacturer's warranty covering delamination of secondary backing, edge ravel and tuft bind of carpet under both wet and dry conditions.
- C. Wear Warranty: Manufacturer's warranty that carpet will lose no more than 10 percent by weight of face yarn.

1.13 EXTRA MATERIALS

- A. Provide full modular tiles equal to 5 percent of amount installed for each type and color but not less than 10 square yards under the provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Interface Flor, LLC, Style: To Scale with Glassbac RE Backing, www.interfaceflor.com.
- B. The Mohawk Group, Lees, Style: Sequences II Collection, Pattern: Ground Strata II Modular with Eco Flex NXT backing, www.themohawkgroup.com.
- C. Mannington Mills, Inc., Style: Infinity RE Modular Tile, Pattern: New Possibilities II, www.mannington.com.
- D. Tandus, Collins and Aikman Corp., Style: Ethos 3 / Omnicoat Modular Tile, Pattern: Haphazard II, www.tandus.com.
- E. Shaw Industries, Inc., Style: Ecoworx Tile, Collection: No Rules, Pattern: Disperse, www.shawcontractgroup.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Carpet shall conform to published specification characteristics of named manufacturer as modified by requirements specified in this section.
- B. Size: 18 x 18 inches up to 24 x 24 inches.
- C. Fiber Type: Invista Antron Legacy, Antron Lumena or Universal Nylon Type 6, 6.
- D. Pile Height: Maximum 1/2 inch.
- E. Backing: Synthetic, non-woven, 100 percent recycled content. No latex backing to be used.
- F. Soil-Resistance Treatment: Manufacturer's standard integral stain resistant treatment.

- G. Carpet shall contain a minimum of 40 percent recycled content by weight with 10 percent post-consumer recycled content and 5 percent pre-consumer recycled content.

2.3 ACCESSORIES

- A. Sub-Floor Filler: White premix portland cement and latex; type as recommended by carpet manufacturer.
- B. Primers and Adhesives: Waterproof; releasable type recommended by carpet manufacturer. Shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.
- C. Edge Strips: Vinyl type, color as selected. Strip shall be beveled with a slope no greater than 1 inch unit vertical to 2 units horizontal (50 percent slope).

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine subfloors and conditions for compliance with requirements for moisture content, humidity levels, alkalinity range and other conditions affecting performance of carpet.
- B. Verify that subfloor surfaces are smooth and flat and are ready to receive work.
- C. Beginning of installation means acceptance of subfloor and site conditions.

3.2 PREPARATION

- A. Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.
- B. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to leave smooth, flat, hard surface.
- D. Prohibit traffic until filler is cured.
- E. Apply subfloor primer compatible with adhesive where recommended by carpet manufacturer.
- F. Vacuum floor surface.

3.3 INSTALLATION

- A. Apply carpet and adhesive in accordance with manufacturer's instructions and CRI 104, Section 10.2.
- B. Fully adhere carpet tile to substrate.
- C. Lay carpet on floors with tiles laid in straight pattern.
- D. Install pattern parallel to walls.
- E. At doorways, center seams under door in closed position.
- F. Fit seams straight, not crowded or peaked, free of gaps.
- G. Extend carpet into toe spaces, door reveals, open-bottomed obstructions, alcoves and similar openings.
- H. Cut and fit carpet around interruptions.
- I. Fit carpet tight to intersection with vertical surfaces without gaps.

3.4 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Vacuum carpet surfaces.

3.5 PROTECTION

- A. Comply with requirements of CRI 104, Section 13.7.
- B. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION

SECTION 09 72 06

DIGITAL WALL COVERING GRAPHIC

1. PART 1 GENERAL

1.1 SECTIONS INCLUDED

- A. Surface preparation.
- B. Prime painting.
- C. Wall covering.
- D. Digital graphic.
- E. Adhesives and accessories.

1.2 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. CFFA-W-101-D - Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wall Covering.
- C. FS CCC-W-408 A and B - Wall Covering, Vinyl Coated.
- D. FS L-P-1040-B - Plastic Sheets and Strips (Polyvinyl Fluoride).
- E. UL - Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing commercial wall coverings containing digital graphics with five years documented experience.
- B. Applicator: Company specializing in installing commercial wall covering with five years documented experience.

1.4 REGULATORY REQUIREMENTS

- A. Conform to flame/smoke developed ratings of no more than 25/50 when tested according to ASTM E84 by UL.
- B. Each roll of material used shall have UL labels affixed thereto verifying tests.

1.5 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating digital graphic in full color rendition for designated locations with all seams and panels identified for proper sequence.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples of digital wall covering graphic 36 x 36 inch in size illustrating digital color, finish, and texture.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

- F. Submit test reports verifying flame/smoke ratings.
- 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and protect products under provisions of Section 01 61 00.
- B. Inspect roll materials on site to verify acceptance.
- C. Protect packaged adhesive from temperature cycling.
- D. Do not store roll goods on end.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 60 degrees F, unless required otherwise by manufacturer's instructions.
- B. Do not apply adhesive when substrate surface temperature or ambient temperature is below 60 degrees F or relative humidity is above 40 percent.
- C. Maintain these conditions 72 hours before, during, and after installation of wall covering.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Essex Wallcoverings, www.omnova.com.
- B. JM Lynne Co., Inc., www.jmlynne.com.
- C. Metro Wallcoverings, www.metrowallcoverings.com.
- D. MDC Wallcovering, www.mdcwall.com.
- E. Koroseal Wallcoverings, www.koroseal.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Basis of Design Wall Covering: Vinyl fabric roll stock, as manufactured by Koroseal Wallcoverings conforming to FS CCC-W-408 A and B and CFFA W-101-D for Type II wallcovering and the following:
 - 1. Total Weight : 21.0 oz/lin yd
 - 2. Roll Width : 54 inches
 - 3. Color : Off white
 - 4. Pattern : Nassau Dunes
 - 5. Graphic : Digital Media by KoroGraphics
 - 6. Fire Rating, ASTM E84 : Class A
 - (a) Flame Spread 15
 - (b) Smoke Developed 20
 - 7. Stain Resistance: Teflon overcoating, 0.37 inch thick.
- B. Substitutions: Wall covering from listed acceptable manufacturers.

2.3 ACCESSORIES

- A. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate. Mildew-resistant, non-staining, and strippable. Shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168.
- B. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- C. Substrate Primer and Sealer: As recommended by adhesive and wall covering manufacturer.
- D. Digital Graphic: Electronic media provided by Architect.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that substrate surfaces are ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.
- C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Fill cracks and smooth irregularities with filler; sand smooth.
- B. Sand glossy surfaces. Shellac marks which may bleed.
- C. Remove electrical and telephone wall plates, covers and wall mounted fixtures.
- D. Vacuum clean surfaces free of loose particles.
- E. Prime and seal substrate in accordance with manufacturer's recommendations. Apply surface sealer to gypsum drywall which will permit subsequent removal of wallcovering without damage to paper facing.

3.3 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to fabric surface immediately prior to application of wall covering.
- C. Use wall covering in roll number sequence.
- D. Register wall covering to insure digital graphic uniformity.
- E. Razor trim edges.
- F. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.
- G. Horizontal seams are not acceptable.
- H. Do not seam within 6 inches of internal or external corners.
- I. Install wall covering before installation of bases, cabinets, hardware, or items attached to or spaced slightly from wall surface. Do not install wall covering more than 1/4 inch below top of resilient base.
- J. Cover spaces above and below windows, above doors, in sequence from roll.
- K. Apply fabric covering to electrical and telephone wall plates prior to replacing.

L. Where wall covering tucks into door frame reveals, or metal wallboard or plaster stops, apply covering with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

M. Remove excess wet adhesive from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Replace wall plates and accessories removed prior to work of this Section.

3.5 PROTECTION

A. Protect finished installation under provisions of Section 01 61 00.

3.6 APPLICATION SCHEDULE

A. Graphic: shall be located per elevation drawings.

END OF SECTION

SECTION 09 77 33

FIBER REINFORCED PLASTIC PANELS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass reinforced plastic (FRP) panels.
- B. Panel moldings.

1.2 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data for panels and accessories.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 4 x 4 inches in size illustrating panel pattern and color. Submit two 12 inch long samples of panel moldings.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include data for cleaning and stain removal.
- C. Include manufacturer's recommendations for cleaning materials, polishes, and waxes.

1.5 REGULATORY REQUIREMENTS

- A. Conform to flame/smoke developed rating of 25/450 when tested in accordance with ASTM E84.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install fiberglass reinforced plastic panels when temperatures are below 60 degrees F or above 90 degrees F.
- B. Maintain temperature range for 24 hours before, during, and 72 hours after installation of panels.

1.8 WARRANTY

- A. Provide one year warranty under provisions of Section 01 77 00.
- B. Include coverage for surface staining and finish deterioration.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Crane Composites, Inc., www.cranecomposites.com.
- B. Glasteel Inc., www.glasteel.com.
- C. Lasco Products, www.lascoboard.com.
- D. Marlite, www.marlite.com.
- E. Nudo Products, Inc., www.nudo.com.
- F. Panolam Industries, www.panolam.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Fiberglass reinforced plastic panels of 0.090 inch thickness in 4 x 8 foot sheet sizes.
- B. Panels to have pebble textured surface finish in color selected by Architect.
- C. Panels to have a flame/smoke rating of 25/450 for a Class A finish when tested according to ASTM E84.

2.3 ACCESSORIES

- A. Moldings: Extruded aluminum or plastic panel accessories in maximum practical lengths. Finish to match panels.
- B. Adhesive: Latex based non-flammable construction adhesive.
- C. Sealant: Silicone sealant specified in Section 07 92 00.
- D. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work.
- B. Verify that field measurements and tolerances are as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation constitutes acceptance of existing substrate surface conditions by installer.

3.2 PREPARATION

- A. Clean substrate surfaces.
- B. Protect elements of work adjacent to work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install panels and accessories in accordance with manufacturer's instructions.
- B. Coordinate location of panel joints to minimize interference with fixtures and accessories.

- C. Apply panel adhesive at 6 inches on center over entire field of panel.
- D. Set panel ends and edges in moldings.
- E. Seal moldings and panel joints with sealant.

3.4 FIELD QUALITY CONTROL

- A. Panels shall lay flush with substrate, without air pockets or warpage.
- B. Remove and replace panels not conforming to manufacturer's installation guidelines.

3.5 CLEANING

- A. Clean work under provisions of Section 01 77 00.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.

END OF SECTION

SECTION 09 90 00

PAINTING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Products and application.
- C. Surface finish schedule.

1.2 SUMMARY OF PAINTED SUBSTRATES

- A. Section includes the application of paint systems on the following interior substrates:

- 1. Concrete.
- 2. Concrete masonry units (CMU).
- 3. Primed or unprimed steel.
- 4. Cast iron.
- 5. Steel doors, frames and lights.
- 6. Glass frames in steel and wood doors.
- 7. Wood doors.
- 8. Access doors and frames.
- 9. Overhead coiling doors and frames.
- 10. Sectional overhead doors and frames.
- 11. Rolled steel windows.
- 12. Wood.
- 13. Horizontal and vertical gypsum board.
- 14. Plaster.
- 15. Spray-textured ceilings.
- 16. Suspended acoustic ceilings.
- 17. Applied acoustic ceilings.
- 18. Wall louvers.

- B. Section includes the application of paint systems on the following exterior substrates:

- 1. Concrete.
- 2. Concrete masonry units (CMU).
- 3. Primed or unprimed steel.

4. Galvanized metal.
5. Steel handrails, guardrails, and fittings.
6. Steel roof deck.
7. Steel lintels and shelf angles.
8. Decorative metal fencing.
9. Bollards.
10. Sheet metal flashing and trim.
11. Sheet metal gutters and downspouts.
12. Steel pipe downspouts.
13. Intumescent fireproofing.
14. Aluminum (not anodized or otherwise coated).
15. Steel doors, frames and lights.
16. Glass frames in steel and wood doors.
17. Wood doors.
18. Access doors and frames.
19. Overhead coiling doors and frames.
20. Sectional overhead doors and frames.
21. Rolled steel windows.
22. Wood.
23. Portland cement plaster (stucco).
24. Wall louvers.
25. Electrical panel board covers.

- C. Substrate listings are for principal surfaces only. Refer to drawings, details and individual specification sections for items, surfaces, and substrates not specifically listed.

1.3 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. SSPC - The Society for Protective Coatings.

1.4 SYSTEM DESCRIPTION

- A. Preparation of all surfaces to receive final finish.
- B. Painting and finishing work of this section using coating systems of materials including primers, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

- C. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- D. Painting and finishing all exterior and interior surfaces of materials including structural, mechanical, and electrical work on site, in building spaces, and above or on the roof.
- E. Paint exposed surfaces except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.

1.5 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.6 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.
- B. Applicator: Company specializing in commercial painting and finishing with five years documented experience.
- C. Coats: The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply such additional coats as are necessary to produce the required finish.
- D. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer.
- E. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.
- F. The minimum dry film thickness of each coat of paint shall comply with the manufacturer's recommendations for each type of paint used.

1.7 REGULATORY REQUIREMENTS

- A. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.
- B. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
- C. Comply with South Coast Air Quality Management District (SCAQMD) Rule 1113. A copy of this regulation can be obtained from <http://www.aqmd.gov/rules/reg/reg11/r1113.pdf>.
- D. In the South Coast Air Quality Management District (SCAQMD), where lower VOC contents are specified for a number of categories, certain products may be covered under the manufacturer's SCAQMD - approved Averaging Program. As a result, certain products may be fully compliant with SCAQMD Rule 1113, despite having VOC contents higher than specified limits.

1.8 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Product data for each coating type shall include as a minimum the following items. Listing shall be by manufacturer's catalog number:
 - 1. Solvent type.
 - 2. Resin type and percentage.

3. Prime pigments by percent of weight.
 4. Reinforcing pigment by percent of weight
 5. Solids and volume by weight.
 6. VOC and RAVOC limits.
 7. Coverage rates and film thickness both wet and dry.
 8. Conformance to environmental standards listed.
 9. Surface preparation recommendations.
 10. Application, storage, clean up and disposal recommendations.
 11. Special instructions from the manufacturer for proper preparation and application.
- C. Provide manufacturer's technical information and instructions for application of each material proposed for use by catalog number.
 - D. List each material by catalog number and cross-reference specific coating with specified finish system.
 - E. Technical data sheets and all container labels must match and shall contain the same product identification numbers. The term "Series " is not acceptable.
 - F. Provide manufacturer's written and signed certificate that products proposed meet or exceed specified materials.
 - G. Submit samples under provisions of Section 01 33 00.
 - H. Submit two samples 8-1/2 x 11 inch in size of each paint color and texture applied to cardboard. Resubmit samples until acceptable color, sheen and texture is obtained.
 - I. On same species and quality of wood to be installed, submit two 4 x 8 inch samples showing system to be used for varnishes and stains.

1.9 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 33 00.
- B. On wall surfaces and other exterior and interior components, duplicate specified finishes on at least 100 sq.ft. of surface area.
- C. Provide full-coat finishes until required coverage, sheen, color and texture are obtained.
- D. Simulate finished lighting conditions for review of field samples.
- E. After finishes are accepted, the accepted surface may remain as part of the work and will be used to evaluate subsequent coating systems applications of a similar nature.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and store and protect under provisions of Section 01 61 00.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
- C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing. Paint containers not displaying product identification will not be acceptable.

- D. Store paint materials at minimum ambient temperature of 50 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain interior surface and ambient temperatures above 50 degrees F with a maximum humidity level of 50 percent for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.
- C. Minimum Application Temperatures for Latex Paints: 50 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Urethane Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.12 EXTRA MATERIAL

- A. Provide a one gallon unopened container of each color to Owner.
- B. Label each container with color, texture, and room locations in addition to the manufacturer's label.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PAINT

- A. Unless specifically identified otherwise, product designations included in this section are those that are manufactured and distributed by the Dunn-Edwards Corporation, www.dunnedwards.com and shall serve as the basis of design standard for kind, quality, performance and function.
- B. Subject to full compliance with specified requirements, other manufacturers offering equivalent products are:
 - 1. Behr Process Corp., www.behrpaint.com.
 - 2. Benjamin Moore Paints, www.benjaminmoore.com.
 - 3. Glidden Professional, www.gliddenprofessional.com.
 - 4. Kelly-Moore Paint Company, www.kellymoore.com.
 - 5. Pittsburgh Paints, www.ppg.com.
 - 6. Sherwin Williams, www.sherwin-williams.com.
 - 7. Tnemec Company, Inc., www.tnemec.com.
 - 8. Vista Paint Corporation, www.vistapaint.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS - MULTICOLORED PAINT COATING

- A. Bollen International, Inc., (Crafton), www.bolleninternational.com.
- B. Dunn-Edwards Corporation (Multispec), www.dunnedwards.com.

- C. Textured Coatings of America (Tex-Cote), www.textcote.com.
- D. Trikes (Polomyx and Zolatone), www.zolatone.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.3 ACCEPTABLE MANUFACTURERS - CERAMIC EPOXY COATING

- A. Tnemec Company, Inc. www.tnemec.com.
- B. Vitrocem, www.vitrocem.com.

2.4 ACCEPTABLE MANUFACTURER - HEAT REFLECTIVE COATING

- A. Textured Coatings of America (Tex-Cote), www.textcote.com.

2.5 MATERIALS

- A. Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
- B. Good flow and brushing properties; capable of drying or curing free of streaks or sags.
- C. "Deep Tone" colors to be composed of 100 percent acrylic pigments with a colored base.
- D. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- E. Chemical Components of Interior Paints and Coatings: Shall not exceed the limitations of Green Seal's Standard GS-11 for VOC content and the following restrictions:
 - 1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
 - 2. Non-Flat Paints and Coatings: VOC content of not more than 50 g/L.
 - 3. Anticorrosive Coatings: VOC content of not more than 100 g/L.
 - 4. Varnishes and Sanding Sealers: VOC content of not more than 275 g/L.
 - 5. Stains: VOC content of not more than 250 g/L.
 - 6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - 7. Silica Compounds: Paints and coatings, to include colorants, shall not contain any silica.
 - 8. Restricted Components: Paints and coatings shall not contain any of the following:
 - (a) Acrolein.
 - (b) Acrylonitrile.
 - (c) Antimony.
 - (d) Benzene.
 - (e) Butyl benzyl phthalate.
 - (f) Cadmium.
 - (g) Di (2-ethylhexyl) phthalate.

- (h) Di-n-butyl phthalate.
- (i) Di-n-octyl phthalate.
- (j) 1,2-dichlorobenzene.
- (k) Diethyl phthalate.
- (l) Dimethyl phthalate.
- (m) Ethylbenzene.
- (n) Ethylene Glycol.
- (o) Formaldehyde.
- (p) Hexavalent chromium.
- (q) Isophorone.
- (r) Lead.
- (s) Mercury.
- (t) Methyl ethyl ketone.
- (u) Methyl isobutyl ketone.
- (v) Methylene chloride.
- (w) Naphthalene.
- (x) Toluene (methylbenzene).
- (y) 1,1,1-trichloroethane.
- (z) Vinyl chloride.

2.6 FINISHES

- A. Refer to schedule at end of Section for surface finish schedule.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard	:	12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry	:	12 percent.
3. Interior Located Wood	:	15 percent.
4. Exterior Located Wood	:	15 percent.

- D. Beginning of installation means acceptance of existing surfaces.

3.2 SURFACE PREPARATION - GENERAL

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Remove all finish hardware from doors and frames prior to preparing surfaces or finishing.
- C. Correct minor defects and clean surfaces which affect work of this Section.
- D. Shellac and seal marks which may bleed through surface finishes.
- E. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Aluminum Surfaces: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Gypsum Board: Repair all voids, nicks, cracks and dents with patching materials and finish flush with adjacent surface. Latex fill minor defects. Spot prime defects after repair.
- J. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Pretreat with phosphoric acid etch or vinyl wash. Apply coat of etching primer the same day as pretreatment is applied.
- K. Concrete and Unit Masonry: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- L. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- M. Uncoated Steel and Iron: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint after repairs.
- N. Shop Primed Steel: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime paint steel surfaces.
- O. Interior Wood: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- P. Exterior Wood: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- Q. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- R. Wood Doors: Seal top and bottom edges with 2 coats of spar varnish sealer.
- S. Existing surfaces to be recoated shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.

3.3 SURFACE PREPARATION - MODERNIZATION

- A. Properly prepare all existing surfaces to receive new paint.
- B. Prior to application of any new paint, existing surfaces to be cleaned free of damaged paint, dust, corrosion, and other foreign matter which will destroy bond or mar appearance of new paint.
- C. Sand, scrape, fill and repair surfaces flush with suitable fillers. Patch and repair; feather edges to provide smooth transitions; match existing surfaces.
- D. Remove hardware and accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- E. Existing surfaces to be painted shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as for new work.
- F. Existing paint removal:
 - 1. Remove loose, blistered, scaled, oxidized, cracked, alligatored, or defaced paint down to a sound surface.
 - 2. Brush and clean free all loose material.
 - 3. Feather edges of removal areas to provide a smooth transition between surfaces.
- G. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
- H. Washing and Cleaning:
 - 1. Remove all loose and foreign materials.
 - 2. At building interiors, wash all surfaces clean with approved cleaner and rinse with clean water.
 - 3. At building interiors, vacuum existing ceiling panels to remove all dirt and dust from the material surface. Utilize caution so as not to mar or damage the finish surface in any way.
 - 4. Completely remove wax from surfaces which receive new paint.
- I. Remove dust, grit, and foreign matter from existing wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks, and other defects after priming and spot prime repairs when fully cured.
- J. Repair and crack filling:
 - 1. Wood: Putty cracks and holes flush at stained and or varnished work, color putty to match. Sand smooth any rough spots. Seal knots and pitch pockets.
 - 2. Gypsum Wallboard: Fill all nail heads, screw heads, holes, cracks, or defects with drywall joint compound or spackle. Sand any rough spots smooth; do not raise nap on paper covering. Remove dust. Skim coat drywall must be sealed with a suitable sealer recommended by the coating manufacturer.
 - 3. Plaster:
 - (a) Cracks exceeding 1/16 inch wide shall be V-grooved out, and then filled flush.
 - (b) Interior Plaster: Fill with spackle or patching plaster.

- (c) Exterior Plaster: Small defects may be filled with exterior spackle. Cracks more than 1/16 inch wide shall be filled with cement grout, textured to match adjacent surfaces.
- 4. Concrete / Masonry: Fill as specified for exterior plaster.
- K. Natural / Stain Finished Wood Doors:
 - 1. Typically, fully strip existing natural finish clear coat, fill all dents, gouges, scrapes, etc., and finish sand to prepare surface to receive a complete new finish coat system.
 - 2. All patching materials shall be natural wood dough tinted to match existing natural wood color.
 - 3. Doors shall appear as new when work is finished.
- L. Concrete and masonry surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, mortar spots, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
- M. Ferrous metal shall be cleaned of oil, grease, and foreign matter. Cleaning method: SSPC-SP No. 1 "Solvent Cleaning".
- N. Ferrous Steel: Where raw metal surface is exposed, proceeds follows:
 - 1. Cleaning method: SSPC-SP No. 2 "Hand Cleaning" or No. 3 "Power Brush Cleaning" as required to remove corrosion, loose paint, and rust.
 - 2. Priming: Prime immediately after cleaning.
- O. Galvanized Metal: Where galvanizing is exposed, proceed as follows:
 - 1. Cleaning: Solvent clean per SSPC-SP No. 1 "Solvent Cleaning".
 - 2. Pre-Treatment; Apply Supreme Chemical Metal Clean and Etch SC-ME01, follow manufacturer's recommendations and the following:
 - (a) Application: Brush apply in a thin even coat. Remove excessive solution from surface with rags, squeegee, or sponge. When using full strength, rinse surface with water.
 - (b) Thinning: Use water, do not reduce solution beyond 3 parts water to 1 part Supreme Chemical Metal Clean and Etch SC-ME01.
 - (c) Drying: Allow to dry for 10 minutes, rinse thoroughly with water and wipe dry with rags.
 - 3. Cleaned and treated galvanized metal should be primed within 48 hours.
- P. Thoroughly back paint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Back paint items to be painted with a priming coat. Use a clear sealer for back priming where transparent finish is required.
- Q. Pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.

3.4 PROTECTION OF ADJACENT WORK

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

- D. Remove empty paint containers from site.

3.5 WORK NOT TO BE PAINTED

- A. Painting is not required on surfaces in concealed and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.
- B. Do not paint metal surfaces such as stainless steel, chromium plate, brass, bronze, and similar finished metal surfaces.
- C. Do not paint anodized aluminum or other surfaces which are specified to be factory pre-finished.
- D. Do not paint sandblasted or architecturally finished concrete surfaces.
- E. Do not paint prefinished acoustic materials or acoustic suspension systems unless called out on finish schedule.
- F. Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.

3.6 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply prime coat to surfaces which are to be painted or finished.
- D. Apply each coat to uniform finish.
- E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand lightly between coats to achieve required finish.
- G. Allow applied coat to dry before next coat is applied.
- H. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
- I. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Prime back surfaces of interior and exterior woodwork with primer paint.
- K. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- L. Paint mill finished door seals to match door or frame.
- M. Paint primed steel glazing stops in doors to match door or frame.
- N. Cloudiness, spotting, lap marks, brush marks, runs, sags, spikes and other surface imperfections will not be acceptable.
- O. Where spray application is used, apply each coat of the required thickness. Do not double back to build up film thickness of two coats in one pass.
- P. Where roller application is used, roll and redistribute paint to an even and fine texture. Leave no evidence of roller laps, irregularity of texture, skid marks, or other surface imperfections.

3.7 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint shop primed equipment. Do not paint shop prefinished items.
- B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- D. Replace identification markings on mechanical or electrical equipment when painted accidentally.
- E. Paint interior surfaces of air ducts, and connector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and connector and baseboard cabinets to match face panels.
- F. Paint exposed conduit and electrical equipment occurring in finished areas.
- G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.
- I. Paint grilles, registers, and diffusers which do not match color of adjacent surface.
- J. Paint all mechanical and electrical equipment, vents, fans, and the like occurring on roof.
- K. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts.
- L. Do not paint over labels or equipment identification markings.
- M. Do not paint mechanical room specialties such as compressors, boilers, pumps, control panels, etc.
- N. Do not paint switch plates, light fixtures, and fixture lenses.

3.8 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.9 PROTECTION OF COMPLETED WORK

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Erect barriers and post warning signs. Maintain in place until coatings are fully dry.
- C. Confirm that no dust generating activities will occur following application of coatings.

3.10 PATCHING

- A. After completion of painting in any one room or area, repair surfaces damaged by other trades.
- B. Touch-up or re-finish as required to produce intended appearance.

3.11 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary.
- C. The Owner will engage the services of an independent testing agency to sample paint material being used.
- D. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
- E. The testing agency will perform appropriate quantitative materials analysis and other characteristic testing of materials as required by the Owner.
- F. If test results show materials being used and their installation do not comply with specified requirements or manufacturer's recommendations, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing and repaint surfaces to acceptable condition.

3.12 COLOR SCHEDULE

- A. Paint and finish colors shall be selected by the Architect from manufacturer's entire range of standard and custom color selections and special colors selected to match or compliment the colors of other materials, equipment, or components which comprise the work.
- B. Access doors, registers, exposed piping, electrical conduit and mechanical/electrical panels: Generally the same color as adjacent walls.
- C. Exterior and interior steel doors, frames and trim: Generally a contrasting color to adjacent walls.
- D. Doors generally are all the same color, but of a contrasting color from frame and trim.
- E. Exterior and interior steel fabrications: Generally a contrasting color to adjacent walls.
- F. Exposed interior mechanical/ductwork: Generally a contrasting color to adjacent walls or ceiling.
- G. Ceilings are generally to be painted a different color than walls.
- H. See elevation for different color schemes for painting of walls.
- I. Approximately 20 percent of overall painting work will be required to be "Deep Tone" colors. This work will require one additional coat of paint beyond that as specified.

3.13 SCHEDULE - EXTERIOR SURFACES

- A. Wood-Painted (Flat Acrylic)
 - 1st coat: ESZPROO EZ Prime Premium
 - 2nd coat: EVSH10 Evershield
 - 3rd coat: EVSH10 Evershield
- B. Wood Painted (Eggshell Acrylic)
 - 1st coat: EZPROO EZ Prime Premium
 - 2nd coat: EVSH30 Evershield
 - 3rd coat: EVSH30 Evershield

- | | | |
|----|---|---------------------------------------|
| C. | Wood - Painted (Semi-Gloss Acrylic) | |
| | 1st coat: | EZPROO EZ Prime Premium |
| | 2nd coat: | SSHL50 Spartashield |
| | 3rd coat: | SSHL50 Spartashield |
| D. | Wood - Painted (Gloss Acrylic) | |
| | 1st coat: | EZPROO EZ Prime Premium |
| | 2nd coat: | SSHL60 Spartashield |
| | 3rd coat: | SSHL60 Spartashield |
| E. | Wood - Semi-Transparent | |
| | 1st coat: | OKN-19-OKON Weather Pro ST Wood Stain |
| F. | Concrete (Flat Acrylic) | |
| | 1st coat: | ESPROO Eff-Stop Premium |
| | 2nd coat: | EVSH10 Evershield |
| | 3rd coat: | EVSH10 Evershield |
| G. | Concrete (Eggshell Acrylic) | |
| | 1st coat: | ESPROO Eff-Stop Premium |
| | 2nd coat: | EVSH30 Evershield |
| | 3rd coat: | EVSH30 Evershield |
| H. | Concrete Masonry Units (Flat Acrylic) | |
| | Fill coat: | SBRPROO Smooth Blocfil Premium |
| | 1st coat: | EVSH10 Evershield |
| | 2nd coat: | EVSH10 Evershield |
| I. | Concrete Masonry Units (Eggshell - Acrylic) | |
| | Fill coat: | SBRPROO Smooth Blocfil Premium |
| | 1st coat: | EVSH30 Evershield |
| | 2nd coat: | EVSH30 Evershield |
| J. | Concrete Masonry Units (Flat Elastomeric) | |
| | 1st coat: | FPSL00 Flex Prime Select |
| | 2nd coat: | EDLX10 Enduralastic 10 |
| | 3rd coat: | EDLX10 Enduralastic 10 |
| K. | Cement Plaster (Flat Acrylic) | |
| | 1st coat: | ESPROO Eff-Stop Premium |
| | 2nd coat: | EVSH10 Evershield |
| | 3rd coat: | EVSH10 Evershield |

- L. Cement Plaster (Eggshell Acrylic)
- 1st coat: ESPROO Eff-Stop Premium
- 2nd coat: EVSH30 Evershield
- 3rd coat: EVSH30 Evershield
- M. Cement Plaster (Flat Elastomeric)
- 1st coat: FPSL00 Flex Prime Select
- 2nd coat: EDLX10 Enduralastic 10
- 3rd coat: EDLX10 Enduralastic 10
- N. Steel-Primed or Unprimed (Flat Acrylic)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: EVSH10 Evershield
- 3rd coat: EVSH10 Evershield
- O. Steel - Primed or Unprimed (Eggshell Urethane Alkyd Enamel)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: ASHL30 Aristoshield
- 3rd coat: ASHL30 Aristoshield
- P. Steel - Primed or Unprimed (Semi-Gloss Urethane Alkyd Enamel)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: ASHL50 Aristoshield
- 3rd coat: ASHL50 Aristoshield
- Q. Steel - Primed or Unprimed (Gloss Urethane Alkyd Enamel)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: ASHL70 Aristoshield
- 3rd coat: ASHL70 Aristoshield
- R. Steel - Galvanized and Aluminum (Flat Acrylic)
- 1st coat: Pre Treat - Supreme Chemical Metal Clean and Etch SCME-01
- 2nd coat: ULGM00 Ultrashield Galvanized Metal Primer
- 3rd coat: EVSH10 Evershield
- 4th coat: EVSH10 Evershield
- S. Steel - Galvanized and Aluminum (Eggshell Urethane Alkyd Enamel)
- 1st coat: Supreme Chemical Metal Clean and Etch SCME-01
- 2nd coat: ULGM00 Ultrashield Galvanized Metal Primer
- 3rd coat: ASHL30 Aristoshield
- 4th coat: ASHL30 Aristoshield

- T. Steel - Galvanized and Aluminum (Semi-Gloss Urethane Alkyd Enamel)
- | | |
|-----------|---|
| 1st coat: | Supreme Chemical Metal Clean and Etch SCME-01 |
| 2nd coat: | ULGM00 Ultrashield Galvanized Metal Primer |
| 3rd coat: | ASHL50 Aristoshield |
| 4th coat: | ASHL50 Aristoshield |
- U. Steel - Galvanized and Aluminum (Gloss Urethane Alkyd Enamel)
- | | |
|-----------|---|
| 1st coat: | Supreme Chemical Metal Clean and Etch SCME-01 |
| 2nd coat: | ULGM00 Ultrashield Galvanized Metal Primer |
| 3rd coat: | ASHL70 Aristoshield |
| 4th coat: | ASHL70 Aristoshield |

3.14 SCHEDULE - INTERIOR SURFACES

- A. Wood - Painted (Eggshell, Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | UGPROO Ultra-Grip Premium |
| 2nd coat: | SPMA30 Suprema |
| 3rd coat: | SPMA30 Suprema |
- B. Wood - Painted (Semi-Gloss Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | UGPROO Ultra-Grip Premium |
| 2nd coat: | SPMA50 Suprema |
| 3rd coat: | SPMA50 Suprema |
- C. Wood-Painted (Gloss Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | UGPROO Ultra-Grip Premium |
| 2nd coat: | SSHL60 Spartashield |
| 3rd coat: | SSHL60 Spartashield |
- D. Glue-Laminated Wood and Wood Timber Members (Satin-Flat Polyurethane)
- | | |
|-----------|------------------------------------|
| 1st coat: | V109 Stainseal - Minwax Stain |
| 2nd coat: | Cabot W.B. Polyurethane CAB 8082-1 |
| 3rd coat: | Cabot W.B. Polyurethane CAB 8082-1 |
| 4th coat: | Cabot W.B. Polyurethane CAB 8082-1 |
- E. Wood - Transparent (Stain - Semi-Gloss Polyurethane)
- | | |
|-------------------------------------|------------------------------------|
| 1st coat: | V109 Stainseal - Minwax Stain |
| Filler coat (Open grain wood only): | Valspar Wood Filler VSP 0109 |
| 2nd coat: | Cabot W.B. Polyurethane CAB 8087-1 |
| 3rd coat: | Cabot W.B. Polyurethane CAB 8087-1 |
| 4th coat: | Cabot W.B. Polyurethane CAB 8087-1 |

- F. Wood-Transparent (Stain-Semi-Gloss Lacquer)
- | | |
|-----------|-----------------------------------|
| 1st coat: | Valspar Stainseal V-QYB and V-QYR |
| 2nd coat: | Contractors Edge CE-275PROSS |
| 3rd coat: | Contractors Edge CE-275PRO60 |
| 4th coat: | Contractors Edge CE-275PRO60 |
- G. Concrete (Flat-Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | UGPROO Ultra-Grip Premium |
| 2nd coat: | SPMA10 Suprema |
| 3rd coat: | SPMA 10 Suprema |
- H. Concrete (Eggshell, Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | UGPROO Ultra-Grip Premium |
| 2nd coat: | SPMA30 Suprema |
| 3rd coat: | SPMA30 Suprema |
- I. Concrete (Semi Gloss Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | UGPROO Ultra-Grip Premium |
| 2nd coat: | SPMA50 Suprema |
| 3rd coat: | SPMA50 Suprema |
- J. Concrete Floors - Sealed (Low Sheen Epoxy Acrylic)
- | | |
|-----------|--|
| 1st coat: | Seal Krete - Clean - N - Etch |
| 2nd coat: | Seal Krete - Lock Down Primer |
| 3rd coat: | Seal Krete - Epoxy Seal with Decorative Flakes |
| 4th coat: | Seal Krete - Clear Sealer |
- K. Concrete Masonry Units (Flat Acrylic)
- | | |
|-----------|-------------------------------|
| 1st coat: | SBPROO Smooth Blocfil Premium |
| 2nd coat: | SPMA10 Suprema |
| 3rd coat: | SPMA10 Suprema |
- L. Concrete Masonry Units (Eggshell, Acrylic)
- | | |
|-----------|-------------------------------|
| 1st coat: | SBPROO Smooth Blocfil Premium |
| 2nd coat: | SPMA30 Suprema |
| 3rd coat: | SPMA30 Suprema |
- M. Concrete Masonry Units (Semi Gloss Acrylic)
- | | |
|-----------|-------------------------------|
| 1st coat: | SBPROO Smooth Blocfil Premium |
| 2nd coat: | SPMA50 Suprema |
| 3rd coat: | SPMA50 Suprema |

- N. Concrete Masonry Units (Semi Gloss Epoxy)
- 1st coat: Carboline Sanitile 100
- 2nd coat: Carboline Carboguard 890 VOC
- 3rd coat: Carboline Carboguard 890 VOC
- O. Steel - Primed or Unprimed (Flat Acrylic)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: SPMA10 Suprema
- 3rd coat: SPMA10 Suprema
- P. Steel - Primed or Unprimed (Eggshell, Urethane Alkyd Enamel)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: ASHL30 Aristoshield
- 3rd coat: ASHL30 Aristoshield
- Q. Steel - Primed or Unprimed (Semi-Gloss Urethane Alkyd Enamel)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: ASHL50 Aristoshield
- 3rd coat: ASHL50 Aristoshield
- R. Steel - Primed or Unprimed (Gloss Urethane Alkyd Enamel)
- 1st coat: BRPR00 Bloc-Rust Premium
- 2nd coat: ASHL70 Aristoshield
- 3rd coat: ASHL70 Aristoshield
- S. Steel - Galvanized and Aluminum (Flat Acrylic)
- 1st coat: ULGM00 Ultrashield Galvanized Metal Primer
- 2nd coat: SPMA10 Suprema
- 3rd coat: SPMA10 Suprema
- T. Steel - Galvanized and Aluminum (Eggshell, Urethane Alkyd Enamel)
- 1st coat: ULGM00 Ultrashield Galvanized Metal Primer
- 2nd coat: ASHL30 Aristoshield
- 3rd coat: ASHL30 Aristoshield
- U. Steel - Galvanized and Aluminum (Semi-Gloss Urethane Alkyd Enamel)
- 1st coat: ULGM00 Ultrashield Galvanized Metal Primer
- 2nd coat: ASHL50 Aristoshield
- 3rd coat: ASHL50 Aristoshield
- V. Steel - Galvanized and Aluminum (Gloss Urethane Alkyd Enamel)
- 1st coat: ULGM00 Ultrashield Galvanized Metal Primer
- 2nd coat: ASHL70 Aristoshield
- 3rd coat: ASHL70 Aristoshield

W.	Gypsum Board (Flat Acrylic)	
	1st coat:	VNPROO Vinylastic Premium
	2nd coat:	SPMA10 Suprema
	3rd coat:	SPMA10 Suprema
X.	Gypsum Board (Eggshell Acrylic)	
	1st coat:	VNPROO Vinylastic Premium
	2nd coat:	SPMA30 Suprema
	3rd coat:	SPMA30 Suprema
Y.	Gypsum Board (Semi-Gloss Acrylic)	
	1st coat:	VNPROO Vinylastic Premium
	2nd coat:	SPMA50 Suprema
	3rd coat:	SPMA50 Suprema
Z.	Gypsum Board (Gloss Acrylic)	
	1st coat:	VNPROO Vinylastic Premium
	2nd coat:	SSHL60 Spartashield
	3rd coat:	SSHL60 Spartashield
AA.	Gypsum Board (Gloss Epoxy)	
	1st coat:	Carboline Sanitile 120
	2nd coat:	Carboline Carboguard 890 VOC
	3rd coat:	Carboline Carboguard 890 VOC
BB.	Plaster (Flat Acrylic)	
	1st coat:	ESPROO Eff-Stop Premium
	2nd coat:	SPMA10 Suprema
	3rd coat:	SPMA10 Suprema
CC.	Plaster (Eggshell Acrylic)	
	1st coat:	ESPROO Eff-Stop Premium
	2nd coat:	SPMA30 Suprema
	3rd coat:	SPMA30 Suprema
DD.	Plaster (Semi Gloss Acrylic)	
	1st coat:	ESPROO Eff-Stop
	2nd coat:	SPMA50 Suprema
	3rd coat:	SPMA50 Suprema
EE.	Plaster (Gloss Acrylic)	
	1st coat:	ESPROO Eff-Stop Premium Primer
	2nd coat:	SSHL60 Spartashield
	3rd coat:	SSHL60 Spartashield

FF. Plaster (Gloss Epoxy)

1st coat:	Carboline Sanitile 120
2nd coat:	Carboline Carboguard 890 VOC
3rd coat:	Carboline Carboguard 890 VOC

GG. Acoustic Ceiling Panels (Flat polyvinyl acetate)

1st coat:	W615 AcoustiKote
2nd coat:	W615 AcoustiKote

HH. Acoustic Panels - Wood - Tectum (Latex Dry Fall Eggshell)

1st coat:	Aqua 30 Aquafall
2nd coat:	Aqua 30 Aquafall

3.15 SCHEDULE - SPECIAL SURFACES

A. Wood - Painted (Polyurethane Enamel Gloss)

1st coat:	Carboline Carbocrylic 120
2nd coat:	Carboline Carbothane 134 MC
3rd coat:	Carboline Carbothane 134 MC

B. Steel-Primed or Unprimed (Polyurethane Enamel Semi Gloss)

1st coat:	Carboguard 890 MC
2nd coat:	Carbothane 133 MC
3rd coat:	Carbothane 133 MC

C. Plaster, Gypsum Board (Polyurethane Enamel Gloss)

1st coat:	Carbocrylic 120
2nd coat:	Carbothane 134 MC
3rd coat:	Carbothane 134 MC

D. Concrete (Multi Colored Coating)

1st coat:	Polomyx No. 202 Basecoat
2nd coat:	Polomyx Aegis Series Finish Coat
3rd coat:	Polomyx Aegis Series Finish Coat

E. Concrete Masonry Units (Multi Colored Coating)

1st coat:	Polomyx No. 206 Block Filler
2nd coat:	Polomyx Aegis Series Finish Coat
3rd coat:	Polomyx Aegis Series Finish Coat

F. Steel - Primed or Unprimed (Multi Colored Coating)

1st coat:	Polomyx No. 210 Metal Basecoat
2nd coat:	Polomyx Aegis Series Finish Coat
3rd coat:	Polomyx Aegis Series Finish Coat

- G. Steel - Galvanized - (Multi Colored Coating)
- | | |
|-----------|-------------------------------------|
| 1st coat: | Polomyx No. 212 Galvanized Basecoat |
| 2nd coat: | Polomyx Aegis Series Finish Coat |
| 3rd coat: | Polomyx Aegis Series Finish Coat |
- H. Gypsum Board (Multi Colored Coating)
- | | |
|-----------|----------------------------------|
| 1st coat: | Polomyx SPII ECO - Block |
| 2nd coat: | Polomyx Aegis Series Finish Coat |
| 3rd coat: | Polomyx Aegis Series Finish Coat |
- I. Plaster (Multi Colored Coating)
- | | |
|-----------|----------------------------------|
| 1st coat: | Polomyx No. 202 Basecoat |
| 2nd coat: | Polomyx Aegis Series Finish Coat |
| 3rd coat: | Polomyx Aegis Series Finish Coat |
- J. Gypsum Board (Ceramic Epoxy Coating)
- | | |
|-----------|-------------------------------|
| 1st coat: | Tnemec Series 201 Epoxprime |
| 2nd coat: | Tnemec Series 280 Tneme-Glaze |
| 3rd coat: | Tnemec Series 280 Tneme-Glaze |
- K. Concrete Masonry Units (Ceramic Epoxy Coating)
- | | |
|------------|-------------------------------|
| Fill coat: | Tnemec Series 130 Envirofil |
| 1st coat: | Tnemec Series 201 Epoxprime |
| 2nd coat: | Tnemec Series 280 Tneme-Glaze |
| 3rd coat: | Tnemec Series 280 Tneme-Glaze |

END OF SECTION

SECTION 09 96 23

GRAFFITI RESISTANT COATING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Anti-graffiti coating system on exterior surfaces.
- B. Application schedule.

1.2 REFERENCES

- A. SCAQMD - South Coast Air Quality Management District

1.3 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00.
- B. Samples: Submit samples of coating system.
- C. Furnish samples on the same materials to which coating will be applied. Coat one-half of each sample with the other half non-coated.
- D. Product Data: Submit manufacturer's technical data and installation instructions, recommended coverage rates, and evidence that coatings conform to all requirements specified. Submit evidence of regulatory agency approvals.
- E. Installer: Submit written evidence that installer is a certified applicator by the manufacturer of the anti-graffiti coating system specified in this section and has completed at least 10 projects of similar complexity within the past 5 years.
- F. Certificate and Summary Statement: Before Substantial Completion, submit a certificate stating that coatings applied conform to all specified requirements. Provide a summary statement setting forth the following:
 - 1. Number of square feet of each surface treated with coating, classified as to the kind of material treated, open pore or closed pore type, and whether vertical or horizontal.
 - 2. The number of gallons of each type, class, or grade of coating required to treat all involved surfaces, based on the number of square feet of each type and orientation of the material coating was installed on.
 - 3. Total gallons of each coating type, class, or grade installed.
- G. Maintenance Instructions: Furnish manufacturer's recommended graffiti removal instructions, and recommendations for recoating. Furnish names and addresses of cleaning firms and of suppliers of maintenance materials.
- H. Maintenance Material: Furnish five gallons of each coating system component and remover.

1.4 QUALITY ASSURANCE

- A. Installer: Applicator shall be certified by the manufacturer of the anti-graffiti coating system.
- B. Manufacturer: Shall have been regularly engaged in manufacture of anti-graffiti coating system for at least 10 years. Manufacturer shall supply references of at least 50 satisfactory installations in which anti-graffiti coating has been in service for at least 5 years.

- C. Manufacturer's Observation: Start coating application under the observation of the coating manufacturer's technical representative. Notify the Architect at least 72 hours before starting installation.
- D. Preliminary Tests: Perform tests on surface to be treated to establish the actual application rates required to provide the surface resistant to defacing and meet warranty requirements. Test shall demonstrate the coating does not yellow, darken, mottle, or discolor any treated surface and those surfaces to be treated are dry. Established application rates shall not be less than those recommended in the coating manufacturer's technical data for the kind and surface orientation of the material.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Deliver all coating materials to the Project site in containers bearing name and batch number of manufacturer, with seals intact.
- C. Protection: Install temporary coverings and protection and do not allow any coating to contact plastic, planting soil, plants, asphaltic paving, roofing membranes, or other materials damaged by coating.

1.6 PROJECT CONDITIONS

- A. Weather Conditions: Do not install coating during windy, wet, or excessively hot or dry weather conditions.
- B. Air temperature limitations are between 40 and 100 degrees F with a humidity level of no more than 85 percent.

1.7 WARRANTY

- A. Provide 10 year warranty under provisions of Section 01 77 00.
- B. Warranty shall include coverage for failure of system to withstand complete graffiti removal, ghosting, shadowing, chemical staining, yellowing, and normal environmental effects.

2. PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Graffiti Solution System (GSS) manufactured by GSS Coatings, LLC, www.gsscoatings.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 COATING MATERIALS

- A. Primer: GSS500 Aqua-lock WB siloxane penetrating water sealer.
- B. GSS-10 Top Coat: GSS100 clear matte.
- C. Graffiti Remover: GSS-Erasol, non-flammable, biodegradable graffiti remover.

2.3 PROPERTIES

- A. Coating shall not darken or discolor treated surfaces and shall be non-toxic, compatible with all standard polymer type caulking and sealing materials.
- B. Coating system shall conform to AQMD Rule 1113.

- C. Coatings shall be non-sacrificial.

3. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not start installation of coating if conditions are present that prevent or interfere with the correct preparation of surfaces or installation of coating system.

3.2 PREPARATION

- A. Remove dust, dirt, oil, grease, other deleterious substances and stain, efflorescence and laitance from surfaces.
- B. Mask and protect adjoining surfaces and glass.

3.3 APPLICATION

- A. Install anti-graffiti coating system to surface areas in locations as indicated on drawings.
- B. Primer: Apply coating in one continuous successive wet-on-wet application in accordance with manufacturer's instructions. Minimum coating thickness of 3 to 4 mils dry film thickness.
- C. Undercoating and Top Coat Application Rates: Install base and finish coats in a minimum of one coat each as recommended by manufacturer, in the quantity of coating and coverage rates per coat established by preliminary tests. Total quantity shall not be less than the rate recommended for the involved surface in manufacturer's technical data.
- D. Spray Application: Install each coat by airless spray with nominal 20 psi nozzle pressure. Obtain complete coverage of each coat. Document areas that are coated when application is stopped or at the end of the day.
- E. Apply anti-graffiti coating 9'-0" from finished exterior grade line full height of wall surface unless noted otherwise.

3.4 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off site.

3.5 FIELD QUALITY CONTROL

- A. Apply an alkyd based graffiti to a 2 square foot treated area as selected by Architect.
- B. Apply graffiti a minimum of 5 days after anti-graffiti coating application.
- C. Demonstrate complete removal of graffiti in presence of Architect.

3.6 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.7 APPLICATION SCHEDULE

- A. Apply anti-graffiti coating system to the following exterior surfaces:
 - 1. Per plans and elevations.

END OF SECTION

SECTION 10 11 19

MARKERBOARDS AND TACKBOARDS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Markerboards.
- B. Tackboards.
- C. Trim, chalkrail, and accessories.

1.2 REFERENCES

- A. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- C. ASTM A424 - Steel Sheets for Porcelain Enameling.
- D. ASTM C208 - Insulation Board (Cellulose Fiber).
- E. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- F. CFFA-W-101-A - Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wallcovering.
- G. FS CCC-W-408 A and B - Wall Covering, Vinyl-Coated.
- H. Porcelain Enamel Institute - Performance Specifications for Porcelain Enamel Chalkboards.
- I. UL - Underwriters Laboratories, Inc.

1.3 REGULATORY REQUIREMENTS

- A. Conform to flame/fuel/smoke rating of 25/0/25 for vinyl fabric covered tackboards when tested in accordance with ASTM E84 by UL.

1.4 SUBMITTALS

- A. Provide product data on markerboards, tackboards, tackboard surface covering, trim and accessories.
- B. Submit samples under provisions of Section 01 33 00.
- C. Submit two samples 6 x 6 inch in size illustrating materials and finish, color, and texture of markerboard, tackboard surfacing.
- D. Horizontal Sliding Panel System: Submit 18 x 24 inch sample panel illustrating materials and construction.

1.5 MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include maintenance information on regular cleaning and stain removal.

1.6 WARRANTY

- A. Provide five year warranty under provisions of Section 01 77 00.

- B. Warranty: Include coverage for discoloration of surfaces due to cleaning, crazing or cracking and staining.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. AARCO Products, Inc., www.aarco.com.
- B. Claridge Products and Equipment, Inc., www.claridgeproducts.com.
- C. Lemco, www.adplemco.com.
- D. Nelson Adams, www.nelsonadamsnaco.com
- E. Platinum Visual Systems, www.pvsusa.com.
- F. Tri-Best Visual Display Products, www.tri-best.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Steel Sheet: ASTM A424, Type I, commercial quality.
- B. Aluminum Extrusions: ASTM B221, 6063 alloy, T5 temper.
- C. Cork: Fine grain natural cork, homogeneous composition.
- D. Particle Board: ANSI A208.1; wood shavings set with waterproof resin binder, sanded faces.
- E. Fiberboard: Industrial insulation board, ironed and prime coated, ASTM C208, cellulosic, 3/8 inch thick, 4 foot wide x required length, made with binder containing no urea formaldehyde.
- F. Foil Backing: Aluminum foil sheet.
- G. Honeycomb: Honeycell/Honeycomb.
- H. Tackboard Covering: Koroseal Wallcoverings, www.koroseal.com conforming to FS CCC-W-408 A and B and CFFA W-101-B, Type II and the following:
 - 1. Total Weight: 20 oz/lin yd
 - 2. Roll Width: 54 inches
 - 3. Pattern: Spellbound or Muratone
 - 4. Color: As selected
- I. Adhesives: Type recommended by manufacturer.

2.3 ACCESSORIES

- A. Map Rail Accessories: Formed aluminum display hooks, map roller brackets, and flag holder. Sliding type to fit map rail. One pair of display hooks and map roller brackets for every two feet of map rail. One flag holder per map rail.
- B. Protective Cover: Sheet polyethylene, 8 mil thick.
- C. Blocking Pads: Manufacturer's standard padding designed to prevent deflection.
- D. Metal Mounting Clips: Steel angle clips, 2 inches long x 16 gage thick.

2.4 FABRICATION - MARKERBOARDS

- A. Outer Face Sheet: Steel, 24 gage thick. Equivalent to Claridge LCS.
- B. Core: Particle Board, 3/8 inch thick
- C. Backing Surface: Aluminum foil, 0.005 inch thick.
- D. Units up to 16 feet in length to be one piece construction, no joints.

2.5 FABRICATION - TACKBOARDS

- A. Outer Facing: Tackboard covering.
- B. Underlayment: Cork, 1/8 inch thick.
- C. Core: Fiberboard, 3/8 inch thick.
- D. Units up to 16 feet in length to be one piece construction, no joints.

2.6 FRAME AND TRIM

- A. Frame: Extruded aluminum, equivalent to Claridge Series 5 profile; concealed fasteners; map rail with 1/4 inch thick cork insert over markerboard surfaces.
- B. Chalkrail: Extruded aluminum, equivalent to Claridge 992 profile; one piece, full length of markerboard; concealed fasteners.

2.7 HORIZONTAL SLIDING PANEL ASSEMBLY

- A. Frame, Hardware, and Accessories
 - 1. Trim: PVCO C-12 extruded aluminum with punched and wrapped safety corner.
 - 2. Top Track: PVCO C-1 extruded aluminum guide.
 - 3. Bottom Track: PVCO BT-1 extruded aluminum track.
 - 4. Filler Strip: PVCO BT-1F extruded aluminum series.
 - 5. Rollers: PVCO HB Series, Model MAL-33 bottom rollers.
 - 6. Sheaves: PVCO 1607 adjustable brass ball bearing sheaves. Two wheels per sheave and two sheaves per panel.

2.8 FINISHES

- A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; low gloss; white color.
- B. Tackboard Surface: Vinyl of color as selected from manufacturer's standard range.
- C. Aluminum Frame and Accessories: Clear satin finish.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces and internal wall blocking are ready to receive work, and dimensions are as instructed by the manufacturer.

- B. Beginning of installation means acceptance of substrate construction.

3.2 INSTALLATION

- A. Install markerboards and tackboards in accordance with manufacturer's instructions and as indicated on drawings.
- B. Install blocking pads behind markerboards and tackboards at 16 inches on center both vertically and horizontally.
- C. Install metal clips at 16 inches on center at sides and bottom of boards.
- D. Secure units level and plumb.
- E. Butt markerboard panels tight with concealed spline to hairline joint.
- F. Carefully cut holes in markerboards and tackboards for thermostats, wall switches, and other wall mounted objects.

3.3 CLEANING

- A. Clean markerboard and tackboard surfaces in accordance with manufacturer's instructions.
- B. Cover markerboard surfaces with protective cover, taped to frame.
- C. Remove protective cover at Date of Substantial Completion.

3.4 HORIZONTAL SLIDING PANEL ASSEMBLY CONFIGURATION SCHEDULE

- A. Abbreviations: MB - Markerboard, TB - Tackboard.
- B. Schedule of Installation: Per plans and elevations.

END OF SECTION

SECTION 10 11 25

TACKABLE BULLETIN BOARD

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Tackable bulletin board.
- B. Aluminum trim.
- C. Adhesive and accessories.

1.2 REFERENCES

- A. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in tackable bulletin board work with five years documented experience.

1.4 REGULATORY REQUIREMENTS

- A. Conform to flame spread and smoke developed ratings of no more than 15/20 for surfaces when tested in accordance with ASTM E84.
- B. Adhesives shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168.

1.5 SUBMITTALS

- A. Submit product data and samples under the provisions of Section 01 33 00.
- B. Provide product data on bulletin board.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit full range of manufacturer's color selection.
- E. Submit test reports verifying flame/smoke ratings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Deliver tackable bulletin board to site in unbroken and undamaged factory wrappings, clearly labeled with manufacturers lot number.
- C. Protect tackable bulletin board from moisture during shipment, storage and installation. Room temperature within the storage area to be maintained at not less than 70 degrees F during the period materials are stored.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not begin installation of tackable bulletin board until spaces have been enclosed and are ventilated and heated to maintain substrate surface temperature.
- B. Maintain constant temperature of no less than 70 degrees F and humidity level of 30 to 50 percent 72 hours prior to, during and after installation of the work of this section.

1.8 EXTRA STOCK

- A. Provide 5 percent installed area of each color of tackable bulletin board under provisions of Section 01 77 00.
- B. Package and label tackable bulletin board by color and designated room number; store where directed.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - BULLETIN BOARD

- A. Forbo Linoleum, Inc. Product: Forbo Bulletin Board, www.forbo.com.
- B. Walltalkers, Inc. Product: TacWall, www.walltalkers.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS - BULLETIN BOARDS

- A. Bulletin Board - Uni-colored linoleum and ground cork on Jute Backing, composition as follows:

- | | |
|---------------------------|---------------------------|
| 1. Thickness | 1/4 inches |
| 2. Roll Width | 48 inches |
| 3. Roll Length | 90 LF |
| 4. Fire Rating, ASTM E84: | Class B |
| (a) Flame Spread | 15 |
| (b) Smoke Developed | 20 |
| 5. Color | As selected by Architect. |

2.3 ACCESSORIES

- A. Primers: Manufacturer's recommended primer that is to be used under flexible wall coverings.
- B. Panel Adhesive: As recommended by manufacturer of Bulletin Board. Shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168. Solvent free, SBR type linoleum adhesive.
- C. Trim: Manufacturer's standard 1/4 inch aluminum "J" molding Clear anodized.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions in which tackable bulletin board will be installed.
 - 1. Complete finishing operations, including painting, before beginning installation of tackable bulletin board materials.
 - 2. Wall surfaces to receive tackable bulletin board material shall be dry and free from dirt, grease, loose paint and scale.
 - 3. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Insure backing materials are firmly attached, free from warps and surface defects and ready to receive individual panels.
- C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Surface Preparation: Remove hardware, accessories, plates and similar items to allow tackable bulletin boards to be installed. Begin installation when moisture content is no greater than five percent.
 - 1. Gypsum Board Surface: Recess nails and screws. Repair irregular tape joints, sand and remove dust.
 - 2. Painted Surfaces: Remove loose paint or scale. Sand surface of enamel or gloss paint and rinse with clear water.
 - 3. Ensure gypsum wallboard surfaces scheduled to receive bulletin board are properly primed under Section 09 90 00.
- B. Prime substrate.

3.3 APPLICATION

- A. Comply with manufacturer's printed installation instructions.
- B. Install width of bulletin boards in a vertical direction. Mount at a horizontal height from finished floor level per elevations.
- C. Apply aluminum trim all exposed edges which abut dissimilar surface.
- D. Apply adhesive with 1/16-inch square notch trowel to area to receive bulletin board material at a rate of 90 square feet per gallon.
- E. Work from top to bottom then side to side. Roll bulletin board material firmly into adhesive for positive contact and to remove air bubbles.
- F. Remove adhesive residue immediately.
- G. Scribe, cut and fit material to butt tightly to adjacent surfaces, built-in casework and permanent fixtures and pipes.
- H. Lap and double cut seams.

3.4 TOLERANCES

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

3.5 CLEANING

- A. Clean tackable bulletin boards using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners.
- B. Remove excess adhesive using methods and materials recommended by manufacturer.

3.6 PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 10 14 00

SIGNAGE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Plastic/acrylic signs.
- B. Metal signs.
- C. Letters and numbers.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings listing sign styles, lettering and locations, spacing and installation method.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples illustrating full size sample sign, of type, style and color specified including method of attachment.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- F. Include installation templates and hardware.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR), Title 24, Part 2 and the 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design for accessibility requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Package signs, labeled in name groups.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesive mounted signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acrylic Signs:
 - 1. Architectural Sign Identity, www.architecturalsignidentity.com.
 - 2. ASI - Sign Systems, www.asisignage.com.

3. Best Manufacturing, www.bestsigns.com.
4. Bravo Sign and Design, www.bravosign.com.
5. CA Signs, www.casigns.com.
6. Mohawk Sign Systems, www.mohawksign.com.
7. Neiman and Company, www.neimanandco.com.
8. Signs and Lucite Products, Inc., www.adasignscalifornia.com
9. Signtec, www.signtec.com.
10. Southwell Company, www.southwellco.com.
11. Vomar Products, Inc., www.vomarproducts.com.
12. Substitutions: Under provisions of Section 01 25 13.

B. Letters and Numbers:

1. ARK Ramos, www.arkramos.com.
2. ASI - Sign Systems, www.signage.com.
3. Bravo Sign and Design, www.bravosign.com.
4. Gemini, www.gemini.signproducts.com
5. Matthews, www.matthewssigns.com.
6. Nelson-Harkins Ind., www.nelson-harkins.com.
7. Neiman and Company, www.neimanandco.com.
8. Southwell Company, www.southwellco.com.
9. Signs and Lucite Products, Inc., www.adasignscalifornia.com.
10. Signtec, www.signtec.com.
11. Vomar Products, Inc., www.vomarproducts.com.
12. Substitutions: Under provisions of Section 01 25 13.

C. Metal and Traffic Signs:

1. Four S Company, (877) 597-1288. No URL available.
2. Signs and Lucite Products, Inc., www.adasignscalifornia.com
3. Signtec, www.signtec.com.
4. Traffic Management Inc., www.trafficmanagement.com.
5. Substitutions: Under provisions of Section 01 25 13.

2.2 MANUFACTURED UNITS

- A. Room Control Signage: Mohawk Sign Systems, Series 200A, Format D Sand Carved Process, with 1/32 inch raised border and letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/40 inch. Material shall be 1/8 inch thick x 6 inch high MP plastic plate of length required with 1 inch high helvetica medium lettering; adhesive and mechanical mounting with copy centered on plate. Provide one sign for each door shown on the drawings. Allow for twelve letters and three numerals for each sign. Signage to be in compliance with the requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.
- B. Tactile Exit Signage: Mohawk Sign Systems, Series 200A, Format D Sand Carved Process, with 1/32 inch raised border and letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/40 inch. Material shall be 1/8 inch thick x 6 inch high MP plastic plate of length required with 1 inch high helvetica medium lettering; adhesive and mechanical mounting with copy centered on plate. Provide signs at locations shown on the drawings. Signage to be in compliance with the requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 1011.4 and 11B-703.
- C. Pictorial Symbol Signage: Mohawk Sign Systems, Series 200A, Format D Sand Carved Process, with 1/32 inch raised border and letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/40 inch. Material shall be 1/8 inch thick MP plastic plate of size indicated with lettering and symbols as indicated; adhesive and mechanical mounting with copy centered on plate. Provide sign in locations shown on the drawings. Signage to be in compliance with the requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.
- D. Entrance and Restroom Signage:
 - 1. Restroom Doors: Acrylic plastic signs equivalent to that as detailed on the drawings; 12 inch circle and triangle with international symbol of accessibility in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-216.8 and 11B-703.7.2.6.
 - 2. Building Entrance: Equivalent to 5 inch square, reflective plastic accessible sign in accordance with CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-216.6 and 11B-703.7.2.1.
- E. Exterior Directional Signage: 0.080 inch thick aluminum sheet sign of size indicated. Paint with reflectorized paint. Graphics and text to be as indicated. Mount sign to wall with four countersunk vandal resistant screws or on free standing 2-inch diameter standard weight galvanized steel pipe post as indicated. Signs shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-216.9.2 and 11B-703.5.
- F. Accessible Gate Signage: 0.080 inch thick aluminum sheet sign of size indicated. Paint with reflectorized paint. Graphics and text to be as indicated. Attach sign to adjacent fence with 12 gage wire ties at each corner. Mount sign at 5'-0" from grade to center of sign. Sign shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-206.4.7 and 11B-404.1.1.
- G. Fire Wall Barrier Identification Sign: 11 x 15 inch adhesive backed vinyl sign with minimum 3 inch high letters identifying wall as a fire and or smoke barrier; listing hourly rating of fire wall; with specific language stating that all openings in wall are to be protected. Sign shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 703.7.
- H. Safe Dispersal Area Sign: 0.080 inch thick aluminum sheet sign in size indicated. Paint with reflectorized paint. Text to be as indicated. Mount and attach sign to adjacent fence fabric, post, or wall as indicated on drawings. Sign shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 1028.5.
- I. Storage Room Sign: Mohawk Sign Systems, Series 200A, Format A, Sand Carved Process. Material shall be 1/8 inch thick MP plastic plate of size indicated with lettering indicated, mechanical and adhesive mounting with copy centered on plate. Provide signs in locations as shown on drawings. Signage shall be in conformance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 3005.4. 1. 6.

J. Traffic Signage:

1. Van Parking Stall: 12 inch x 18 inch 0.080 inch thick aluminum accessible sign in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-502.6 and 11B-703.7.2.1 with separate 12 inch wide x 4 inch high sign with "Van-Accessible" wording and additional language below symbol of accessibility that states "Minimum Fine \$250.00." Mount on 2 inch diameter standard weight galvanized steel pipe post.
2. Auto Parking Stall: 12 inch x 18 inch 0.080 inch thick aluminum accessible sign in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-502.6 and 11B-703.7.2.1 with additional language below symbol of accessibility that states "Minimum Fine \$250.00." Mount on 2 inch diameter standard weight galvanized steel pipe post
3. Drive Approach: 18 inch x 24 inch 0.080 inch thick aluminum tow-away sign with local address and police phone number in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-502.8.1. Mount on 2 inch diameter standard weight galvanized steel pipe post.
4. Passenger Loading Zone: 12 inch x 18 inch 0.080 inch thick aluminum sign as detailed on drawings. Mount on 2 inch diameter standard weight galvanized steel pipe post.

K. Occupant Load Signage:

1. Provide maximum occupant load signs where indicated on drawings. Locate near main exit of space.
2. Material: 1/8 inch thick x 6 inch high MP plastic plate of length required with 3/4 and 1/2 inch high helvetica medium lettering: adhesive and mechanical mounting with copy centered on plate.
3. Signage to conform to the requirements of the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 1004.3.

L. Accessories: Provide all anchors, adhesives, and accessories for a complete installation.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Install true, plumb, level and adequately secured to substrate.
- C. Clean and polish.

3.3 INSTALLATION - FIRE BARRIER

- A. Install fire wall barrier identification signs on fire walls in accessible concealed floor, floor-ceiling or attic space above accessible ceilings.
- B. Install at intervals not exceeding a 30' - 0" horizontal spacing.
- C. Install at maximum 15' - 0" from end of wall.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet and accessories.
- B. Framed mirror units.
- C. Concealed anchor devices and backing plate reinforcements furnished to other Sections.
- D. Attachment hardware.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
- D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- F. ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
- G. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- H. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.3 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, the 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design and for accessibility requirements.
- B. Structural strength of grab bars, shower seats, fasteners and mounting devices shall conform to requirements of the CBC, California Building Code, (CCR) Title 24, Part 2, Section 11B-609, 11B-610 and shall withstand the application of a 250 lb. point load.

1.4 COORDINATION

- A. Coordinate the work of this Section under provisions of Section 01 31 00.
- B. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc., www.bobrick.com.
- B. American Specialties, Inc. (ASI), www.americanspecialties.com.
- C. Bradley Corporation, www.bradleycorp.com.

- D. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel, Type 304.

2.3 ACCESSORIES

- A. Adhesive: Two component epoxy type waterproof.
- B. Fasteners, Screws, and Bolts: Hot dip galvanized, tamperproof.
- C. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.4 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.
- E. Shop assemble components and package complete with anchors and fittings.
- F. Provide steel anchor plates, adapters, and anchor components for installation.
- G. Hot dip galvanize exposed and painted ferrous metal and fastening devices.
- H. Toilet tissue dispensers located in accessible toilet rooms or stalls shall not have their flow restricted and shall be capable of continuous flow.

2.5 FACTORY FINISHING

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.
- D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- E. Stainless Steel: No. 4 satin luster finish.
- F. Mirror Glass: FS DD-G-451 Type I, Class 1, Quality of 2, 1/4 inch thick with silver coating, copper protective coating and non metallic paint coating complying with FS DD-M-411.
- G. Stainless Steel Mirror: Type 430, 20 gage, bright annealed stainless steel.

3. PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

3.3 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Accessories required to be accessible shall be mounted at heights according to CBC Section 11B-603.5 and as indicated on the drawings.
- D. Toilet paper dispensers and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished surface of the wall nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar.

3.4 SCHEDULE

- A. Model numbers refer to Bobrick items.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Non-rated cabinets.
- C. Accessories.

1.2 REFERENCES

- A. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- B. NFPA 10 - Portable Fire Extinguishers.
- C. CFC - California Fire Code, (CCR) California Code of Regulations, Title 24, Part 9.
- D. Title 19, State Fire Marshal Regulations.

1.3 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CFC, Section 906, and Title 19 - State Fire Marshal Regulations, Chapter 3.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01 77 00.
- B. Include test, refill or recharge schedules, procedures, and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperatures may cause freezing.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amerex Corporation, www.amerex-fire.com.
- B. J. L. Industries, www.jlindustries.com.
- C. Larsen's Mfg. Co., www.larsensmfg.com.
- D. Potter-Roemer, Inc., www.potterroemer.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 EXTINGUISHERS

- A. Dry Chemical Type: Equivalent to J.L. Industries Cosmic Model 10E, UL 4A:80B:C nominal capacity with multi-purpose chemical agent and inert material in enameled-steel container, with pressure-indicating gage.

- B. Wet Chemical Type: Equivalent to J.L. Industries Saturn Model 25, UL 2A:K.

2.3 CABINETS

- A. Non-rated cabinets equivalent to J.L. Industries Academy Model No. 1024H10Fx2 with vertical duo panel doors, clear glazing and Saf-T-Lok.

2.4 FABRICATION

- A. Form body of cabinet with tight inside corners and seams.
- B. Fabricate body of fire rated cabinet of double wall construction filled with a 5/8 inch thick layer of protective fire barrier insulation.
- C. Predrill holes for anchorage.
- D. Form perimeter trim by welding, filling, and grinding smooth.
- E. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch with pull handle.
- F. Glaze doors with resilient channel gasket glazing.

2.5 ACCESSORIES

- A. Steel Cable Theft Device: Model STI 6200 as manufactured by STI Inc., www.sti-usa.com.

2.6 FINISHES

- A. Extinguisher: Red enamel.
- B. Cabinet Trim and Door: Type 304 stainless steel with No. 4 finish.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify rough openings for cabinet are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install cabinets plumb and level in wall openings.
- B. Secure rigidly in place in accordance with manufacturer's instructions.
- C. Install fire rated cabinets in strict conformance with manufacturer's instructions and listing requirements of Warnock-Hersey.
- D. Attach steel cable theft device to each extinguisher. Locate inside cabinet.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Locker units with hinged doors.
- B. Base, top, and filler panels.
- C. Hooks, latches, and hardware.
- D. Attachment hardware.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- E. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

1.3 SYSTEM DESCRIPTION

- A. Lockers: Surface mounted multi tier lockers; with metal base; with sloped tops; padlock hasps.
- B. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld locker groups into one-piece structures. Grind exposed welds flush.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- B. Lockers: Five percent of all lockers shall be made accessible to persons with disabilities. Locations of lockers to be as indicated on drawings.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include locker types, sizes, configurations, layout of groups of lockers, accessories, and numbering plan.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit samples under provisions of Section 01 33 00.
- E. Provide two samples 3 x 6 inches of each color selected on actual base material.

1.6 PROTECTION

- A. Store and protect lockers under provisions of Section 01 61 00.
- B. Protect locker finishes and adjacent surfaces from damage during installation.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. DeBourgh Mfg. Co., www.all-american-lockers.com.
- B. List Industries, www.listindustries.com.
- C. Lyon Metal Products, www.lyonworkspace.com.
- D. Penco Products, www.pencoproducts.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Sheet Steel: ASTM A 1008, Commercial Steel (CS) Type B, ASTM A653, Grade 33, A60 galvanealed coating according to ASTM A924; of the following minimum thicknesses:
 - 1. Body and Shelf : 0.0598 inch.
 - 2. Doors : 0.0747 inch.
 - 3. Door Frames : 0.0747 inch.
 - 4. Hinges : 0.0747 inch.
 - 5. Base, Top, Trim : 0.0598 inch.
 - 6. End Panels : 0.0598 inch.
 - 7. Backs : 0.0478 inch.

2.3 ACCESSORIES

- A. Provide hat shelf on single tier lockers.
- B. Provide aluminum number plates with etched figures.
- C. Provide each locker with two double prong wall hooks.
- D. Provide recessed single point latching handle for padlock. Locking device supplied by manufacturer.
- E. Doors shall have a magnetic catch to retain unlocked doors in the closed position.
- F. Locker doors shall have rubber bumpers riveted to door strike.
- G. Provide 4 inch high steel bases.
- H. Provide digital lock assembly at all accessible lockers equal to Zephyr, Model 5170 RFID Electronic Lock as manufactured by Zephyr Lock, www.zephyrlock.com.
- I. Provide accessible decal at all accessible lockers equal to Model No. RFH550 as manufactured by Flags and Banners Unlimited, www.flagsbanners.net.
- J. Fasteners: Zinc coated flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

2.4 FABRICATION

- A. Street Locker: 12 inches wide x 18 inches deep x 24 inches high in size; triple tier. Total overall height of 72 inches.
- B. Bodies: Formed and flanged with stiffener ribs; electrically spot welded.
- C. Door Frame: Formed channel shape, welded and ground flush, welded to body.
- D. Doors: 1-3/16 inch thickness; channel reinforced top and bottom with intermediate stiffener ribs. Finish edges smooth.
- E. Full Loop Hinges: Three for doors 42 inches and higher, two for doors under 42 inches high. Weld securely to unit body and rivet to unit door.
- F. Number Plates: One for each locker. Mount at top of opening with pop rivets. Numbering sequence as directed by Architect.
- G. Wall Hooks: Mount to locker body with pop rivets.
- H. Provide end panels, filler panels, and sloped metal tops to close off all openings.
- I. Ventilation openings:
 - 1. Street and Box Locker: Die cut diamond perforated side walls and doors.
 - 2. Hall Lockers: Louvered doors.
- J. Finish edges smooth without burrs.

2.5 FINISHES

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of anti-microbial electrostatic baked on powder coat enamel.
- B. Coat locker doors and bodies in one color throughout.
- C. Color: As selected from manufacturer's entire range.

2.6 LOCKER ROOM BENCH

- A. Hardwood Maple Bench: 9-1/2 inches wide x 1-1/4 inches thick with two coats of clear acrylic finish. Length of bench to be as indicted on drawings.
- B. Bench Support: Heavy duty cast iron tubular design anchored to top and floor with 0.0781 inch thick metal plate. Floor plate to have floor cover. Color and finish of support to match lockers.
- C. Height of Bench: 1'-6" overall.

2.7 ACCESSIBLE LOCKER ROOM BENCH

- A. Hardwood Maple Bench: 2'-0" wide x 4'-0" long x 1-1/4 inches thick bench with two coats of clear acrylic finish.
- B. Accessible Bench Support Bracket: 15 inch x 21 inch x 1/8 inch thick pre-manufactured angled steel bracket, black paint finish, minimum 1,000 lb. load support capability, with 7 predrilled anchor holes per bracket leg. Manufactured by A & M Hardware, Inc., www.aandmhardware.com.
- C. Height of Bench: 1'-7" overall.

3. PART 3 EXECUTION

3.1 PREPARATION

- A. Verify bases are properly sized and located.

3.2 INSTALLATION

- A. Install lockers secure, plumb, square, and in line.
- B. Anchor lockers with appropriate anchor devices to suit materials encountered.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. Install end panels, filler panels, sloped tops and bases to completely close off openings.
- E. Install accessories as specified for each locker.
- F. Install one hat shelf in accessible locker at a height of 4'-0" and one at a height of 15 inches above floor line.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum flagpoles.
- B. Ground mount.
- C. Halyards, accessories, and flag(s).

1.2 REFERENCES

- A. AAMA 611 – Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- B. AAMA 612 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
- C. AAMA 2603 - Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- D. AAMA 2605 - Specification for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- E. AASHTO M-36 - Corrugated Metal Culvert Pipe.
- F. ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
- G. ASTM C33 - Standard Specification for Concrete Aggregate.
- H. ASTM D1187 – Standard Specifications for Asphalt Based Emulsions for Use as Protective Coatings for Metal.
- I. NAAMM – National Association of Architectural Metal Manufacturers.

1.3 PERFORMANCE

- A. Pole With Flag Flying: Resistant without permanent deformation, 80 miles/hr wind velocity, non-resonant, safety design factor of 1.6.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate on shop drawings, detailed dimensions, base details, anchor requirements, and imposed loads.
- C. Provide product data on pole, accessories, and configurations.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples illustrating material, color, and finish.
- F. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01 61 00.
- B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- C. Protect flagpole and accessories on site from damage or moisture.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Aabec Pole Division, Morgan Francis Co., www.morgan-francis.com.
- B. American Flagpole, www.americanflagpole.com.
- C. Concord Industries, Inc., www.concordindustries.com.
- D. Eder Flag Manufacturing Co., Inc., www.ederflag.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 POLE MATERIALS

- A. Aluminum: ASTM B241; 6063 alloy, T6 temper.

2.3 POLE FABRICATION

- A. Outside Butt Diameter: 6 inches.
- B. Outside Top Diameter: 3.5 inches.
- C. Wall Thickness: 3/16 inch.
- D. Type: Ground set; fixed type.
- E. Pole Design: Cone tapered.
- F. Nominal Height: 25 ft measured from ground.
- G. Halyard: Internal type.

2.4 COMPONENTS AND ACCESSORIES

- A. Finial Ball: Aluminum; 5 inch diameter.
- B. Truck Assembly: Cast aluminum; revolving; stainless steel ball-bearings, non-fouling.
- C. Flag: United States and California design, 4 x 6 feet standard size, 100 percent woven, two ply, spun polyester bunting.
- D. Cleats: 9 inch size, cast aluminum with stainless steel fastenings, one per halyard.
- E. Halyard: 5/16 inch diameter polypropylene, braided, white, with 1/16 inch diameter galvanized steel core.
- F. Cleat Cover: Cast aluminum with cylinder lock, one per cleat.
- G. Halyard Cover: Cast aluminum with cylinder lock, minimum 5'-0" in length.
- H. Connecting Sleeves For Multiple Section Poles: Same material as pole, precision fit for field assembly of pole, concealed fasteners.

- I. Flashing Collar: Spun aluminum.
- J. Sand: ASTM C33, fine aggregate.
- K. Bituminous paint: ASTM D1187, cold applied asphalt emulsion.
- L. Elastomeric Joint Sealant: Single component neutral curing silicone sealant as specified in Section 07 92 00.

2.5 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M-36, corrugated 16 gage steel, galvanized.
- B. Pole Base Attachment: 3/16 inch thick steel bottom plate with steel centering wedges. Galvanized.
- C. Lightning Ground Rod: 18 inch long copper rod, 3/4 inch diameter.

2.6 GENERAL FINISHES

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.
- B. Finial: Lacquered finish.

2.7 ALUMINUM FINISHES

- A. Natural Satin Finish: NAAMA AA-M32, fine, directional medium satin polish, buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.
- B. Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required by unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement.

3.3 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Place foundation tube sleeve, center, and brace to prevent displacement.
- D. Place concrete in accordance with Section 03 30 00. Vibrate concrete.
- E. Trowel exposed concrete surfaces to a smooth dense finish. Provide positive slope to perimeter of base.
- F. Install flagpole plumb in foundation tube sleeve.

- G. Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place.
- H. Place and compact sand in place and remove hardwood wedges.
- I. Seal top of foundation tube sleeve with a 2 inch thick layer of elastomeric joint sealant and cover with flashing collar. Secure collar in place.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: One inch.

3.5 ADJUSTING AND CLEANING

- A. Clean surfaces.
- B. Adjust operating devices so that halyard and flag(s) function smoothly.

END OF SECTION

SECTION 11 40 00

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. The work referred to in this section consists of furnishing all labor and material required to provide and deliver all food service equipment hereinafter specified into the building, uncrate, assemble, hang, set in place, level, and completely install, exclusive of final utility connections. Final utility connections to all equipment, shall be part of the work under additional appropriate sections of the work and not part of the food service work.
1. The equipment and its component parts shall be new and unused. All items of standard manufactured equipment shall be current models at the time of delivery. Parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement and repair.
 2. The materials or products specified herein by trade names, manufacturer's name or catalog number shall be provided as specified. Substitutions will not be permitted unless approved by owner's representative in writing no later than 10 days prior to bidding. This stipulation applies to all equipment and materials.
 - a. Any request for substitution or alternate must include documentation supporting that the requested substitution/alternate will perform in all aspects as well as the original specification. Alternative exhaust hood manufacturers are required to provide heat load based design exhaust volume calculations prior to alternate being considered. Request must include the following:
 - 1) Grease filtration performance data and manufacturer's own airflow calculations based on convective heat load of cooking equipment beneath the hood.
 - 2) Efficiency comparison data performed in accordance with ASTM Standard F1704-96 for a standard 24" high exhaust hood.
 - 3) A written guarantee of compliance with Title 24 Part 6 with Kitchen Ventilation acceptance tests NA7.11.1.2 and NA7.11.1.3.
 - b. Should no request for substitution be received and approved as stated above, the project is to be provided as specified.
 3. The food service equipment contractor shall be responsible for all costs associated with the acceptable alternate or approved alternate items, if the item requires additional space or specific utilities that differ from specifications or drawings. The FSEC is responsible for all coordination, documentation and costs associated with any alternate item that was not submitted for approval and accepted by the consultant prior to bid. The FSEC shall be responsible for any costs associated with building changes, utility changes and drawings changes. The food service equipment contractor shall be responsible to pay Webb Foodservice Design to review proposed substitutions. These costs will be billed at an hourly rate of \$125/hr. All proposed substitutions shall be accompanied with supporting factory quotes for both specified and proposed manufacturer including factory contact information. Food service equipment contractor must completely fill out the foodservice substitution request form supplied in this section.

- B. Coordinate Owner and Vendor-supplied equipment noted on the drawings or in the specifications as NIFSEC, "not in food service equipment contract". Show on roughing in Plans and sizes, utilities, and other requirements as furnished in the specifications, by owner or appropriate supplier in submittals as if the equipment is contractor furnished.
- C. Bidders shall carefully examine the specifications and the project site including location and condition of existing equipment to determine cost for each "Existing-Reset" and "Existing-Modify" item to cover removal, modification (including materials), cleaning, inspection for damage, repair and resetting.
- D. Field measurements shall be made prior to fabrication or installation of any equipment item.
- E. The cutting of holes in equipment for pipe, drains, electrical outlets, etc., required for this installation, shall be part of this work. Work shall conform to the highest standards of workman-ship and shall include welded sleeves, collars, ferrules and escutcheons.
- F. Repair of all damage to the premises as a result of the equipment installation as well as the removal of all debris left by the work of this section.
- G. Food service equipment and fixtures shall be cleaned and ready for operation at the time the facility is turned over to the Owner for final inspection by the Owner's Representative.
- H. Food Service Equipment Contractor shall be responsible for coordinating with the Architect and Contractor in submitting all applicable documents.
- I. All bidders shall submit with their itemized costing a list of the subcontractors that are included in their bids and a complete "schedule of values" for all equipment and labor.
- J. The food service equipment contractor shall submit an itemized Schedule of Values to Webb Foodservice Design for acceptance no later than 10 days after bid date using the "Schedule of Values" form included herein.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Work In Other Sections by appropriate trades include the following:
 - 1. Division 5 Section "Metal Fabrications" for equipment supports.
 - 2. Division 6 Section "Interior Architectural Woodwork" for wood casework and plastic laminate substrates.
 - 3. Refer to Division 23 Sections for supply and exhaust fans; exhaust ductwork; demand control ventilation requirements; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire extinguishing systems; and other materials required to complete food service equipment installation.
 - 4. Refer to Division 26 & 28 Sections for connections to fire alarm systems, wiring, disconnects, and other electrical materials required to complete food service equipment installation.
- C. All electric services including wiring to, and final connections to, the fixtures except, as specified differently in the specifications, drawings, or herein.
- D. All water, waste and gas services to the fixtures including shut-off valves, trim, traps, etc., and final connections to the fixtures, except as specified differently in the specifications, drawings, or herein.

- E. All hood or ventilator duct work above the connection position on such exhaust hoods or exhaust ventilators, except as specified differently in the specifications, drawings, or herein. Final welded connections at the junction point of exhaust hoods or exhausts ventilators, shall be part of the food service work.
- F. Floors, quarry tile, concrete bases, walls, ceilings, finishes and related building work, except as specified differently in the specifications, drawings or herein.

1.3 DEFINITIONS

- A. Terminology Standard: Refer to NSF 2, "Food Equipment", NSF 4, Heated Cabinets, NSF 7, Refrigerated Equipment, or other applicable NSF standards for definitions of food service equipment and installation terms not otherwise defined in this Section or in other referenced standards.
- B. FSEC: Food Service Equipment Contractor
- C. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.
- D. Vendor-Furnished Equipment: Where indicated the Owner's or operator's vendor will furnish equipment items.
- E. NIFSEC: Not Included in Food Service Equipment Contract.

1.4 SUBMITTALS

- A. Submittal Process: All submittals will be separated as a stand-alone file and submittal by discipline with identifying tracking number (i.e. 11400.1, 11400.2 etc..) as listed below. Any other disciplines for particular project will be submitted and given the next available tracking number.
 - 1. 11400.1 Product Data Submittal Book
 - 2. 11400.2 FSEC MEP Construction Documents Drawings
 - 3. 11400.3 Walk In Box Submittal
 - 4. 11400.4 Refrigeration Rack Submittal
 - 5. 11400.5 Exhaust Hood Submittal
 - 6. 11400.6 Fire Suppression Submittal
 - 7. 11400.7 Custom Stainless Steel Submittal
 - 8. 11400.8 Custom Millwork Submittal
 - 9. 11400.9 Custom Sneeze Guards Submittal
- B. Regardless of drawing formats provided it will remain the responsibility of equipment supplier to develop submittals in accordance with the Specific Conditions and assume all required responsibilities there to. The consultant is not to be liable for errors or omissions by the FSEC's use of electronic data provided by the Consultant or the development of data used in the submittal approval process. Checking product data, rough-in drawings, wall backing drawings, shop drawings, and refrigeration drawings by Designer is for design concept only, and does not relieve the Food Service Equipment Contractor of responsibility for compliance with Contract Documents, verification of utilities with equipment requirements for conformity and location, verification of all dimensions of equipment and building conditions or reasonable adjustments due to deviations.

- C. The Food Service Equipment Contractor shall review and provide an affidavit through the proper channels and chain of command with each submittal stating that such review has been completed by an authorized agent of the food service equipment contractor.
- D. Product Data: For each type of food service equipment indicated. Include manufacturer's model number and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel, and service-connections including roughing-in dimensions.
- E. Shop Fabrication Drawings: For food service equipment not manufactured as standard production and/or catalog items by manufacturers the fabricator of the equipment shall prepare and submit through the Food Service Equipment Contractor one electronic file or two bond or original prints of all shop drawings showing all information necessary for the fabrication and installation of the work of this section. Include plans, elevations sections, material schedule, roughing-in dimensions, fabrication details, service requirements and attachments to other work. All drawings to be fully detailed and dimensioned to a minimum scale of 3/4 inch to the foot for plan and elevation views and 1 1/2 inch to the foot for section views. Reduced or enlarged drawings are not acceptable. Drawings not submitted in the proper format will not be reviewed.
 - 1. Wiring Diagrams: Details of wiring for power, signal, and control systems and differentiating between manufacturer-installed and field-installed wiring.
 - 2. Piping Diagrams: Details of piping systems and differentiating between manufacturer-installed and field-installed piping.
- F. Coordination Drawings: For locations of food service equipment and service utilities. Key equipment with item numbers and descriptions indicated in Contract Documents. Include plans and elevations of equipment, access- and maintenance-clearance requirements, details of concrete, masonry or metal bases and floor depressions, and service-utility characteristics. Ventilation requirements for refrigerated equipment shall be identified in these drawings.
- G. Contract Document Drawings:
 - 1. Drawings furnished, constitute a part of these specifications and show locations of equipment and general arrangement of mechanical and electrical services. Necessary deviation from the illustrated arrangements to meet structural conditions, shall be considered a part of the work of this section. Such deviations shall be made without expense to the owner. Equipment drawings are definitive only and should not be used as construction documents or shop details.
 - 2. The drawings are for the assistance and guidance of the Food Service Equipment Contractor. Exact locations shall be governed by the building configuration. The Food Service Equipment Contractor shall accept his contract with this understanding.
 - 3. Should there be a conflict between the drawings and the specifications, the FSEC shall submit a "Request for Information" (RFI) for clarification.

H. Utility Roughing-in Drawings:

1. The Food Service Equipment Contractor shall prepare and submit one electronic file or two bound sets of a valid prints, of all roughing-in drawings, showing information necessary for the roughing-in of refrigerant lines, syrup/beer lines, plumbing, steam, mechanical and electrical utility requirements. Drawings shall also include construction requirements necessary for all equipment including floor depressions, raised bases, wall blocking, wall recesses and any critical dimensions for specific equipment requirements. Acceptance will be made upon the electronic file or one print which will be returned to the Food Service Equipment Contractor for reproduction purposes. Drawings not properly submitted in this format, will not be reviewed. Drawings without an "Accepted" or "Accepted as noted" stamp, will not be considered an authorized shop drawing and will not be allowed on the job site.

a. Furnish four (4) sets "Accepted" and/or "Accepted as Noted" shop drawings, for distribution to the field, as directed.

I. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for exposed products with color finishes.

J. Samples for Verification: Of each type of exposed finish required, minimum 4-inch- (100-mm-) square or 6-inch- (150-mm-) long sections of linear shapes and of same thickness and material indicated for work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

K. Product Certificates: Signed by manufacturers of refrigeration systems, refrigerated equipment or their authorized agents certifying that systems furnished comply with NSF 7 requirements and will maintain operating temperatures indicated in the areas or equipment that they will serve.

L. Maintenance Data: Operation, maintenance, and parts data for food service equipment to include in the maintenance manuals specified in Division 1. Include a product schedule as follows:

1. Product Schedule: For each food service equipment item, include item number and description indicated in Contract Documents, manufacturer's name and model number, and authorized service agencies' addresses and telephone numbers.

2. See itemized specifications for closeout and owner's maintenance manual requirements.

1.5 QUALITY ASSURANCE AND LAWS AND ORDINANCES

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing food service equipment, who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance. See specifications section 3.5 for installation requirements pertaining to refrigeration, fire suppression, and walk in box installation as well as food service drawings.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing food service equipment similar to that indicated for this Project and with a record of successful in-service performance. See itemized specifications section 3.5 for custom fabricated stainless steel and/or millwork. Food Service Equipment Contractor to submit and procure specified custom manufacturer as listed in the itemized specifications as this company has demonstrated quality control and proper coordination from design development through closeout requirements.

C. Source Limitations: Obtain each type of food service equipment through one source from a single manufacturer.

- D. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equal size and performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- E. Regulatory Requirements: Comply with the following National Fire Protection Association (NFPA) and California Electrical Codes (CBC) codes:
1. NFPA 17, "Dry Chemical Extinguishing Systems."
 2. NFPA 17A, "Wet Chemical Extinguishing Systems."
 3. NFPA 54, "National Fuel Gas Code."
 4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
 5. CEC, California Electrical Code, 2016
 6. The FSEC shall certify that all work and materials comply with Federal, State and Local laws, ordinances, and regulations and is confirmed by the local inspector having jurisdiction.
 - a. US PUBLIC HEALTH SERVICE
 - b. LOCAL HEALTH DEPARTMENT
 - c. NATIONAL BOARD OF FIRE UNDERWRITERS
 - d. OSHA
 - e. UL
 - f. HACCP
 - g. NFPA 96 – Current
 - h. ADA
 - i. OSHPD
 - j. DSA
- F. Listing and Labeling: Provide electrically operated equipment or components specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the California Electrical Code, Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- G. AGA Certification: Provide gas-burning appliances certified by the American Gas Association (AGA).
- H. ASME Compliance: Fabricate and label steam-generating and closed steam-heating equipment to comply with ASME Boiler and Pressure Vessel Code.
- I. ASHRAE Compliance: Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration."

- J. Food Service Equipment: Where provided, check-out aisles, sales counters, service counters, food service lines, queues, and waiting lines shall comply with CBC Sections 11B-227 and 11B-904. The top of tray slides shall be 28" minimum and 34" maximum above finish floor. Space and elements within food service employee work areas shall meet the requirements of CBC Section 11B-203.9. Food service equipment required to be accessible shall conform to all reach requirements in CBC Figures 2016, 11B-403.5.1, 11B-227.4, 11B-904.5, 11B-904.5.1, and 11B-904.5.2.
 - K. NSF Standards: Comply with applicable NSF International (NSF) standards and criteria and provide NSF, UL Sanitation or ETL Sanitation Certification Mark on each equipment item, unless otherwise indicated.
 - L. ANSI Standards: Comply with applicable ANSI standards for electric-powered and gas-burning appliances; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.
 - M. SMACNA Standard: Where applicable, fabricate food service equipment to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Food Service Equipment Fabrication Guidelines," unless otherwise indicated.
 - N. Seismic Restraints: Provide seismic restraints for food service equipment according to the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Food Service Equipment Fabrication Guidelines," appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment," unless otherwise indicated.
 - O. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."
 - P. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to food service equipment including, but not limited to, the following:
 - 1. Review access requirements for equipment delivery.
 - 2. Review equipment storage and security requirements.
 - 3. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 4. Review structural loading limitations.
 - 5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - Q. Walk-in cooler and/or freezer shall comply with CBC Figures 2016, 11B-404.2.4, 11B-404.2.4.4, 11B-404.2.7 and 11B-309.4.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver food service equipment as factory-assembled units with protective crating and covering.
 - B. Store food service equipment in original protective crating and covering and in a dry location.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions and proceed with fabricating equipment without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.
 - 2. Food service aisles shall be a minimum 36" wide and tray slides shall be mounted at 34" maximum above the floor. Insure compliance with paragraphs 1.5.J and 1.5.Q.
 - 3. Pass-thru windows for food service shall conform to the reach and access requirements of paragraphs 1.5.J and 1.5.Q. Accessible pass-thru shelves shall not exceed 34-inch height above interior finished floor surface or exterior pavement.

1.8 COORDINATION

- A. Coordinate equipment layout and installation with other work, including light fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate location and requirements of service-utility connections.
- C. Coordinate size, location, and requirements of concrete bases, positive slopes to drains, floor depressions, and insulated floors. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- D. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

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. Warranty period: 1 year from date of substantial completion.
- B. Refrigeration Compressor Warranty: 5 years from date of substantial completion. Submit a written warranty signed by manufacturer agreeing to repair or replace compressors that fail in materials or workmanship within the specified warranty period.

PART 2 - PRODUCTS

2.1 MATERIALS - METAL

- A. Submit a certified copy of the mill analysis of materials if requested by the Architect.
- B. Finish for exposed surfaces to be #4 polished, unless otherwise specified.
- C. Protective covering shall be provided on all polished surfaces of stainless steel sheet work, and retained and maintained until time of final testing, cleaning, start-up and substantial completion.

- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304, stretcher leveled, and in finish specified in "Stainless-Steel Finishes" Article.
1. Stainless steel finishes
 - a. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
 - 1) Remove or blend tool and die marks and stretch lines into finish.
 - 2) Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - b. Concealed surfaces: No. 2B finish (bright, cold-rolled, unpolished finish).
 - c. Exposed surfaces: No. 4 finish (bright, directional polish).
 - d. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - e. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- E. Stainless-Steel Tube: ASTM A 554, Grade MT-304, and in finish specified in "Stainless-Steel Finishes" Article.
- F. Zinc-Coated Steel Sheet: ASTM A 653, G115 (ASTM A 653M, Z350) coating designation; commercial quality; cold rolled; stretcher leveled; and chemically treated.
- G. Zinc-Coated Steel Shapes: ASTM A 36 (ASTM A 36M), zinc-coated according to ASTM A 123 requirements.
- H. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.
1. Color: As selected by Architect from manufacturer's full range of colors.
 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- I. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8-inch (3-mm) thickness that does not chip, flake, or blister.
- J. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds.
- K. Casters: NSF-certified, heavy duty, stainless-steel, swivel stem casters with 5-inch- (125-mm-) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width, and 200-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.
- L. Approved manufacturers for custom fabricated equipment are: Stainless Fixtures Inc. (909) 622-1615, B&W Custom Restaurant Equipment (714) 578-0332 or Kemco (909) 923-3153.

2.2 MATERIALS – CASEWORK/MILLWORK

- A. Cabinet Hardware: Provide NSF-certified, stainless-steel hardware for equipment items as indicated. Pulls, Handles and Catches to be included.
- B. All wood to be thoroughly seasoned and kiln dried prior to being used for fabrication of custom casework. All wood to be free from knots, pitchy seams, or other imperfections. All exposed wood to be grade A pine.
- C. All plywood to be thoroughly seasoned and kiln dried prior to being used. All plywood to be free from knots, pitchy seams, and other imperfections. All plywood to be glued with water resistant resin. Particle board may not be substituted for plywood panels. "W.I. - Custom Grade" marine grade plywood is required on all fixtures to be installed in high humidity environments.
- D. All wood to have less than 12% moisture content and be a species listed by the national hardwood association.
- E. Plastic laminates shall be 1/16th thick, general purpose grade GP-50 as manufactured by Wilson Art or equal. Patterns, textures, and colors as specified under individual items. Semi ex-posed and cabinet liners shall be CL-20. Countertops, backsplashes and edges shall be grade GP-50 on exposed and grade BK-20 on underside of tops. Exposed vertical surfaces and cabinet liners shall be grade CL-20. Sides and edges of shelving shall be grade 50. Adhesive shall be waterproof and low VOC.
- F. Hardware that is furnished and installed shall be of solid material unless specified otherwise. The hardware shall be provided with the necessary mechanisms for locking. All locks shall be furnished with two (2) keys.
- G. Solid Surface Material (SSM) shall be Caesarstone, Silestone or approved equal and installed over 3/4" plywood per manufacturer's instructions. Provide air space, trim and /or insulation around any heat or cold producing equipment to guard against discoloration and cracking.
- H. Approved manufacturers for custom fabricated equipment are: Stainless Fixtures Inc. (909) 622-1615, B&W Custom Restaurant Equipment (714) 578-0332 or Kemco (909) 923-3153.

2.3 FABRICATION, GENERAL, METAL,

- A. Fabricate food service equipment according to NSF (standards 2, 4 & 7) requirements. Factory assemble equipment to the greatest extent possible.
- B. STAINLESS-STEEL EQUIPMENT: for all parts of custom tables, tops, benches, sinks, cabinets, etc., as drawn or as specified, shall be AICI type 304 (18-8 Austenitic). All gauges called for shall be U.S. Standard Gauges, "S/S" or "S.S." as shown in the drawings or specifications, shall indicate stainless steel.
 - 1. Edges and Backsplashes: Provide equipment edges and backsplashes indicated complying with referenced SMACNA standard, unless otherwise indicated.
 - 2. Apply sound dampening to underside of metal work surfaces, including sinks and similar units. Provide coating with smooth surface and hold coating 1 inch (25 mm) back from open edges for cleaning.
 - 3. Tables: Fabricate with reinforced tops, legs, and reinforced undershelves or cross bracing to comply with referenced SMACNA standard, unless otherwise indicated, and as follows:
 - a. Tops: Minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.

- b. Legs: 1-5/8 inch (41.3 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset and adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 - c. Undershelves: Minimum #16 gauge / 0.625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
 - d. Top and Undershelf Reinforcement: Provide minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick, stainless-steel reinforcing, unless otherwise indicated.
 - e. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
- 4. Sinks: Fabricate of minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel with fully welded, 1-piece construction. Construct 2 sides and bottom of sink compartment from 1 stainless-steel sheet with ends welded integral and without overlapping joints or open spaces between compartments. Provide double-wall partitions between compartments with 1/2-inch- (13-mm-) radius rounded tops that are welded integral with sink body. Cove horizontal, vertical, and interior corners with 3/4-inch (19-mm) radius. Pitch and crease sinks to waste for drainage without pooling. Seat wastes in die-stamped depressions without solder, rivets, or welding.
 - a. Wastes: 2-inch (50-mm), stainless steel ball valve, rotary-handle waste assembly with stainless-steel strainer plate, rough chrome plated body.
 - b. Drainboards: Minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel, pitched to sink at 1/8 inch/12 inches (3 mm/300 mm) of length. Reinforce drainboards with minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.
 - c. Legs: 1-5/8 inch (41.3 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset welded to #12 gauge / 0.1094-inch- (2.779-mm-) thick, stainless-steel support plate. Provide adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 - d. Drainboard Braces: 1 inch (25 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588- mm-) thick stainless steel, unless otherwise indicated.
 - e. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
- 5. Wall Shelves and Overshelves: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated, and with minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick, stainless-steel shelf tops.
- 6. Drawers: Provide lift-out type, 1-piece, die-stamped drawer pan fabricated from #18 gauge / 0.050-inch- (1.27-mm-) thick stainless steel with inside corners radiused. Support drawer pan with #16 gauge / 0.0625-inch- (1.588-mm-) thick, stainless-steel channel frame welded to drawer front. Provide 1-inch- (25-mm) thick, double-wall front fabricated from #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel and with integral recessed pull. Fill void in drawer front with semi rigid fiberglass sound dampening. Mount drawers on NSF-certified, full-extension, stainless-steel drawer slides that have minimum 100-lb (45-kg) load capacity per pair, ball-bearing rollers, and positive stop. Mount drawer slides for self-closing on drawer housing as indicated.

7. Refrigerated Bases: Unit to be all welded construction and fabricated in accordance with NSF Standard 7.
 - a. Top: 18 gauge galvanized sub-top or 14 gauge stainless steel top.
 - b. Exterior: Front and Sides to be 18 gauge number 4 finish type 304 stainless steel; bottom and back to be 18 gauge galvanized (unless otherwise noted).
 - c. Interior liner: 20 gauge number 4 finish type 304 stainless steel with 3/8" radius corners.
 - d. Insulation: Minimum 2" thick polyurethane foam in place insulation (CFC free).
 - e. Doors: 18 gauge front and 20 gauge door pan number 4 finish type 304 stainless steel with 2" polyurethane foam in place insulation, long-life press in place gasket.
 - f. Drawers: 300 lb. capacity with 14 gauge stainless steel track system, tandem 2" all stainless steel skate wheels, each drawer accommodates two 6" deep, 12" x 20" pans side by side.
 - g. Shelving: Each door section shall have stainless steel wire racks.
8. Refrigerated Pan Rails: Unit to be all welded construction and fabricated in accordance with NSF Standard 7.
 - a. Top: 16 gauge number 4 finish type 304 stainless steel top and inner liner.
 - b. Outer liner: To be 18 gauge type 304 stainless steel; bottom and back to be 18 gauge galvanized (unless otherwise noted).
 - c. Insulation: Minimum 2" thick polyurethane foam in place insulation (CFC free).
 - d. Drain: Provide with 1" stainless steel drain
 - e. Control: Provide with on/off control to be field installed.
- C. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Provide ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 1. Welded Butt Joints: Provide full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and underpressed.
 4. Coat unexposed stainless-steel welded joints with suitable metallic-based paint to prevent corrosion.
 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPCPaint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780.
- D. Fabricate field-assembled equipment prepared for field-joining methods indicated. For metal butt joints, comply with referenced SMACNA standard, unless otherwise indicated.

- E. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- F. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- G. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- H. Provide surfaces in food zone, as defined in NSF 2, free from exposed fasteners.
- I. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- J. Provide pipe slots on equipment with turned-up edges and sized to accommodate service and utility lines and mechanical connections.
- K. Provide enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- L. Seismic Restraints:
 - 1. Fabricate to comply with referenced "SMACNA Guidelines for Seismic Restraint of Kitchen Equipment" in any State, province, or jurisdiction that has legislated this requirement as necessary for acceptance. This shall include:
 - a. Identifying these items on his submittal drawings, Plans, Elevations, and Sections.
 - b. Showing required SMACNA methods of restraint on his submittal drawings.
 - c. Referencing the appropriate detail(s).
 - d. Obtain regulatory approval for all seismic engineering details

2.4 FABRICATION, MILLWORK/CASEWORK

- A. Fabricate food service equipment according to the "Manual of Millwork, current edition" of the Woodwork Institute, including all amended printed revisions, and NSF Standards. All composite wood products shall meet the latest California Air Resources Board (CARB) Composite Wood Products Regulations. Factory assemble equipment to greatest extent possible. All specially fabricated equipment must be by one manufacturer/fabricator per specialty acceptable to Consultant and the Owner.
- B. Solid Surface Material (SSM) shall be Caesarstone, Silestone or approved equal and installed over 3/4" plywood per manufacturer's instructions. Provide air space, trim and /or insulation around any heat or cold producing equipment to guard against discoloration and cracking.

2.5 EXHAUST HOOD FABRICATION

- A. Definitions:
 - 1. Listed Hood: A hood, factory fabricated and tested for compliance with UL-710 by a testing agency acceptable to authorities having jurisdiction.
 - 2. Type I Hood: A hood designated for grease exhaust applications.
 - 3. Type II Hood: A hood designed for heat and steam removal and for other non-grease applications.
 - 4. Non-listed Hoods are not acceptable for this project.

- B. General: Provide listed hoods with dual wall construction and manufactured from minimum #18 gauge / 0.050-inch- (1.27-mm-) thick type 304 stainless steel, unless otherwise indicated. FSEC shall verify size and location of all connections required before fabrication.
1. Exhaust hood performance tests shall be in accordance with ASTM F1704-05. Manufacturer, upon request, shall be required to submit validation that full capture and containment of appliance thermal plume and smoke can be accomplished at specified/design air volumes without modifications to duct size, filter velocity or hood/system static pressure.
 2. Hoods shall comply with current NFPA 96, NSF, ASHRAE 90.1, ASHRAE 154, CA-Title 24 (CA Based Projects Only), Local Applicable Codes and Manufactures Recommendations.
 3. Product/system must meet the design, construction, performance and operational intent of the project. It is the responsibility of the FSEC to verify interface of the system with all associated trades including, but not limited to; electrical, mechanical, sheet metal, plumbing and controls per Division 23.
 4. Design exhaust volume shall be based on hood manufacturers heat load based design calculations and not estimated CFM/linear foot or minimum UL-710 listed volume.
- C. Grease Removal: Provide removable, stainless-steel, single stage, baffle-type grease filter. Provide minimum #18 gauge / 0.0781-inch- (1.984-mm-) thick, stainless steel filter frame and removable collection basins or troughs. Filters/baffles shall be UL 1046 Classified and tested according to ASTM Standard F 2519-05 "Standard Test Method for Grease Particle Capture Efficiency of Commercial Kitchen Filters and Extractors" by a nationally recognized testing laboratory acceptable to authorities having jurisdiction. The filters/baffles must be single stage and have a minimum extraction rate of 93% at 5 microns and 98% at 15 microns.
- D. Sound Level Criteria: Isolated grease filter sound levels shall not exceed an NC rating of 55 at full design exhaust volume.
- E. Light Fixtures: Provide NSF, UL, CSA AND CE-certified LED fixtures, vapor-tight sealed lenses, to provide 3500K with 50 foot candles at the cooking surface. Any exposed wiring shall be concealed in stainless-steel.
- F. Appliance Interlock: Hoods to be provided with Appliance Interlock Temperature Sensor to comply with IMC 2006 requirement, section 507.2.1.1.
- G. Exhaust-Duct Collars: Minimum #18 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel, FSEC shall provide all stainless steel duct collars and make final connections to hood, welded 100% grooved smooth and painted.
- H. Fires suppression system: Hoods to be provided with factory pre-piping for connection to wet chemical fire suppression system, model R102 as manufactured by "Ansul" or equal in accordance with UL300 standards.
1. Surface drop exposed piping shall be stainless steel.

2.6 WALK-IN COOLERS/FREEZERS

A. Panel Construction:

1. Panels shall be pre-fabricated, sectional construction (minimum 5-inches thick for Coolers and Freezers), of tongue and groove design with foamed-in-place "double bubble" PVC gaskets (not glued, stapled, or nailed) on the male side of all interior and exterior panels and rigid urethane frame. Every panel shall be NSF and UL factory approved and bear the certifying labels. Walk-in box height to be 108"; Interior Height, except freezers with pre-fab floor in combination with cooler without floor to be 104" or unless otherwise specified.
2. Gaskets shall be impervious to stains, greases, oils, and mildew and be resistant to chemical corrosion and ultraviolet radiation. Gasket operating temperature shall be -30 degrees F to 160 degrees F (-34 degrees C to +71 degrees C).
3. Corner panels shall be 90-degree angles with coved corners; interior partition walls shall utilize 'T' panels with coved corners. All panels shall be manufactured in accordance NSF approved standards.
4. Panels shall be completely filled with rigid 100% foamed-in-place non-CFC urethane between interior and exterior metal 'skins' which have been die-formed and gauged for uniformity in size. Rigid polyurethane blowing agents shall comply with current US EPA SNAP program listings. Slab urethane or polystyrene are not acceptable. In addition, wood shall not be acceptable in any panel including doors, walls, floor, and ceiling.
5. Insulation shall have a 95% closed cell structure with an average in-place density of 2.2 lbs. per cubic foot, and compression strength at yield point of 19 lbs. per square inch. The R-Values of the floor, ceiling and wall panels meet the requirements under the Energy Independence and Security Act of 2009 (EISA).
6. Floor panels: Floor panels shall be die stamped with 3/8-inch radius NSF coved corners. All plane intersections shall be drawn, not cut and welded. Panels shall be fabricated similar to other panels and designed to readily withstand uniformly distributed loads, point loads for stationary shelving, rolling loads from hand truck and mobile food racks. Where noted, pre-fabricated floors shall withstand rolling loads from either manual pallet jacks or electric pallet jacks.

B. Door Construction: Walk-in coolers and freezers shall have entry and exit door hardware that complies with all of the requirements of CBC Section 11B-404.2.8.1 and maneuvering clearances at the exterior side per CBC Section 11B-404.2.7 & 11B-309.4. Doors shall be flush (in-fitting) type, self-closing, 36-inches by minimum 80-inches high, 20-gauge stainless steel interior and exterior.

1. Doors shall be mounted with three adjustable cam-lift hinges (Kason 1245) and hydraulic adjustable automatic hold-open (rack and pinion) door closers. Door hardware shall be chrome plated Kason model 27C. Mounting height of latching hardware shall be 34 to 44 inches above finish floor. All hardware shall meet the requirements of CBC 11B-404.2.7 & 11B-309.4.
2. Door latches shall lock and have a safety release to prevent entrapment (one quarter turn of the release handle unlocks the door from the inside).
3. All freezer door will be provided with a Department of Energy approved heater strip, heated sweep gaskets, and a heated pressure relief port.
4. All door sections to have raised casings. Light fixtures to be wired through digital controllers, refer to para. 2.7.E.5 for controller requirements. Provide additional switches as required for light activation from multiple locations.

5. The doorjamb, frames, and thresholds shall be made of durable Fiberglass Reinforced Plastic (FRP) or polyvinyl chloride (PVC).
- C. Assembly: Panels shall be assembled by Posi-Locs or equal which shall be foamed-in-place and activated by a hex wrench. Floor panels shall utilize post tension construction within the floor panels. Access ports to locking devices shall be covered by snap caps and shall be located in interior of walk-in.
- D. Finishes: Refer to the finishes shown and the Foodservice Equipment Schedule paragraph 3.5.
1. Surfaces (walls, ceiling and closure panels):
 - a. Exposed exterior 20-gauge Type 304 stainless steel, #4 finish, pattern per manufacturer drawings.
 - b. Unexposed exterior surfaces to be 20 gauge smooth galvanized steel.
 - c. Interior finishes: minimum 20 gauge type 304 stainless steel on walls and white stucco aluminum on ceiling.
 - d. Interior floor: verify on finish schedule and item specification, paragraph 3.5.
- E. Accessories:
1. Provide interior and exterior doors with 14 gauge (stainless steel) kickplates to 36-inches high.
 2. Provide (s/s) closure panels to interior ceiling and all adjacent walls, finished with 90- degree angles at the box and the ceiling/wall; no raw edges will be accepted.
 3. Provide vinyl strip curtains.
 4. Include LED light fixtures to provide 20 ft. candles of light throughout compartment.
 5. Refrigerated compartments fabricated and standard, shall be fitted with flush mounted digital temperature controllers. Thermometers on such controllers shall be adjustable and calibrated after installation. All thermometers shall have an accuracy of 2 degrees. Controller shall be Modularm 75 LC, or equal, and include frame mounted door magnets for door ajar alarm, interior panic alarm button and motion detector activated automatic panic alarm. All controllers are to be programmable and have the capability of being connected to remote monitoring systems or building management systems.
 6. Per document drawings, provide 14-inches by 24-inches view port - unheated for cooler door, heated for freezer door.
 7. Freezer Door Fan Switches (at ambient facing freezer door only)
 8. When Anthony doors are specified: include Optimax Pro LED Lighting.
- F. Insulated Floor Depressions: The FSEC shall provide styrofoam insulation for cooler and freezer floors. Insulation shall be a minimum of 3 layers Dow high load 60 extruded polystyrene, 2-inch thick. Overall R-value to meet DOE requirements for freezer floors with vertical compressive strength of 60 psi and maximum water absorption of 0.1% by volume.
- G. Approvals: Fire hazard classification according to ASTM E-84 (UL723) shall be a flame spread rating of 25 or less with a certifying UL label attached to every panel showing the meeting of the fire code. Smoke development rating to be 450 or less; NSF-listed with an approved toxicity rating.

- H. Walk-in coolers and freezers shall have level maneuvering clearances at the exterior side (CBC 118-404.2.4.1) and accessible entry and exit door hardware (CBC 11B-404.2.7, 11B-309.4 & 11B-404.2.8.1).
- I. Installation: Equipment identified under this section shall be erected by individuals approved by the manufacturer who qualify as "factory certified" installers.
- J. Food service equipment provider shall contract all aspects of installation for walk-in boxes directly with specified factory so as to not void warranty.

2.7 REMOTE REFRIGERATION SYSTEMS

- A. Furnish and install mechanical refrigeration work as indicated and specified, complete and ready for use. All systems shall comply with the latest edition of Title 24, 2016 Building Efficiency Standards. Principal items of work include:
 - 1. Mechanical refrigeration systems, including compressor units, condensers, refrigerant piping, evaporator coils, control valves, compressor racks, weather covers and required miscellaneous items. Refrigeration equipment shall consist of two major assemblies. One is the condensing unit assembly with all necessary components, factory installed and wired including single point electrical control panel, circuit breakers and contactors, OSHA approved fan guards, aluminum flexible conduit for internal wiring, suction filter, sight glass, drier, adjustable dual pressure control, flexible pressure hoses, Rotolock compressor adaptors and necessary tubing. The other is the refrigeration coil assembly/heat exchanger with expansion valve, electronic thermostat temperature control with electronic defrost time clock and on/off power switch, completely factory mounted and factory pressure tested with dry nitrogen.
 - a. Utilize refrigerant with an ozone depleting potential of 0
 - b. R-448A Low to Medium Temperatures
 - c. Other refrigerant approved by the Department of Energy for use in remote systems after December 31, 2017.
 - d. Glycol – Food Grade
 - 2. Furnishing of motor starters and walk-in refrigerator/freezer thermostats for installation under Electrical Section.
 - 3. Sleeves, inserts, hangers, supports and other incidental items necessary to complete the work.
 - 4. Cutting and patching of non-structural and other incidental items necessary to complete the work on this section.
 - 5. Testing, charging, adjusting, operational testing and cleaning of equipment. Conduct all tests as required by local inspecting agencies concerned with this project. Each refrigeration items specification is written to provide minimum specifications and scope of work.
 - 6. Refrigeration equipment shall be designed and installed to maintain the following general temperature unless otherwise specified.

a. Walk-In Refrigerators	1.7°C / 35°F
b. Walk-In Freezers	-23.2°C / -10°F
c. Reach-In Refrigerators	1.7°C / 35°F
d. Reach-In Freezers	-23.2°C / -10°F
e. Undercounter Refrigerators	1.7°C / 35°F
f. Undercounter Freezers	-23.2°C / -10°F
g. Cold Pan	4°C / 39°F

- B. Compressors and Condensing Unit: Factory assembled, scroll compressors with air cooled condensers operating at such speed within recommended range of section and discharge pressures for economical operation and with required BTU rating per hour, sizes and capacities in accordance with specifications. Provide units of same manufacturer and type throughout, new standard cataloged, to operate with refrigerant R-407A. 100 degrees ambient air, capacities selected on 16 hour running time basis for medium temperature fixtures and 18 hour running time basis for low temperature fixtures. For locations where the ambient exceeds 100 degrees Fahrenheit, the system is to be engineered for the maximum recorded ambient temperature. Additionally, all parallel systems shall include a minimum of one digital scroll compressor and be designed with 75% redundancy minimum.
- C. Condensing units shall be scroll air cooled condensing unit with rigid structural bases, 20 gauge weather covers, OSHA-approved fan guards and shrouds and waterproof electrical systems. Include internal inherent motor protection, suction line, shut off valves, liquid line shut off valves, oil pressure safety switches when required, adjustable dual pressure control, crank case heaters and oil separators on systems with longer than 100 lin. ft. run from condensing unit to the evaporator coil. Any outdoor installation within 20 miles of the salt air environment shall be provided with coated condenser coils.
- D. Medium temperature evaporators shall be equipped with Electronically Commutated Motors (ECM). Coils shall be low profile UL/NSF approved units with inline fans and cross fins staggered. Provide copper tubing, aluminum cased, permanently lubricated motors with thermal overload protection. Unit shall be provided with evaporator controller system capable of providing evaporator fan control, remote monitoring and diagnostics. Control system shall be interconnected to the local area network and be capable of sending alarm alerts via mobile telephone or e-mail. Water proof electrical system pre-wired to a single connection. Coils are designed to operate above 34 degrees Fahrenheit.
- E. Low Temperature evaporators shall be equipped with Electronically Commutated Motors (ECM). Coils shall be low profile UL/NSF approved units with inline fans and cross fins staggered. Provide copper tubing, aluminum cased, permanently lubricated motors with thermal overload protection. Unit shall be equipped with electric demand defrost controller system. Controller system shall provide on-demand defrost, remote monitoring and diagnostics and be interconnected to the local area network with the capability of sending alarm alerts via mobile telephone or e-mail. Water proof electrical system pre-wired to a single connection. Coils are designed to operate in a range from 30 degrees above Fahrenheit to -20 degrees Fahrenheit.
- F. Refrigerant lines shall be type "L" ACR copper tubing with wrought copper fittings assembled by silver soldering joints.
- G. Coil drains shall be 1" IPS copper. Route and pitch ½" per foot to drain. Provide electrical heaters on freezer drains. Drain lines to floor sinks by Plumber.
- H. Refrigeration lines insulation shall have a minimum ¾" Armstrong Armaflex AP Pipe insulation sealed with adhesive foam insulation. For glycol systems the minimum insulation shall be ¾". Tape fittings to be sufficient thickness to prevent condensation. Lines ran externally shall include a hard white PVC cover.
- I. Food service equipment provider shall contract all aspects of installation for refrigeration systems directly with specified factory so as to not void warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Unless expressly stipulated, and in a timely manner, no additional allowances will be made for Contractors or Manufacturers for errors, omissions or ambiguities not reported at time of bidding. Carefully review and compare the Contract Documents and at once report to Owner and/or Designer any errors, ambiguities, inconsistencies or omissions. Unless expressly stipulated, and in a timely manner, Kitchen Equipment Contractor shall be liable to Owner or Designer for any damage resulting from such errors, inconsistencies or omissions in the Contract Documents. Work shall not be done without approved Drawings, Specifications and/or Modifications and without receiving prior written receiving authorizations from Owner or Designer. Drawings and equipment specifications are intended to complement each other. Therefore, neither should be considered complete without the others.
- B. Examine areas and conditions, with Installer present, for compliance with requirements or installation tolerances, service-utility connections, and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Examine roughing-in for piping, mechanical, and electrical systems to verify actual locations of connections before installation.
- D. Verify all conditions at the building, particularly door openings and passageways for large equipment. Coordinate with General Contractor access to insure delivery of equipment to the required areas. Coordination shall include, but not be limited to, early delivery, hoisting, window removal and/or delay of wall construction. All special equipment, handling charges, window removal, etc. shall be paid for by the Food Service Equipment Contractor.
- E. Any and all food service equipment and equipment systems noted as "by owner/operator", "by purveyor", or "existing" in the food service construction documents are presented for reference only. These representations must be verified in writing by the food service equipment contractor, owner, operator, and/or general contractor prior to the release of "for construction" documentation. It will be the general contractor's responsibility to further verify and coordinate all necessary information pertaining to this equipment or systems making up, or relating to, this equipment including, but not limited to, local health department regulations, local sanitation code requirements, mechanical, structural, plumbing and electrical requirements prior to commencement of construction. Consultant or Architect take no responsibility for design, intent, function, performance, utility requirements, or code compliance of non-specified equipment.

3.2 INSTALLATION, GENERAL

- A. Install food service equipment level and plumb, according to manufacturer's written instructions, original design, and referenced standards.
- B. Complete equipment field assembly, where required, using methods indicated.
 - 1. Provide closed butt and contact joints that do not require a filler.
 - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "Fabrication, General" Article.
- C. Install equipment with access and maintenance clearances according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- D. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections. Cut holes and provide sleeves for pipes on equipment, for drains, electrical, plumbing, etc., as required for proper installation. Verify sizes with Owner on the following items before ordering or fabrication: steam pans, sheet pans, trays, glass and cup racks.

- E. Except for mobile and adjustable-leg equipment, securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- F. Install hoods to comply with NFPA 96 requirements and to remain free from vibration when operating.
- G. Install seismic restraints according to referenced SMACNA standard.
- H. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches (1200 mm) O.C. maximum.
- I. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- J. Prohibit cold storage rooms from being used by any other trade for storage or work areas. Repair or cause replacement to any damaged areas on the interior of the cold storage rooms, if the damage was caused due to the cold storage rooms being used for storage or work areas.

3.3 PROTECTING

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

3.4 START-UP, TESTING AND COMMISSIONING

- A. Startup Services: Engage factory-authorized service representatives to perform startup services for all equipment.
 - 1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized. Provide demonstrations for both operations and maintenance personnel.
 - 2. Remove protective coverings and clean and sanitize equipment, both inside and out, and re-lamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.
 - 3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.
 - a. Start up and testing for ice making equipment to be performed by the Original Equipment Manufacturer's authorized representative after substantial completion by the FSEC prior to final testing. All issues of installation hook-up and operational conditions are to be addressed. Any conditions not meeting operational needs will be identified and reviewed with the FSEC and/or GC.
 - b. Type I grease hoods and fire protection systems are to be reviewed by the Original Equipment Manufacturer's authorized representative after substantial completion and prior to final testing. This review shall also take place prior to the start-up and demonstration of any cooking equipment under the hood. All issues of installation hook-up and operational conditions will be addressed. Any conditions not meeting operational needs will be identified and reviewed with the FSEC and/or GC. A field inspection report will be provided as part of the Owner's equipment manual and submitted to the GC and local fire marshal when required by code.
 - 4. Provide maintenance and proper operations training to both the client maintenance and operations staff.

5. Provide maintenance manuals, service parts manuals and product schedule in accordance with paragraphs 1.4.K and 1.4.K.1
- B. Demonstration and Commissioning: Representatives of authorized service agencies, manufacturer or original equipment supplier shall provide these services with FSEC in attendance.
1. Demonstrate in the presence of the owner, owner's designated representative and owner's maintenance and operations personnel the proper initial start-up, operation clean-up, preventative maintenance safety procedures of each item of equipment.
 2. FSEC is to provide a signed log or record of all demonstrations, training and start-ups conducted to the owner with equipment operations manuals.

3.5 FOOD SERVICE EQUIPMENT SCHEDULE

SIS# W010

Project Name: San Bernardino City SD - Warm Springs ES
Project Job Number: 2019-0004

ITEM # 1-01 AIR CURTAIN

Quantity: One (1)
Manufacturer: Mars Air Systems
Model: NH248-1UA-TS

1. One (1) Model NH248-1UA-TS High Velocity Series 2 Air Curtain, for NSF Certified 48" wide door, Unheated, 115v/60/1-ph, Titanium Silver powder coated cabinet (Standard Production Color) cETLus, CE, NSF
2. One (1) 5 year warranty, standard
3. One (1) Options WITHOUT control panel
4. One (1) Options WITHOUT time delay
5. One (1) Model 99-014 Steel Mechanical Universal Surface-mounted Plunger/Roller Switch

ITEM # 1-02 EMPLOYEE LOCKERS <NIC>

Quantity: Two (2)
Manufacturer: NIFSEC

1. Two (2) Employee Lockers - NIFSEC

ITEM # 1-03 OFFICE DESK AND CHAIR <NIC>

Quantity: One (1)
Manufacturer: NIFSEC

1. One (1) Office Desk and Chair - NIFSEC

ITEM # 1-04 DRY SHELVING UNITS

Quantity: Eight (8)
Manufacturer: Cambro
Model: CAMSHELVING

1. Eight (8) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall be removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Shelves to be vented with the exception of the bottom shelf, which should be solid. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-05 WORK COUNTER

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WCNT-WBB-7830

1. One (1) Model WCNT-WBB-7830 Approximately 6'-6" l x 2'-6" w. Provide Stainless Fixtures, Inc. stainless steel work counter with undershelf and/or mid shelf, galvanized metal base, and 6" high back and end splash (where required). Top shall be 14 ga stainless steel, body to be 16 ga.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-06 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WSK-WBB-1278

1. One (1) Model WSK-WBB-1278 Approximately 6'-6" l x 1'-0" w. Provide Stainless Fixtures, Inc. stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-07 BUMPER RAILS

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: BR-WBB

1. One (1) Model BR-WBB (LOT) Approximately 10'-0" l. Provide Stainless Fixtures, Inc. 14 ga. stainless steel bumper rails guards mounted at 34" above the finished floor. Stainless steel shall have a #4 finish

ITEM # 1-08 WALL MOUNTED HAND SINK W/SOAP AND TOWEL DISPENSER

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. One (1) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF
2. One (1) Model -LRS Left & right side splashes

ITEM # 1-09 HAND SINK FAUCET, SPLASH MOUNT

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1146-04

1. One (1) Model B-1146-04 Workboard Faucet, wall mount, 4" centers, 5-3/4" swivel gooseneck nozzle (includes lockwasher to convert to rigid), 2.2 GPM aerator, quarter-turn Eterna cartridges with spring checks, 4" wrist blade handles, 1/2" NPT male inlets, ADA Compliant
2. One (1) 4" wrist action handle, standard
3. One (1) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 1-10 MICROWAVE OVEN

Quantity: One (1)
Manufacturer: ACP
Model: RMS10TS

1. One (1) Model RMS10TS Amana® Commercial Microwave Oven, 0.8 cu. ft. capacity, 1000 watts, low volume, 3-stage cooking, (5) power levels, (20) memory settings, 60-minute max cooking time, LED display, touch control, interlock safety switch, ADA-compliant Braille touch pads, audible end of cycle signal, side hinged door with tempered glass, lighted interior, stainless steel exterior wrap & interior, 120v/60/1-ph, 13.0 amps, 15 MCA, 1500 watts (total), NEMA 5-15P, cULus, ETL-Sanitation
2. One (1) 3-year limited warranty (1 year full)
3. One (1) Model CK10 Cleaning Kit, sample size, includes (1) 2 oz. bottle oven cleaner and (1) 2 oz. bottle oven shield protectant, suitable for all ACP Inc. ovens (shipped in USA Only)

ITEM # 1-11 HEATED CABINET <Existing>

Quantity: One (1)
Manufacturer: EXISTING
Model: TO REMAIN

1. One (1) Model TO REMAIN Heated Cabinet - Existing to Remain

ITEM # 1-12 CORNER GUARDS

Quantity: Two (2)
Manufacturer: Stainless Fixtures Inc
Model: CG-WBB

1. Two (2) Model CG-WBB (LOT) Provide Stainless Fixtures, Inc. 16 ga. stainless steel corner guards at 6'-6" in height. Stainless steel shall have a #4 finish.

ITEM # 1-13 WALK-IN REFRIGERATOR

Quantity: One (1)
Manufacturer: RMI Refrigerator Manufacturers Inc.
Model: CUSTOM

1. One (1) Model CUSTOM Refer to Section 114000.

ITEM # 1-14 EVAPORATOR COIL <Included>

Quantity: One (1)
Manufacturer: Airdyne Refrigeration Inc.
Model: CUSTOM

1. One (1) Model CUSTOM Evaporator coil provided as an integral part of the remote refrigeration system.

ITEM # 1-15 REFRIGERATOR STORAGE SHELVING UNITS

Quantity: Six (6)
Manufacturer: Cambro
Model: CAMSHELVING

1. Six (6) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall be removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Shelves to be vented with the exception of the bottom shelf, which should be solid. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Verify evaporator coil location, shelving units below coil to have 3 shelves. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-16 WALK-IN FREEZER <Included>

Quantity: One (1)
Manufacturer: RMI Refrigerator Manufacturers Inc.
Model: PART OF ITEM #1-13

1. One (1) Model PART OF ITEM #1-13 Walk-in Freezer - Part Of Item #1-13

ITEM # 1-17 EVAPORATOR COIL <Included>

Quantity: One (1)
Manufacturer: Airdyne Refrigeration Inc.
Model: CUSTOM

1. One (1) Model CUSTOM Evaporator coil provided as an integral part of the remote refrigeration system.

ITEM # 1-18 SPARE NO.

ITEM # 1-19 SPARE NO.

ITEM # 1-20 SPARE NO.

ITEM # 1-21 FREEZER STORAGE SHELVING UNITS

Quantity: Six (6)
Manufacturer: Cambro
Model: CAMSHELVING

1. Six (6) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall be removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Shelves to be vented with the exception of the bottom shelf, which should be solid. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Verify evaporator coil location, shelving units below coil to have 3 shelves. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-22 WALL MOUNTED HAND SINK W/SOAP AND TOWEL DISPENSER

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. One (1) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF
2. One (1) Model -LRS Left & right side splashes

ITEM # 1-23 HAND SINK FAUCET, SPLASH MOUNT

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1146-04

1. One (1) Model B-1146-04 Workboard Faucet, wall mount, 4" centers, 5-3/4" swivel gooseneck nozzle (includes lockwasher to convert to rigid), 2.2 GPM aerator, quarter-turn Eterna cartridges with spring checks, 4" wrist blade handles, 1/2" NPT male inlets, ADA Compliant
2. One (1) 4" wrist action handle, standard
3. One (1) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 1-24 CLEAN DISH TABLE WITH 3 COMPARTMENT POT SINK

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: CDT-WBB-23130

1. One (1) Model CDT-WBB-23130 Approximately 19'-3" l x 2'-6" w. Provide Stainless Fixtures, Inc. stainless steel landing table with 1-5/8" legs with adjustable bullet feet, under and/or mid shelves, 10" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga.
2. One (1) Model PS3-WBB-120 Provide Stainless Fixtures, Inc. stainless steel pot sink assembly with 1-5/8" legs with adjustable bullet feet, under and/or mid shelves, 10" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga.
3. Three (3) Model SINKS Provide 16 ga stainless steel sink tub measuring approximately 24" w x 26" d x 14" h. Welded in place with polished seams.
4. Three (3) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish
5. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-25 SPLASH MOUNTED HI-FLO UTENSIL SINK FAUCET

Quantity: Two (2)
Manufacturer: T&S Brass
Model: B-0291

1. Two (2) Model B-0291 Kettle & Pot Sink Faucet, Big-Flo, wall mounted 8" centers, 3/4" IPS model LL street EL inlets with locknuts, 18" swing nozzle, 175°F four arm handles, 1-1/4" dia. holes required in backsplash

ITEM # 1-26 WALL SHELF (KNIFE BRACKETS)

Quantity: Two (2)
Manufacturer: Stainless Fixtures Inc
Model: WSK-WBB-1242

1. Two (2) Model WSK-WBB-1242 Approximately 3'-6" l x 1'-0" w. Provide Stainless Fixtures, Inc. stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel.
2. Two (2) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-27 UTENSIL RACK

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: UR-WBB-84

1. One (1) Model UR-WBB-84 Approximately 7'-0" l x 1/4" w x 2" d. Provide Stainless Fixtures, Inc. stainless steel flatbar utensil rack with integral 1/4" x 2" mounting bracket. Include sliding hooks 8" on center. Stainless steel shall be type 304 with #4 finish.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-28 SPARE NO.

ITEM # 1-29 SPARE NO.

ITEM # 1-30 SPARE NO.

ITEM # 1-31 WALL FLASHING

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WFH-WBB

1. One (1) Model WFH-WBB (LOT) Approximately 29'-6" l. Provide Stainless Fixtures, Inc. 18 ga. stainless steel wall flashing from floor to exhaust hood and a #4 finish. Provide all necessary closure and trim strips for a complete installation.

ITEM # 1-32 EXHAUST HOOD, TYPE II

Quantity: One (1)
Manufacturer: Accurex
Model: XO

1. One (1) Model XO Heat and Fume hood(s) shall be of the Type II, exhaust only canopy. The hood(s) shall be constructed of a minimum of 18 gauge 300 series stainless steel. Provide Exhaust Hood as shown on plans and in accordance with the following specification:

ITEM # 1-33 EXHAUST HOOD TRIM AND CLOSURE PANEL

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: HTP-WBB

1. One (1) Model HTP-WBB Approximately 4'-2" l x 3'-7" w. Provide Stainless Fixtures, Inc. 18 ga stainless steel exhaust hood trim and closure panels with #4 finish. Provide all necessary closure, louvers and trim strips for a complete installation.

ITEM # 1-34 DOOR TYPE DISHWASHER (TALL) WITH BOOSTER HEATER

Quantity: One (1)
Manufacturer: Hobart
Model: AM15T+BUILDUP

1. One (1) Model AM15T+BUILDUP AM Select Tall Dishwasher, door type, 27" H opening, convertible high/low temperature sanitizing, 58-65 racks/hour capacity, includes pan rack to accommodate 18" x 26" sheet pans or a 60 quart mixing bowl. straight-thru/corner installation, stainless steel finish, ENERGY STAR®
2. One (1) Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
3. One (1) Hobart Prosurance: Includes 2 PM Visits with proactive replacement of specific parts, Full Parts, Labor & Travel Contract coverage / M-F (8-5) / No Guaranteed Response Time (net)
4. One (1) Model AM15T-ELE0EU 208-240v/60/3-ph
5. One (1) Model AM15T-BSTYES With electric booster
6. One (1) Model AM15T-HTEELE Electric heat
7. One (1) Model SINGLE-POINT Single Point Electrical Connection (factory installed, 3 phase booster machines only)
8. One (1) Model DWT-AM15 Drain water tempering kit
9. One (1) Installation of DWT kit only (NET)
10. One (1) Model DISHRAK-PEG20 Peg rack
11. One (1) Model DISHRAK-COM20 Combination rack
12. One (1) Model SEISMIC-FEET Seismic feet with holes (set of 4)
13. One (1) Model SPEC-KIT Single point electrical connect AM15 kit (field installation required) (3 phase booster machines only)
14. One (1) Model RACK-6PAN 6 pan rack to hold sheet pans (Tall only)

ITEM # 1-35 SOILED DISH TABLE W/SCRAP SINK AND QUICK DRAIN

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: SDT-WBB-65

1. One (1) Model SDT-WBB-65 Approximately 5'-5" l x 2'-6" w. Provide Stainless Fixtures, Inc. stainless steel landing table with 1-5/8" legs with adjustable bullet feet, under and/or mid shelves, quick drain assembly, 10" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga.
2. One (1) Model SCRAP SINK Provide 16 ga stainless steel sink tub measuring approximately 20" l x 18" w x 8" d. Welded in place with polished seams. Provide with rotary waste valve.
3. One (1) Model SCRAP BASKET Provide 16 ga stainless steel scrap basket measuring 19 1/2" l x 19 1/2" w x 7 3/4" d. Scrap basket to be constructed with coved corners, perforated holes, welded 1/4" x 1/4" h round solid stainless steel rod feet, and rack glide. Perforated holes to be 3/16" at 1/2" on center on all four sides and bottom of basket. Rack glide with lift out handles, to be square tubing and fully welding.
4. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-36 HOSE REEL

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-7232-01

1. One (1) Model B-7232-01 Hose Reel System, open, 3/8" x 35 ft. hose with high flow spray valve, with ratcheting system & adjustable hose bumper, epoxy coated steel
2. One (1) Model B-0513 Concealed Mixing Faucet, lever handles, 3/8" NPT inlets & outlets, 3" centers
3. Two (2) Model B-CVH1-2 Check Valve, 1/2" NPT female, horizontal
4. One (1) Model B-0963 Vacuum Breaker, 1/2" NPT inlet & outlet, continuous pressure, quarter-turn ball valves
5. One (1) Model HW-4B-36 Connector Hose, water, 3/8" dia., 36"L, stainless steel braid with extruded coating, 3/8" M x 3/8" quick disconnect
6. One (1) Model 002535-25 Close Nipple 3/8"
7. One (1) Model 015073-40 Check Valve w/ 1/2" NPT adapter

ITEM # 1-37 TRASH RECEPTACLE W/DOLLY

Quantity: One (1)
Manufacturer: Rubbermaid Commercial Products
Model: FG262000GRAY

1. One (1) Model FG262000GRAY ProSave® BRUTE® Container, without lid, 20 gallon, 19-1/2"D x 22-7/8"H, round, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray, NSF
2. One (1) All-plastic, professional-grade construction will not rust, chip or peel; resists dents.
3. One (1) Reinforced rims add strength and durability
4. One (1) Built-in handles allow easy, non-slip lifting and anti-jam nesting
5. One (1) Double-ribbed base increases stability and dragging capacity
6. One (1) USDA Meat & Poultry Equipment Group listed and assist in complying with HACCP guidelines.
7. One (1) Certified to NSF Standard #2 and Standard #21
8. One (1) Model FG264043BLA BRUTE® Quiet Dolly, 18-1/4"D x 6-5/8"H, non-marking blue casters, black

ITEM # 1-38 SPARE NO.

ITEM # 1-39 SPARE NO.

ITEM # 1-40 SPARE NO.

ITEM # 1-41 WORK TABLE W/MARINE EDGE AND 2 COMPARTMENT PREP SINKS

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: ITM-WBB-30102

1. One (1) Model ITM-WBB-30102 Approximately 8'-6" l x 2'-6" w. Provide Stainless Fixtures, Inc. stainless steel work table with marine edge, 1-5/8" legs with adjustable bullet feet, and under and/or mid shelves. Top shall be 14 ga stainless steel, and legs shall be 16 ga.
2. One (1) Model 2 COMP SINK Provide 16 ga stainless steel with 2 compartment sink tub measuring approximately 18" w x 24" d x 12" h each. Welded in place with polished seams.
3. Two (2) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish
4. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-42 SPLASH MOUNTED PREP SINK FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0231-CR

1. One (1) Model B-0231-CR Faucet, 12" swing nozzle, 8" wall mount base, 1/2" NPT female Inlets, ceramas cartridges

ITEM # 1-43 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WSK-WBB-1227

1. One (1) Model WSK-WBB-1227 Approximately 2'-9" l x 1'-0" w. Provide Stainless Fixtures, Inc. stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-44 WALL FLASHING

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WFH-WBB

1. One (1) Model WFH-WBB (LOT) Approximately 5'-2" l. Provide Stainless Fixtures, Inc. 18 ga. stainless steel wall flashing from floor to exhaust hood and a #4 finish. Provide all necessary closure and trim strips for a complete installation.

ITEM # 1-45 CAN OPENER

Quantity: One (1)
Manufacturer: Edlund
Model: S-11

1. One (1) Model S-11 Can Opener, manual, stainless steel, with cast stainless steel base, NSF certified
2. One (1) 5 year limited warranty, standard

ITEM # 1-46 TRASH RECEPTACLE W/DOLLY

Quantity: One (1)
Manufacturer: Rubbermaid Commercial Products
Model: FG262000GRAY

1. One (1) Model FG262000GRAY ProSave® BRUTE® Container, without lid, 20 gallon, 19-1/2"D x 22-7/8"H, round, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray, NSF
2. One (1) All-plastic, professional-grade construction will not rust, chip or peel; resists dents.
3. One (1) Reinforced rims add strength and durability
4. One (1) Built-in handles allow easy, non-slip lifting and anti-jam nesting
5. One (1) Double-ribbed base increases stability and dragging capacity
6. One (1) USDA Meat & Poultry Equipment Group listed and assist in complying with HACCP guidelines.
7. One (1) Certified to NSF Standard #2 and Standard #21
8. One (1) Model FG264043BLA BRUTE® Quiet Dolly, 18-1/4"D x 6-5/8"H, non-marking blue casters, black

ITEM # 1-47 EXHAUST HOOD, TYPE II

Quantity: One (1)
Manufacturer: Accurex
Model: XO

1. One (1) Model XO Heat and Fume hood(s) shall be of the Type II, exhaust only canopy. The hood(s) shall be constructed of a minimum of 18 gauge 300 series stainless steel. Provide Exhaust Hood as shown on plans and in accordance with the following specification:

ITEM # 1-48 SPARE NO.

ITEM # 1-49 SPARE NO.

ITEM # 1-50 SPARE NO.

ITEM # 1-51 EXHAUST HOOD TRIM AND CLOSURE PANEL

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: HTP-WBB

1. One (1) Model HTP-WBB Approximately 5'-2" l x 5'-0" w. Provide Stainless Fixtures, Inc. 18 ga stainless steel exhaust hood trim and closure panels with #4 finish. Provide all necessary closure, louvers and trim strips for a complete installation.

ITEM # 1-52 DOUBLE CONVECTION OVEN (MOBILE) <Existing>

Quantity: One (1)
Manufacturer: EXISTING
Model: TO REMAIN

1. One (1) Model TO REMAIN Double Convection Oven (Mobile) - Existing to Remain

ITEM # 1-53 PASS THRU SERVING SHELF

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 11'-2" l x 1'-6" w. Provide stainless steel pass thru serving shelf with concealed brackets. Shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-54 HOT FOOD TABLE (MOBILE) <Existing>

Quantity: One (1)
Manufacturer: EXISTING
Model: TO REMAIN

1. One (1) Model TO REMAIN Hot Food Table (Mobile) - Existing to Remain

ITEM # 1-55 AIR CURTAIN

Quantity: One (1)
Manufacturer: Mars Air Systems
Model: LPV272-1UD-TS

1. One (1) Model LPV272-1UD-TS LoPro Series 2 Air Curtain, for 72" wide door, Unheated, (1) 1/6 HP motor, 208-230v/60/1-ph, Titanium Silver powder coated cabinet (Custom Production Color), cETLus
2. One (1) 5 year parts warranty, standard
3. One (1) Options WITHOUT time delay
4. One (1) Model 99-014 Steel Mechanical Universal Surface-mounted Plunger/Roller Switch
5. One (1) Model 99-014 Additional Steel Mechanical Universal Surface-mounted Plunger/Roller Switch, for use with double doors
6. One (1) Model 09-057-TS LoPro Easy Install Top Mounting Kit, Unheated, Titanium Silver

ITEM # 1-56 MILK COOLER (MOBILE) <Existing>

Quantity: One (1)
Manufacturer: EXISTING
Model: TO REMAIN

1. One (1) Model TO REMAIN Milk Cooler (Mobile) - Existing to Remain

ITEM # 1-57 SALAD BAR (MOBILE) <Existing>

Quantity: Two (2)
Manufacturer: EXISTING
Model: TO REMAIN

1. Two (2) Model TO REMAIN Salad Bar (Mobile) - Existing to Remain

ITEM # 1-58 WORK TABLE

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WT-WBB-3060

1. One (1) Model WT-WBB-3060 Approximately 5'-0" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-59 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WSK-WBB-1260

1. One (1) Model WSK-WBB-1260 Approximately 5'-0" l x 1'-0" w. Provide Stainless Fixtures, Inc. stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-60 SPARE NO.

ITEM # 1-61 POS STATION (MOBILE) <Existing>

Quantity: One (1)
Manufacturer: EXISTING
Model: TO REMAIN

1. One (1) Model TO REMAIN POS Station (Mobile) - Existing to Remain

ITEM # 1-62 POS SYSTEM (MOBILE) <Existing>

Quantity: One (1)
Manufacturer: EXISTING
Model: TO REMAIN

1. One (1) Model TO REMAIN POS System (Mobile) - Existing to Remain

ITEM # 1-63 JANITOR'S MOP SINK (FLOOR MOUNTED)

Quantity: One (1)
Manufacturer: Advance Tabco
Model: 9-OP-28

1. One (1) Model 9-OP-28 Mop Sink, floor mounted, 33"W x 25"D x 10"H (overall), 28"W x 20" front-to-back x 6" deep (bowl size), free flow drain with 2" IPS outlet, stainless steel construction

ITEM # 1-64 JANITOR'S SINK FAUCET W/VACUUM BREAKER

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0655-01

1. One (1) Model B-0655-01 Service Sink Faucet, vacuum breaker nozzle with 3/4" garden hose thread, 1/2" NPT female flanged adjustable inlet with screwdriver stops, 6" wrist action handles, pail hook, bottom support, wall brace
2. One (1) 6" wrist action handle, standard, nc

ITEM # 1-65 CHEMICAL WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Stainless Fixtures Inc
Model: WS-WBB-1233

1. One (1) Model WS-WBB-1233 Approximately 2'-9" l x 1'-0" w. Provide Stainless Fixtures, Inc. stainless steel chemical wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel.
2. One (1) Model THIS ITEM TO HAVE POLISHED EDGES STANDARD. This item to have polished edges standard.

ITEM # 1-66 JANITOR'S MOP RACK

Quantity: One (1)
Manufacturer: Advance Tabco
Model: K-242

1. One (1) Model K-242 Mop Hanger, 23", accommodates (3)

ITEM # 1-67 CHEMICAL STORAGE SHELVING UNITS

Quantity: One (1)
Manufacturer: Cambro
Model: CAMSHELVING

1. One (1) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall be removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Shelves to be vented with the exception of the bottom shelf, which should be solid. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-68 SPARE NO.

ITEM # 1-69 SPARE NO.

ITEM # 1-70 SPARE NO.

ITEM # 1-71 REMOTE REFRIGERATION RACK AND SYSTEM

Quantity: One (1)
Manufacturer: Airdyne Refrigeration Inc.
Model: CUSTOM

1. One (1) Model CUSTOM Refer to Section 114000, paragraph 2.8 and FS drawings.

END OF SECTION

SECTION 11 90 00

MISCELLANEOUS EQUIPMENT

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bollards.
- B. Garbage disposal.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.3 SUBMITTALS

- A. Submit product data and manufacturer's installation instructions for each item under provisions of Section 01 33 00.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR), Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

NOT USED

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's printed instructions and as indicated on the drawings.

END OF SECTION

SECTION 12 24 13

WINDOW SHADES CLUTCH XD OPERATED WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manually operated, roll-up fabric interior window shades including mounting and operating hardware.

1.2 RELATED SECTIONS

- A. Section 09 51 23 - Acoustical Tile Ceilings.

1.3 REFERENCES

- A. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.
- B. GREENGUARD Environmental Institute Gold.
- C. US Green Building Council.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Manufacturer's data sheets on each product specified, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation and maintenance instructions.
 - 3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - 4. Storage and handling requirements and recommendations.
 - 5. Mounting details and installation methods.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.
- E. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.
- G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware.
- H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

- B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.
 - C. Mock-Up: Provide a mock-up of one of each type roller shade assembly specified for evaluation of mounting, appearance and accessories.
 - 1. Locate mock-up in window(s) designated by Architect.
 - 2. Do not proceed with remaining work until mock-up is accepted by Architect.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
 - B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.
 - C. Label containers and shades according to Window Shade Schedule.
 - D. Store products in manufacturer's unopened packaging until ready for installation.
- 1.7 SEQUENCING
- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
 - B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
- 1.8 PROJECT CONDITIONS
- A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.
- 1.9 WARRANTY
- A. Hardware and Shade Fabric: Draper's standard twenty-five year limited warranty.
- 1.10 MANUFACTURERS
- A. Acceptable Manufacturer: Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425; Spiceland, IN 47385-0425. ASD. Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Web: www.draperinc.com.
 - B. Substitutions: As equal.
 - C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 13.
- 1.11 MANUALLY OPERATED WINDOW SHADES
- A. Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Manual FlexShade XD as manufactured by Draper, Inc.
 - 1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
 - a. Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.
 - b. Bead chain loop: Stainless steel bead chain.
 - c. Bead chain loop: Polyester bead chain, Ivory, Grey, White, Bronze or Black color as selected by Architect.
 - d. Bead Chain Hold Down: P-Clip.

- e. Bead Chain Hold Down: Spring-Loaded Tensioner.
- 2. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.
 - a. Minimum Roller Tube Diameter: 1.56 inches (40 mm).
 - b. Fabric Connection to Roller Tube: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
 - c. Fabric Length: 6 inches (152 mm) greater than window height minimum.
 - d. Bottom Slat: 13/16 inch (20.6 mm) aluminum dowel, encased in bottom hem with heat sealed ends.
 - e. Orientation: Regular from back of roller.
 - f. Orientation: Reverse from front of roller.
- 3. Bottom Slat
 - a. Closed pocket elliptical slat: 1" (25mm) aluminum elliptical slat inside of a 1 5/8" (41mm) pocket with heat sealed ends
 - b. Open pocket elliptical slat: 1" (25mm) aluminum elliptical slat with plastic ends inside of a 1 5/8" (41mm) pocket.
 - c. Flat exposed hem bar: Small: 7/8" x 5/16" (22mm x 8mm) and Large 1½" x 5/16" (38mm x 8mm) aluminum rectangular hem bar with plastic end caps. Powder coated in black, bronze, ivory, white or clear anodized.
 - d. Round exposed hem bar: Small 5/8" (16mm) and Large 13/16" (21mm) aluminum with plastic end caps. Powder coated in black, bronze, ivory, white or clear anodized.
- 4. Mounting:
 - a. Endcaps only.
 - b. Endcaps and fascia.
 - c. Endcaps and headbox.
 - d. Headbox.
 - e. Ceiling pocket.
 - f. Dual roller endcaps only.
 - g. Dual roller fascia.
 - h. Dual roller horizontal fascia.
 - i. Dual roller with pocket headbox.
- 5. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
 - a. Endcap covers: To match fascia or headbox color.
 - b. Mounted to ceiling.
 - c. Mounted to wall.
 - d. Mounted to jamb.
- 6. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
 - a. Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.
 - b. Shape: Square Fascia Panel.
 - c. Shape: Dual Roller Fascia Panel.
 - d. Shape: Dual Roller Horizontal Fascia Panel.
 - e. Finish: Clear anodized.
 - f. Finish: Black powder coat.
 - g. Finish: White powder coat.
 - h. Finish: Ivory powder coat.
 - i. Finish: Bronze powder coat.
 - j. Finish: Custom powder coat as selected by the Architect.
- 7. Headbox Ceiling/Wall style: Aluminum fabrication with removable closure, endcaps, and back and top cover piece:
 - a. Finish: Clear anodized.
 - b. Finish: Black powder coat.
 - c. Finish: White powder coat.
 - d. Finish: Ivory powder coat.
 - e. Finish: Bronze powder coat.
 - f. Finish: Custom powder coat as selected by the Architect.
- 8. Headbox, Pocket style: Aluminum fabrication with removable closure, endcaps, and U-shaped pocket:
 - a. Finish: Clear anodized.
 - b. Finish: Black powder coat.

- c. Finish: White powder coat.
 - d. Finish: Ivory powder coat.
 - e. Finish: Bronze powder coat.
 - f. Finish: Custom powder coat as selected by the Architect.
9. Dual Roller Ceiling Pocket. Pocket and endcaps designed for recessed ceiling installation of dual roller window shades.
- a. Material: 18 gauge steel with white finish on bottom and front.
 - b. Small Size: 5-3/4 inches (146 mm) wide by 7-3/4 inches (197 mm) high.
 - c. Large Size: 6-12 inches (165 mm) wide by 8-1.2 inches (216 mm) high.
 - d. Horizontal shape Size: 7-1/4 inches (184 mm) wide by 3-7/8 inches (98 mm) high.
 - e. Closure Panel Aluminum, without exposed fasteners:
 - 1) Front Tile Flange
 - 2) Left Tile Flange
 - 3) Right Tile Flange
 - 4) Pre-drilled Mounting Holes
 - 5) Pre-drilled Ventilation holes.
 - f. "L" Channel.
 - g. "U" Channel.
 - h. "H" Channel.
 - i. Channel Liners
10. Type D Shade pocket: Rectangular pocket and endcaps designed for recessed ceiling installation of window shades.
- a. Material: Extruded aluminum alloy or steel with white finish.
 - b. Size: 5 inches (127 mm) wide by 5-3/8 inches (137 mm) high.
 - c. Closure Panel:
 - 1) 1-1/2 (38 mm) closure dimension, recommended for bead chain operation.
 - 2) 3 inch (78 mm). If selected for CL or XD installer must notch the closure panel to allow the chain to pass through.
 - d. Pocket Endcap Kit: Metal endcaps with 7/8 inch (22 mm) lip for support of acoustical ceiling panel.
 - e. Corners: Welded one-piece aluminum sections connecting to and matching pockets to allow continuous shade recess at ceiling corners.
11. Wall Clip with Closure panel: For site constructed ceiling recesses, provide removable closure panel to minimize slot for shade passage but allowing access to shade for maintenance.
- a. Material: Aluminum alloy with white epoxy paint finish.
 - b. Tile Lip: Provide wall clip with 7/8 inch tile lip (22 mm).
 - c. Closure width: 1-1/2 inches (38 mm).
 - d. Closure width: 3 inches (75 mm).
 - e. Closure Width: 5 inches (127 mm).
 - f. Provide continuous wall clip, 1-3/4 (44 mm) by 3/16 inch (5 mm), for snap-in attachment of closure panel without fasteners.
12. Light Gap Reduction Channels.
- a. L Angle - 3/4 inch (19 mm) by 1 inch (25 mm).
 - b. L Angle - 1 inch (25 mm) by 2-3/4 inches (70mm).
 - c. U Channel - 1 inch (25 mm) by 2-1/2 inches (64 mm).
 - d. H Channel - 1 inch (25 mm) by 5 inches (127 mm).

1.12 FABRIC

- A. Light-Filtering Fabrics
 - 1. SheerWeave Series SW2703: Duplex basketweave fabric-light exterior color combined with dark interior color for thermal comfort and view-through. GREENGUARD Children & Schools, and Gold certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools, and Gold certificate. Fire rating: NFPA 701. SW2703-3 percent open.
- B. Color and pattern: As selected by District representative from manufacturer's standard range.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

2.2 PREPARATION

- A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
- B. Coordinate requirements for blocking, construction of shade pockets, and structural supports to ensure adequate means for installation of window shades.
- C. Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings specified in Section 09 51 23.

2.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.
- C. Shade pockets:
 - 1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
 - 2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
 - 3. Install corner pieces securely and in alignment with pockets.
 - 4. Install pocket ends securely and in alignment with pockets.
 - 5. After interior construction is essentially complete, install shade and operating mechanism in pocket.
- D. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
 - 1. Fascias.
 - 2. Closure panels.
 - 3. Endcaps.
- E. Install headbox, side channels, and sill channel with sealant specified in Section 07 92 00 - Joint Sealants.
- F. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

2.4 TESTING AND DEMONSTRATION

- A. Test window shades to verify that interface to other building systems and other operating components are functional. Correct deficiencies.
- B. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.
 - 1. Chain and clutch.
- C. During daylight hours, lower shades and turn off interior lights. Verify that there are no light leaks at perimeter or within shade assembly. Correct deficiencies.
- D. Demonstrate operation of shades to Owner's designated representatives.

2.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

2.6 SCHEDULES

- A. Refer to Drawings for shade types and locations.

END OF SECTION

SECTION 22 05 17

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. Sleeve-seal systems.
 - 3. Grout.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.13 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 SLEEVES: Shall be plastic or galvanized steel where pipes pass through concrete walls or floor slabs.

- A. Isolate pipes through ground floor slabs with Kraft paper, plastic tape or similar materials unless conduit is specified or indicated.
- B. Sleeves for pipes through exterior walls shall be non-metallic with minimum 2" weep ring as manufactured by Link Seal. Pipe shall be sealed with Link Seal modular seal with EPDM seal elements.
- C. Sleeves in or through fire rated walls shall be per U.L. Fire Resistance System No. WL1146 for drywall construction, and U.L. Fire Resistance System No. CAJ1044 for concrete construction. See architectural plans for all locations of rated walls.
- D. Below-grade piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts and sleeves as manufactured by Century Line.
- E. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Metraflex Company (The).
 - 3. Pipeline Seal and Insulator, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel or Stainless steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 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.
 - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in joint sealant Section.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in appropriate firestopping Section.

3.2 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.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 2. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 4. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION

SECTION 22 05 18

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 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.12 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.13 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 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 type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

- e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass 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 type.
 - 2. Existing Piping: Split-casting, floor-plate type.
- 3.2 FIELD QUALITY CONTROL
- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Bronze gate valves.
4. Manual circuit balancing valves.
5. Gas shut-off cocks.

B. Related Sections:

1. Division 2 water distribution piping Sections for general-duty and specialty valves for site construction piping.
2. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
3. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a

proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

- c. Include all pertinent construction, installation, performance and technical data.
- d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
- 5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.12 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61-G and NSF-372 for valve materials for potable-water service.
 1. Valves for domestic water must comply with the Federal Reduction of Lead in Drinking Water Act.
 - a. "Lead Free" refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$.
 - b. All valves must be 3rd party certified.
 - c. Bronze valves shall be made of dezincification-resistant material.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.14 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.16 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Piping systems shall be supplied with valves arranged so as to give complete and regulating control of each building and piping systems throughout the building. And located so all parts are easily accessible and maintained.
 - 1. Valve Design: Rising stem or outside screw and yoke stems. Non-rising stem valves may be used where space conditions prevent full extension of rising stems.
 - 2. Sizes: Same size as upstream pipe, unless otherwise indicated.
 - 3. Extended stems: Where piping insulation is indicated or specified, valves shall be equipped with 2" extended handles of non-thermal conductive material. Also provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Supply with memory stops, which are fully adjustable after insulation is applied.
 - 4. End Connection: 2 inch and under shall be threaded, 2-1/2 inches and larger shall be flanged or full lug style.
- C. Valves for Potable Water must comply with California Lead Free Law, effective January 1, 2010.
 - 1. "Lead Free" refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$. Source: California Health & Safety Code (116875).
 - 2. All valves must be 3rd party certified.
 - 3. Bronze valves shall be made with dezincification-resistant material.
- D. Where possible, valves of one manufacturer shall be used.
- E. Provide Class 150 valves meeting the valve specifications where Class 125 valves are specified but are not available.

- F. Bronze valves shall be made with dezincification-resistant materials, (Bronze ASTM B62, B61, or B584 Alloy C87850). This includes body, ball, stem and / or trim.
- G. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- H. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- I. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- J. Valve Sizes: Same as upstream piping unless otherwise indicated.
- K. Valve Actuator Types:
 - 1. Hand-wheel: For valves other than quarter-turn types.
 - 2. Hand-lever: For quarter-turn valves NPS 6 and smaller.
- L. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Nib-seal handle extension or comparable product by one of the following:
 - b. General valves:
 - 1) NIBCO
 - 2) Hammond
 - 3) Milwaukee
 - c. Below grade domestic water shut-off valves (gate valves) 2" and larger:
 - 1) NIBCO.
 - 2) Clow.
 - 3) Mueller.
 - d. Butterfly Valves:
 - 1) NIBCO.
 - 2) Demco.
 - 3) Dezuric.
 - e. Plug Valves:
 - 1) Hammond.
 - 2) Milwaukee.
 - f. Check valves, lift type:
 - 1) Hammond.
 - 2) Milwaukee.

- g. Below grade backwater valve isolation valves:
 - 1) NIBCO.
 - 2) Clow.
 - 3) Mueller.
 - 2. Butterfly Valves: With extended neck.
 - M. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.
 - N. Valve Bypass and Drain Connections: MSS SP-45.
- 2.2 BRONZE BALL VALVES
- A. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim & Nib-Seal Handle:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-595-Y-66-LF or T-595-Y-66-LF or a comparable product by one of the following,
 - a. Milwaukee Valve Company.
 - b. Apollo.
 - 2. Description:
 - c. Standard: MSS SP-110, NSF 61-G.
 - d. CWP Rating: 600 psig.
 - e. Body Design: Three piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
 - f. Body Material: Bronze ASTM B 584 Alloy C87850 or C87600.
 - g. Ends: Threaded or Solder.
 - h. Seats: PTFE or TFE.
 - i. Stem: 316 Stainless steel.
 - j. Ball: 316 Stainless steel, vented.
 - k. Port: Full.
 - B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim & Nib-Seal Handle:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-585-66-LF or T-585-66-LF or a comparable product by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Milwaukee Valve Company.

2. Description:
 - a. Standard: MSS SP-110, NSF 61-G.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
 - d. Body Material: Bronze ASTM B 584 Alloy C87600.
 - e. Ends: Threaded or Solder.
 - f. Seats: PTFE or TFE.
 - g. Stem: 316 Stainless steel.
 - h. Ball: 316 Stainless steel, vented.
 - i. Port: Full.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-480-Y-LF or T-480-Y-LF or a comparable product by one of the following:
 - a. Hammond.
 - b. Milwaukee.
2. Description:
 - a. Standard: MSS SP-80, Type 2, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 584 Alloy C87850, lead free bronze.
 - e. Ends: Threaded or Solder.
 - f. Disc: PTFE, or TFE.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Nonmetallic TFE Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-Y-LF or T-413-Y-LF or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 4, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Y-pattern Horizontal flow.

- d. Body Material: ASTM B 584 Alloy C87850, lead free bronze.
- e. Ends: Threaded or Solder.
- f. Disc: PTFE or TFE.

2.5 BRONZE GATE VALVES

A. NRS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-113-LF or T-113-LF or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves.
2. Description:
 - a. Standard: MSS SP-139, Type 2, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 584, dezincification-resistant bronze with integral seat and threaded bonnet.
 - d. Ends: Threaded or Solder.
 - e. Stem: Lead free Silicon Bronze.
 - f. Disc: Solid wedge; lead free bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

B. RS Bronze Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-111-LF or T-111-LF or a comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Powell Valves
2. Description:
 - a. Standard: MSS SP-80, Type 2, NSF 61-G.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B584 C87850 dezincification resistant bronze with integral seat and threaded bonnet.
 - d. Ends: Threaded or Solder.
 - e. Stem: Lead free silicon bronze.
 - f. Disc: Solid wedge, lead free bronze.
 - g. Packing: Asbestos free.
 - h. Handwhell: Malleable iron.

2.6 GAS SHUT-OFF COCKS:

A. Gas Shut-Off Cocks, Above Grade (4" and smaller):

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T-FP-600-A or a comparable product by one of the following:
 - a. Or approved equal.
2. Description:
 - a. Standard: MSS SP-110
 - b. CWP Rating: 600 psig.
 - c. SWP Rating: 150 psig.
 - d. Gas Rating: CSA certified and UL/FM listed.
 - e. Body Design: Two piece with threaded body pack nut design (no threaded stem designs allowed) with adjustable stem packing.
 - f. Body Material: Dezincification-resistant brass.
 - g. Seats: PTFE
 - h. Ball: Chrome-plated brass
 - i. Ends: Threaded
 - j. Port: Full

B. Gas Shut-Off Cocks, Below Grade:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Nordstom "Poly-Gas" or comparable product by one of the following:
 - a. Or approved equal.
2. Description:
 - a. Standards: ASTM D-2513 and ANSI B16.40
 - b. Valve boxes: cast iron tops marked "GAS", high-impact heavy-duty ABS valve can as manufactured by C.O. Test Services-VALVCO, Inc. or equal.

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 check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball or Butterfly valves.
- B. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: Threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 - 3. Bronze Lift Check Valves: Class 125, nonmetallic TFE disc.
 - 4. Bronze Swing Check Valves: Class 150, nonmetallic TFE disc.
 - 5. Bronze Gate Valves: Class 150, RS.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Ductile-Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

END OF SECTION

SECTION 22 05 29

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 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7-10.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.6 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.

3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California Division of the State Architect.
 6. California State Division of Industrial Safety.
 7. County Health Department.
 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.7 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

- 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.
- B. Substitution Requirements:
1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
 5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
 6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.13 QUALITY ASSURANCE

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

1.14 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.16 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Pipe Supports: Unless otherwise indicated on the drawings, shall be as follows:

- A. The Contractor shall furnish and install all miscellaneous iron work including angles, channels, etc., required to appropriately support the various piping systems. Hanger spacing and location shall conform to 2016 California Plumbing Code Table 313.1.
- B. All horizontal runs of piping within the building to be supported from the structural framing with steel rods and split ring hangers, B-Line, Grinnell Company, Tolco, or approved equal. Steel rods shall be secured to overhead framing with side beam connectors. Where necessary, install angle iron between framing to accommodate hanger rods. Where several pipes are running together, Unistrut, B-Line or Powerstrut channels with clamps may be used in lieu of individual pipe hangers, and supported from structure as herein specified. Submit test data for type of hanger supports to be provided. For support conditions other than specified herein, the Contractor shall submit method of support for approval prior to any installation.
- C. Horizontal Piping Hangers and Supports:
 - 1. General: Provide factory fabricated horizontal hangers and supports complying with one of the following MSS types listed to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - a. Adjustable Steel Clevis Hangers: (MSS Type 1.) B-Line B 3100

b. Adjustable Swivel Pipe Rings: (MSS Type 5) B-Line B3690

D. Vertical-Piping Clamps:

1. General: Provide factory fabricated vertical-piping clamps complying with the following types listed, to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
2. Two-Bolt Riser Clamps: (MSS Type 8) B-Line B3373

E. Hanger-Rod Attachments:

1. General: Provide factory fabricated hanger-rod attachments B-Line, Tolco or approved equal, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-58 and manufacturer's published product information. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
2. Side beam eye socket, Tolco Fig. #57 for rod sizes 3/8" dia. and Tolco Fig. #25-30-251 for rod sizes 1/2" dia.

F. Building Attachments:

1. General: Provide factory fabricated building attachments, selected by Installer to suit building structural framing conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

G. Hanger Rods and Spacing shall conform to the following table:

<u>Pipe Sizes</u>	<u>Spacing</u>	<u>Rods</u>
2 Inch and Smaller	6 Feet	3/8 Inch
2-1/2 Inch to 3 Inch	8 Feet	1/2 Inch
4 Inch and larger	8 Feet	5/8 Inch

H. Hangers and Supports shall be adequate to maintain alignment and prevent sagging and shall be placed within 18 inches of joint. Support shall be provided at each horizontal branch connection.

I. Provide lateral bracing as manufactured by B-Line or approved equal for all piping to prevent swaying or movement in accordance with SMACNA "Guidelines for Seismic Restraints of Piping Systems". Piping smaller than indicated in the guidelines shall be provided with bracing as specified for the smallest size indicated. The entire water distribution system shall be properly braced and will not move due to the action of quick closing of valves.

J. Miscellaneous Supports, Wall Brackets, Etc.: Provide where required in accordance with the best standard practices of the trade. Submit shop drawings for all fabricated supports.

2.2 Shields:

A. General: Provide shields at piping hangers and supports, factory-fabricated, for all insulated piping as manufactured by Pipeshields Incorporated or approved equal. Size shields for exact fit to mate with pipe insulation.

1. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation or equal 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.3 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe 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 stainless steel.

2.4 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.5 THERMAL-HANGER SHIELD INSERTS

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

1. ERICO International Corporation.
2. PHS Industries, Inc.
3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
4. Piping Technology & Products, Inc.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.

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.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. 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. 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.
 - 4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in appropriate painting section.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. 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. 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.
- J. 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.

- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 22 05 53

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. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Warning tags.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.
- F. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

G. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in appropriate painting Section.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.
 - 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.

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 Color:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
3. Letter Color:
 - a. Cold Water: Black.
 - b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 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. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 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. Storm Drainage, Force-Main Piping: 150 psig.

- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.13 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.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.14 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.16 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.17 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.

1.18 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.19 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:

- A. Hot Water Pipe Insulation: All hot water supply and return piping, except exposed connections to plumbing fixtures, flanges and unions shall be insulated with ASTM C547, Class I, "Johns-Manville" "Micro-Lock" 850-APT, Owens-Corning Fiberglass Corp., ASJ/SL-11 or approved equal, 1" thick for sizes up to 2" and 1-1/2" thick for sizes 2" and larger with "Johns-Manville" "Zeston" pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2016 CMC
 - 1. Exposed insulated piping in occupied areas and exposed outside the building shall be covered with Johns-Manville" "Zeston" 30-mil thick white PVC jacketing material per ASTM D1784 with "Johns-Manville" "Zeston" pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Jacketing shall comply with ASTM E84, and shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2016 CMC
 - 2. Hot water piping below slab shall have insulation protected by a 10-mil thick polyethylene plastic sleeve sealed watertight with poly vinyl chloride tape.
- B. Condensate Pipe Insulation: All condensate piping within the building shall be insulated with "Imcoa" "Imcolock" 3/4" nominal wall thickness closed-cell insulation. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2016 CMC. All joints shall be mitered and secured with black duct tape.
- C. Indirect Waste Pipe Insulation: All indirect waste drains from refrigerated kitchen equipment shall be insulated with "Armacell" "Armaflex" insulating tape.
- D. All insulation shall be continuous through supports and hangers.
- E. All fixtures complying with the provisions of the Americans with Disabilities Act shall be provided with Prowrap insulation for exposed hot water pipe, tailpiece, and trap as manufactured by McGuire, and secured per manufacturers recommendations. No tape wrapping shall be permitted.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.

2.5 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.6 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers,:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. McGuire Manufacturing.
 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (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. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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 thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 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 pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 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 appropriate firestopping Section 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 appropriate firestopping Section.

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, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 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 Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF POLYOLEFIN INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Seal split-tube 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 polyolefin sheet insulation of same thickness as 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 polyolefin 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 cut sections of polyolefin pipe and sheet insulation to valve body.
 2. 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.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in appropriate interior and exterior painting section.
 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 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 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 Hot and Recirculated Hot Water:
 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 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.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. McGuire pre-insulated trap and supply covers.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite domestic water system.

1.8 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.9 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.13 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.14 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Piping within the building and above grade shall be Type "L" ASTM B88, hard drawn copper tubing with wrought copper sweat fittings ANSI B16.18 and B16.22, or mechanically formed tee connections as described herein.
 - 1. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints. Tooling as manufactured by T-Drill or equal.
- B. Outdoor underground piping in sizes 2-1/2" and 3" shall be Type "L" ASTM B88, hard drawn copper as specified for water piping within the building. Piping 2" and smaller shall be Type "K" ASTM B88, hard drawn copper with wrought copper sweat fittings ANSI B16.18 and B16.22. Piping in sizes 4 inches and larger shall be PVC Class 150 DR-18 with ring-tite joints. Provide concrete thrust blocks at all underground fittings per manufacturer's recommendations.
- C. Piping below the building floor shall be Type "K" soft annealed copper tubing with no fittings below the slab.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 INSULATION:

- A. Hot Water Pipe Insulation: All hot water supply and return piping, except exposed connections to plumbing fixtures, flanges and unions shall be insulated with ASTM C547, Class I, "Johns-Manville" "Micro-Lock" 850-APT, Owens-Corning Fiberglass Corp., ASJ/SL-11 or approved equal, 1" thick for sizes up to 2" and 1-1/2" thick for sizes 2" and larger with "Johns-Manville" "Zeston" pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2016 CMC
 - 1. Exposed insulated piping in occupied areas and exposed outside the building shall be covered with Johns-Manville" "Zeston" 30-mil thick white PVC jacketing material per ASTM D1784 with "Johns-Manville" "Zeston" pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Jacketing shall comply with ASTM E84, and shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2016 CMC
 - 2. Hot water piping below slab shall have insulation protected by a 10-mil thick polyethylene plastic sleeve sealed watertight with poly vinyl chloride tape.

2.5 KITCHEN EQUIPMENT & FIXTURES:

- A. The Plumbing Contractor shall run all service lines, rough-in and make final connections to all fixtures and equipment provided by Kitchen Equipment Contractor. The work shall include installing and connecting of all sinks, garbage disposals, drain lines, piping within equipment, through, under or along the backs of working surfaces as required and indicated by equipment manufacturer, Plumbing Contractor shall furnish and install all tailpieces, P-traps, hot and cold water stops, gas cocks as required for Kitchen Equipment furnished sinks and equipment. The Contractor shall also furnish and install sinks and equipment as indicated on plumbing drawings complete with all required trim including faucets, stops, cocks, and P-trap and strainers. The Plumbing Contractor shall also furnish and install all required vents from traps, and all required indirect waste lines. All exposed piping and fittings shall be chrome plated, with the exception of drain line and P-trap serving garbage disposals that are larger than 2-inch in size. Sizes larger than 2 inch shall have type L copper drain and copper P-trap complete with union connections.

2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.
- C. Color: natural.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in appropriate earth-moving or excavating Section for excavating, trenching, and backfilling.

3.2 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 underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- D. Install shutoff valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install domestic water piping level without pitch and plumb.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. 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.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. 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.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- S. Corrosion Protection:
 - 1. General.
 - a. Corrosion protection shall be provided for all below grade cast iron and copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.
 - 2. Materials.
 - a. Copper piping encasement.
 - 1) The polywrap shall be minimum 6 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall conform to the requirements of ASTM D1248.

- 2) The polywrap shall be as manufactured by Northtown Company or approved equal.
- b. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

<u>Pipe Size / Type</u>	<u>Polywrap Flat Tube Width</u>
½" to ¾" copper	2"
1" to 1-½ copper	3"
2" copper	4"
2-1/2" copper	5"
3" copper	6"
- c. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.
 - 1) Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.
- d. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

3. Installation.

- a. The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at each joint to facilitate installation of the poly-wrap. The bunched-up poly-wrap shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the poly-wrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.
- b. Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.
- c. Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices.
- B. Comply with requirements for pipe hanger, support products, and installation 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. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 2 and Smaller: 72 inches with 3/8-inch rod.
 2. NPS 2-1/2 to NPS 3: 8 feet with 1/2-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

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 PIPE AND EQUIPMENT IDENTIFICATION

- A. Each operating and service line shut-off valve shall be identified by a 19 ga. brass tag with stamped, engraved type of service identified and area served, complete with hole and brass chain mounted on valve stem or handle. Tag shall be a minimum of one and one-half inch (1-1/2") in diameter.
- B. All piping systems shall be readily identifiable by appropriate labeling with the name of the piping contained. Such labeling shall be by means of metal tags, stenciling, stamping, or with adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft and at least once in each room and each story traversed by the piping system.
- C. Provide on exterior wall of each building opposite the building's main gas service a sign reading "Gas Shut Off". Sign shall be metal with minimum 1-1/2" high-embossed letters.
 1. All equipment shall be provided with name plate indicating all pertinent information on it

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 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.

3.9 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. Operate all valves during the retention period.
 - 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. Operate all valves during the retention period.
 - 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. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 TESTING

- A. No piping work shall be concealed or covered until piping has been tested, inspected and approved by the Inspector. All piping for plumbing systems shall be completely installed and tested as required by the Uniform Plumbing Code. Test pressures and times indicated are a minimum only. All tests shall be as required by the governing authority as well.

3.11 OPERATION INSTRUCTION

- A. Prior to occupancy or prior to the date of final inspection, whichever may occur first, the Contractor shall prepare two (2) sets of typewritten instructions for the operation of all equipment, valves, etc., specified and furnished as a part of the work under this section, and shall assign a competent person, thoroughly familiar with the job, to demonstrate and instruct a representative of the Owner in the operation of the equipment. The time of said demonstration and instructions shall be arranged with the Owner's representative approximately one (1) week in advance. Verbal instructions shall include shut-off location of gas and water. The Contractor shall assemble all operation and maintenance data supplied by the manufacturers of the various pieces of equipment, all keys and special wrenches required to operate and service the equipment (including keys for yard boxes, gas stops and fixture stops), and all equipment warranties and deliver same to the representative of the Owner on date of said instructions.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 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. Temperature-actuated, water mixing valves.
 - 3. Hose bibbs.
 - 4. Water-hammer arresters.
 - 5. Trap-seal primer valves.
 - 6. Trap-seal primer systems.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite domestic water system.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
- 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
- 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.14 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.15 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.16 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 and NSF 14.

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 the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
 - 2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - b. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - c. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
 - d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Symmons Industries, Inc.
 - b. Bradley.
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110°F.
9. Tempered-Water Design Flow Rate: 0.35 GPM.

2.5 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.

5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Include operating key with each operating-key hose bibb.

2.6 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products, Inc.
 - b. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 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. MIFAB, Inc.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
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.

2.8 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products, Inc.
2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless-steel cover.

5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
 - 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.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Four.
8. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water-hammer arresters in water piping according to PDI-WH 201.
- B. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- C. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 Access Panels:

- A. Wall access panels shall be minimum 12" x 12" for concealed valves and other equipment unless otherwise specified or indicated. Ceiling access panels shall be 18" x 18" minimum. Access panels shall be located and positioned for ready access and service of equipment housed within. Where access panels are specified with keyed cylinder locks, all such locks shall be identically keyed.
 1. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-CL, drywall, stainless steel finish, cylinder lock.
 2. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
 3. Wall, Fire Rated: Elmdor/Stoneman FR-SS-CL, fire rated, stainless steel finish, cylinder lock.
 4. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.
 5. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-AKL, drywall, stainless steel finish, allen key latch.
 6. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
 7. Wall, Fire Rated: Elmdor/Stoneman FR-SS, fire rated, stainless steel finish, return latch.
 8. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.

3.3 CONNECTIONS

- A. Comply with requirements for ground equipment in appropriate electrical systems Section.
- B. Fire-retardant-treated-wood blocking is specified in electrical Section for electrical connections.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 1. Supply-type, trap-seal primer valves.

2. Trap-seal primer systems.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 11 23

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. Valves.
 - 5. Pressure regulators.
 - 6. Concrete bases.

1.3 DEFINITIONS

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

1.4 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.

3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 4. National Fire Protection Association.
 5. California Division of the State Architect.
 6. California State Division of Industrial Safety.
 7. County Health Department.
 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 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 Pressure within Buildings: 0.5 psig or less.

1.7 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Gas Service and Meter Assembly: The Contractor shall arrange with the serving utility company for the installation of new gas service with complete meter assembly of the capacity indicated and in the location as shown on the drawings. All items served with gas shall be operated at full fire and adjusted by the Contractor. In cooperation with gas utility, make all required adjustments to main gas pressure regulators. The Owner shall pay for all required fees.
- E. Gas Service and Meter Assembly: The Contractor shall arrange with the serving utility company to verify if the existing gas service and meter is adequate for the new addition gas load. If the contractor verifies if the service and meter is not adequate, he shall notify the Architect immediately in writing.

1.10 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.11 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.12 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.13 SUBMITTAL DATA

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.

B. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.

- d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

C. Substitution Requirements:

- 1. Product Data: For each type of the following:
 - a. Piping specialties.
 - b. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - c. Pressure regulators. Indicate pressure ratings and capacities.
 - d. Dielectric fittings.
- 2. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 3. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 4. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

5. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
6. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.14 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.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.16 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 Construction Manager 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 Construction Manager's written permission.

1.17 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 Gas Piping:

- A. Concealed gas piping within the building shall be Schedule 40 black steel pipe conforming to ASTM A-53 using 150 pound banded malleable iron screwed fittings for piping 2" and smaller and weld type steel fittings for piping 2-1/2" and larger.
- B. Exposed gas piping outside the building shall be Schedule 40 galvanized steel pipe conforming to ASTM A-53 using galvanized 150 pound banded galvanized malleable iron screwed fittings for piping in sizes 2" and smaller and seamless weld type steel fittings for all piping in sizes 2-1/2" and larger.
- C. Underground gas piping shall be SDR-11 Polyethylene PE2406 (Yellow) as manufactured by Driscopex. Fittings shall be socket fusion weld Polyethylene as manufactured by Performance Pipe or Central, PE2406 (Yellow) complying with ASTM, D2513. Where required provide "Lyco" or Double "O" seal transition fittings between steel and polyethylene as manufactured by Central, all identified and approved for gas service. A 14 gauge copper tracer wire shall be installed with and attached to piping and shall terminate above grade at each end. Underground polyethylene piping shall be installed by personnel certified by the pipe manufacturer as having received instructions directly from the pipe manufacturer's field representative. Contractors not having certified personnel will be required to have a factory representative of the pipe manufacturer visit the site at the time of underground pipe installation and provide the required instructions. All required cost for training and certification shall be paid for by Contractor.
 - 1. Upon completion of the gas piping underground installation, Contractor shall submit a written report directly to the Architect stating that all materials installed are as specified and approved, and that installation was performed by factory certified personnel and tested to 60 P.S.I.
 - 2. All piping on roof shall be supported by pipe supports as manufactured by MAPA Products. Products by Miro Industries and Erico shall be accepted for submittal review.
 - a. Pressurized Piping:
 - 1) For pipe sizes 1" and less: MS-1 single post, adjustable height pipe support.
 - 2) For pipe sizes 2 1/2" and less: MS-4 adjustable, roller pipe support.
 - 3) For pipe sizes 4" and less: MS-5 adjustable, roller pipe support.
 - b. Gravity System Piping 2" and Less: MS-1 single post, adjustable height pipe support.
 - 3. All piping on roof shall be anchored to 4" x 4" redwood blocking with pipe straps. Blocking shall be set in mastic at 6'-0" on center
 - 4. All underground non-metallic piping shall have 14 gauge copper "Tracer Wire" continuous for entire length.

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. 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.
 - f. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - g. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. PE Pipe: ASTM D 2513, SDR 11.
 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Aboveground Portion: PE transition fitting.
 - c. Outlet shall be threaded or flanged or suitable for welded connection.
 - d. Tracer wire connection.
 - e. Ultraviolet shield.
 - f. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.

- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
- 5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Lyall, R. W. & Company, Inc.
 - 2) Mueller Co.; Gas Products Div.
 - 3) Perfection Corporation; a subsidiary of American Meter Company.
 - b. PE body with molded-in, stainless-steel support ring.
 - c. Buna-nitrile seals.
 - d. Acetal collets.
 - e. Electro-zinc-plated steel stiffener.
- 6. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. Stainless-steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Stainless-steel bolts, washers, and nuts.
 - e. Factory-installed anode for steel-body couplings installed underground.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

- 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
- 2. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 3. Corrugated stainless-steel tubing with polymer coating.
- 4. Operating-Pressure Rating: 0.5 psig.
- 5. End Fittings: Zinc-coated steel.
- 6. Threaded Ends: Comply with ASME B1.20.1.

A. Y-Pattern Strainers:

- 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig.
- 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. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 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.
- C. 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.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McDonald, A. Y. Mfg. Co.
 - b. Nibco.
2. Body: Bronze, complying with ASTM B 584.
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.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.

G. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pacific Seismic Products, Inc.
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 0.5 psig.
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.

6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

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. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Meter Company.
 - b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
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: 5psig.

2.8 Access Panels:

- A. Wall access panels shall be minimum 12" x 12" for concealed valves and other equipment unless otherwise specified or indicated. Ceiling access panels shall be 18" x 18" minimum. Access panels shall be located and positioned for ready access and service of equipment housed within. Where access panels are specified with keyed cylinder locks, all such locks shall be identically keyed.
1. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-CL, drywall, stainless steel finish, cylinder lock.
 2. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
 3. Wall, Fire Rated: Elmdor/Stoneman FR-SS-CL, fire rated, stainless steel finish, cylinder lock.
 4. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.
 5. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-AKL, drywall, stainless steel finish, allen key latch.
 6. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
 7. Wall, Fire Rated: Elmdor/Stoneman FR-SS, fire rated, stainless steel finish, return latch.
 8. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.

2.9 Kitchen Equipment & Fixtures:

- A. The Plumbing Contractor shall run all service lines, rough-in and make final connections to all equipment provided by Kitchen Equipment Contractor. The work shall include installing and connecting of all piping within equipment, through, under or along the backs of working surfaces as required and indicated by equipment manufacturer. Plumbing Contractor shall furnish and install all gas cocks as required for Kitchen Equipment furnished equipment. The Contractor shall also furnish and install equipment as indicated on plumbing drawings complete with all required trim including cocks. All exposed piping and fittings shall be chrome plated.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

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, PE, natural-gas piping according to ASTM D 2774.
- C. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- D. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Verify final equipment locations for roughing-in.
- K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

- N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- O. Concealed Location Installations:
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 3. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator.
- U. 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."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.5 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.

3.6 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. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- F. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 2 and Smaller: Maximum span, 6 feet; minimum rod size, 3/8 inch.
 2. NPS 2-1/2 to NPS 3-1/2: Maximum span, 8 feet; minimum rod size, 1/2 inch.

3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

- B. Each operating and service line shut-off valve shall be identified by a 19 ga. brass tag with stamped, engraved type of service identified and area served, complete with hole and brass chain mounted on valve stem or handle. Tag shall be a minimum of one and one-half inch (1-1/2") in diameter.
- C. All piping systems shall be readily identifiable by appropriate labeling with the name of the piping contained. Such labeling shall be by means of metal tags, stenciling, stamping, or with adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft and at least once in each room and each story traversed by the piping system.
- D. Provide on exterior wall of each building opposite the building's main gas service a sign reading "Gas Shut Off". Sign shall be metal with minimum 1-1/2" high-embossed letters.
- E. All equipment shall be provided with name plate indicating all pertinent information on it.

3.10 PAINTING

- A. 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.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. No piping work shall be concealed or covered until piping has been tested, inspected and approved by the Inspector. All piping for plumbing systems shall be completely installed and tested as required by the Uniform Plumbing Code. Test pressures and times indicated are a minimum only. All tests shall be as required by the governing authority as well.
- 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.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping in exposed locations shall be one of the following:
 - 1. Galvanized steel pipe with galvanized steel malleable-iron fittings and threaded joints.
 - 2. Galvanized steel pipe with galvanized wrought-steel fittings and welded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground piping NPS 2 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground piping NPS 2-1/2 and larger shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.

3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Piping valves shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.6 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.8 UTILITIES

- A. See Drawings for Points of Connection.
- B. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, Contractor shall obtain direction from the Owner's representative before proceeding with this work.
- C. Verify that utility companies size their services and meters to suit ultimate demand indicated on the drawings.
- D. Sanitary Sewer: The Contractor shall be responsible for the soil and waste piping outside of the building within five feet (5') of the foundation, and within the building itself. See Civil Engineer's plans for onsite sewer system.
- E. Sanitary Sewer: The Contractor shall be responsible for the soil and waste piping inside and outside of the buildings. See Civil Engineer's plans for connection into the sanitary sewer street main or lateral to property as indicated on drawings.
- F. Sanitary Sewer: The Contractor shall be responsible for all costs incurred in connecting into the sanitary sewer street main or lateral to property as indicated on the drawings, with the exception that all required frontage fees, capacity fees and inspections shall be paid for by the Owner. The installation shall be in accordance with the serving utility company's standards.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

- b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
- c. Include all pertinent construction, installation, performance and technical data.
- d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.14 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.15 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
 2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

1.16 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.17 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.18 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

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.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky SD 4000 series.
 - b. Clamp All HI_TORQ 125 series
 - 2. Standards: ASTM C 1277 and CISPI 310.
 - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 - 4. All above ground vent pipe fittings may be made with "ANACO" or "Clamp All" stainless steel two hand couplings conforming to CISPI Standard 310.

2.3 CORROSION PROTECTION:

- A. General.
 - 1. Corrosion protection shall be provided for all below grade cast iron and copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.
- B. Materials.
 - 1. Cast iron piping encasement.
 - a. The polywrap shall be minimum 8 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall meet or exceed the requirements of AWWA C105, ANSI A21.5 and ASTM A674.
 - b. The polywrap shall be as manufactured by Northtown Company or approved equal.

2. Copper piping encasement.
 - a. The polywrap shall be minimum 6 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall conform to the requirements of ASTM D1248.
 - b. The polywrap shall be as manufactured by Northtown Company or approved equal.
3. The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

<u>Pipe Size / Type</u>	<u>Polywrap Flat Tube Width</u>
½" to ¾" copper	2"
1" to 1-½ copper	3"
2" copper	4"
2-1/2" copper	5"
2" to 3" cast iron	14"
4" cast iron	16"
4. The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.
 - a. Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.
5. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in appropriate Earth-moving Section.

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 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. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices.
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. 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.
- O. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity-flow piping. 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. 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. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

T. Kitchen Equipment & Fixtures:

1. The Plumbing Contractor shall run all service lines, rough-in and make final connections to all fixtures and equipment provided by Kitchen Equipment Contractor. The work shall include installing and connecting of all sinks, garbage disposals, drain lines, piping within equipment, through, under or along the backs of working surfaces as required and indicated by equipment manufacturer. Plumbing Contractor shall furnish and install all tailpieces, P-traps, hot and cold water stops, gas cocks as required for Kitchen Equipment furnished sinks and equipment. The Contractor shall also furnish and install sinks and equipment as indicated on plumbing drawings complete with all required trim including faucets, stops, cocks, and P-trap and strainers. The Plumbing Contractor shall also furnish and install all required vents from traps, and all required indirect waste lines. All exposed piping and fittings shall be chrome plated, with the exception of drain line and P-trap serving garbage disposals that are larger than 2-inch in size. Sizes larger than 2 inch shall have type L copper drain and copper P-trap complete with union connections.

- U. Below-grade piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts and sleeves as manufactured by Century Line.

3.3 JOINT CONSTRUCTION

- A. 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.
- B. 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.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices.
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. 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.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.8 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.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

- C. Aboveground, vent piping shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Underground, soil, waste, and vent piping shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE AND VENT 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. Floor drains.
 - 3. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. HDPE: High-density polyethylene plastic.

1.4 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.

- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.6 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. Storm Drainage, Force-Main Piping: 150 psig.
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.7 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.8 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.9 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

- A. Submittal Requirements:
 - 1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
 - 2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
 - 3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
 - 4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

- c. Include all pertinent construction, installation, performance and technical data.
- d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
- e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

- 1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
- 2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
- 3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
- 4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.13 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that grease interceptors, accessories, and components will withstand seismic forces. Include the following:
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 4. Field quality-control reports.

1.14 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.15 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.16 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.17 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.18 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.19 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements.
- B. Coordinate size and location of roof penetrations.

1.20 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. bottles.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Metal Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn

- b. JR Smith
 - c. Watts
 - 2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Cast-iron soil pipe with cast-iron ferrule Threaded, adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Outlet Connection: Threaded.
 - 7. Closure: Brass plug with tapered threads.
 - 8. Adjustable Housing Material: Cast iron with set-screws or other device.
 - 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 10. Frame and Cover Shape: Round.
 - 11. Top Loading Classification: Heavy Duty.
 - 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Option for drilled-and-threaded plug in first subparagraph below is for a screw for a wall cover plate.
 - 6. Closure: Countersunk, brass plug.
 - 7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 8. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
 - 9. Wall Access: stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn
 - b. JR Smith
 - c. Watts
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating in first subparagraph below is usually used only on sanitary floor drains.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.

B. Stainless-Steel Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Josam Company.
2. Standard: ASME A112.3.1.
3. Outlet: Bottom.
4. Top or Strainer Material: Stainless steel.
5. Top Shape: Round.
6. Trap-Primer Connection: Required.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
 - 1. Install grease interceptors on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in appropriate concrete section.
 - 2. Comply with requirements for vibration isolation and seismic control devices.
 - 3. Comply with requirements for vibration isolation devices.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- J. 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.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- Q. Install wood-blocking reinforcement for wall-mounting-type specialties.
- R. 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 22 13 16 "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.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- D. Ground equipment according to appropriate Section in Electrical specifications.
- E. Connect wiring according to appropriate Section in Electrical specifications.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching 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.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to appropriate Metal Flashing and Trim Section.

- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 33 00

ELECTRIC, DOMESTIC, WATER HEATERS

PART 1 - GENERAL

1.1 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. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Product Certificates: For each type of commercial, electric, domestic-water heater, from manufacturer.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - 2. Standard: UL 1453.

3. Factory-Installed Storage-Tank Appurtenances:

- a. Anode Rod: Replaceable magnesium.
- b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
- c. Insulation: Comply with ASHRAE/IESNA 90.1.
- d. Jacket: Steel with enameled finish.
- e. Heating Elements: 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 domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - c. Taco, Inc.
- 2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

F. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

G. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

- H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. 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."
- H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- K. Fill electric, domestic-water heaters with water.
- L. Charge domestic-water compression tanks with air.

3.2 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.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
 - C. Prepare test and inspection reports.
- 3.5 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION

SECTION 22 42 13.13

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.
 - 3. Toilet seats.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible shall be delivered to the Architect.

1.14 GUARANTEES (Also see General Conditions)

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Equipment and Fixtures:

A. Fixtures:

- 1. See schedule on drawings.

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets: Floor mounted, bottom outlet, top spud.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
- 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. (4.8 L) per flush.
 - h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

2.3 FUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Sloan Valve Company.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. (4.8 L) per flush.
10. Minimum Inlet: NPS 1 (DN 25).
11. Minimum Outlet: NPS 1-1/4 (DN 32).

2.4 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Bemis Manufacturing Company.
 - b. Olsonite Seat Co.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

- D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

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. 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.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements.

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.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

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.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

- A. California Plumbing Code (**CPC**), California Code of Regulations, Title 24, Part 5.
- B. California Fire Code, California Code of Regulations, Title 24, Part 9.
- C. County Health Department.
- D. Any other legally constituted bodies having jurisdiction thereof.
- E. California Building Code (**CBC**), Title 24, Part 2:
- F. 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**.
- G. Effective March 1, 2017, all single-user toilet facilities shall be identified as a Gender Neutral facilities by a door symbol that complies with **CBC Sections 11B-216.8 and 11B-703.2.6.3**. No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of **CBC Section 11B-703**. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" or "UNISEX RESTROOM". **DSA BU 17-01**.
- H. Access plumbing fixtures shall comply with all of the requirements of **CBC Division 6**.
- I. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per **CBC Section 11B-604.3.1**.
- J. Heights and location of all fixtures shall be mounted according to **CBC Sections 11B-602 through 11B-612**.
- K. 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.

END OF SECTION

SECTION 22 42 16.13

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.

1.3 WORK INCLUDED

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. C.C.R., Title 24, Part 5 (2016 CPC).
 - 2. 2016 California Plumbing Code.
 - 3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - 4. National Fire Protection Association.
 - 5. California Division of the State Architect.
 - 6. California State Division of Industrial Safety.
 - 7. County Health Department.
 - 8. Any other legally constituted body-having jurisdiction thereof.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.5 DRAWINGS

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.
- C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
- D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.6 PERMITS, INSPECTIONS AND LICENSES

- A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.7 EXAMINATION OF PREMISES

- A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

- A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

- A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
- C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.
4. To be valid, all submittals must:
 - a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 - b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.
 - c. Include all pertinent construction, installation, performance and technical data.
 - d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
 - 1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
 - 2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.
 - e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.
 - a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.
 - 1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".
 - b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.
3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.
4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.
5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.
6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.11 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

1.12 UNINSPECTED WORK

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.13 RECORD DRAWINGS (Also see General Conditions)

- A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blue-line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducible tracings shall be delivered to the Architect.

1.14 GUARANTEES

- A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.
- B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.1 Equipment and Fixtures:

- A. Fixtures:
 - 1. See schedule on drawings.
 - 2. Accessible plumbing fixtures shall comply with all of the requirements of CBC Section 1115B. Heights and location of all fixtures shall be in accordance with CBC Section 1115B.4 and Table 1115B-1. Fixture controls shall comply with CBC Section 1115B.4.3.1 for lavatories.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Vitreous china, wall mounted, with back.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Faucet-Hole Location: Top.
 - d. Color: White.
 - e. Mounting Material: Chair carrier.
 - 3. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier.

2.3 SOLID-BRASS, MANUALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, single-control mixing, commercial, solid-brass valve.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Chicago Faucets.
 - 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 4. Body Material: Commercial, solid brass.
 - 5. Finish: Polished chrome plate.
 - 6. Mounting Type: Deck, exposed.

2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 3/8.
 - 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

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. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements.
- F. 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."
- G. Point of use mixing valve in cabinet to be recessed in wall, under lavatory.

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.

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.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

3.6 PLUMBING FIXTURES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with **CBC Section 11B-213.2** shall comply with **CBC Section 11B-213.3**.
- B. Effective March 1, 2017, all single-user toilet facilities shall be identified as a Gender Neutral facilities by a door symbol that complies with **CBC Sections 11B-216.8 and 11B-703.2.6.3**. No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of **CBC Section 11B-703**. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" or "UNISEX RESTROOM". **DSA BU 17-01**.
- C. Access plumbing fixtures shall comply with all of the requirements of **CBC Division 6**.
- D. Heights and location of all fixtures shall be mounted according to **CBC Sections 11B-602 through 11B-612**.

- E. 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.
- F. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with **CBC Section 11B-306** when a forward approach is required. **CBC Sections 11B-606.3 and 11B-606.7.**
- G. 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 or sinks. **CBC Section 11B-606.5.**

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
 1. Mechanical sleeve seals.
 2. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated.
- C. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.7 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.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 7. 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 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

- h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping: Use the following:
- a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

- B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 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.

1.5 ACTION SUBMITTALS

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

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

- B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

- C. Copper Pipe 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.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

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. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.

- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. 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.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. 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.
- O. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper 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 might occur.
 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 might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 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 might occur and vertical adjustment is not necessary.
 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 might be required in addition to expansion and contraction.
- 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 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. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 53

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. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, manufacturer, model number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- F. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in other sections.
- B. 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. Pipe Label Color Schedule:
 1. Refrigerant Piping:
 - a. Background Color: Orange.
 - b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 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 HVAC terminal devices 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. All Valve-Tags: 1-1/2 inches minimum, round.
 - 2. Valve-Tag Color:
 - a. All Valve-Tags: Natural.
 - 3. Letter Color:
 - a. All Valve-Tags: Black.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An entity engaged to perform TAB Work.

1.4 ACTION SUBMITTALS

- A. LEED Submittals:
 - 1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - 2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.
- B. TAB Conference: Meet with Architect on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 PROJECT 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.

1.8 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

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 systems for installed 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 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 meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and 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 filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

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", ASHRAE 111, and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 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. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. 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.

6. 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.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record final fan-performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance variable-air-volume systems the same as described for constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure static pressure at the sensor.

7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check liquid level in expansion tank.
 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 6. Set system controls so automatic valves are wide open to heat exchangers.
 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Section 232123 "Hydronic Pumps."
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

3.11 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.
- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.12 PROCEDURES FOR HEAT EXCHANGERS

- A. Measure water flow through all circuits.
- B. Adjust water flow to within specified tolerances.
- C. Measure inlet and outlet water temperatures.

- D. Measure inlet steam pressure.
- E. Check settings and operation of safety and relief valves. Record settings.

3.13 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.14 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
 - 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
 - 6. Capacity: Calculate in tons of cooling.
 - 7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.15 PROCEDURES FOR COOLING TOWERS

- A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
 - 1. Measure condenser-water flow to each cell of the cooling tower.
 - 2. Measure entering- and leaving-water temperatures.
 - 3. Measure wet- and dry-bulb temperatures of entering air.
 - 4. Measure wet- and dry-bulb temperatures of leaving air.
 - 5. Measure condenser-water flow rate recirculating through the cooling tower.
 - 6. Measure cooling-tower spray pump discharge pressure.
 - 7. Adjust water level and feed rate of makeup water system.
 - 8. Measure flow through bypass.

3.16 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.17 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.
- B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

3.18 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 - 5. Calculated kilowatt at full load.
 - 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Airflow.
 - 3. Air pressure drop.
 - 4. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

3.19 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the refrigerant charge.
 4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check the operation of the drain pan and condensate-drain trap.
 7. Check bearings and other lubricated parts for proper lubrication.
 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 4. Balance each air outlet.

3.20 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.21 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.

3.22 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.

- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.

- d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, 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 air flow 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. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.

- k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.

- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 - 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

 - 2. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btu/h.
 - i. High-fire fuel input in Btu/h.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btu/h.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h.

- H. 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.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- J. 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. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 - 1. Unit Data:
 - a. System and air-handling-unit identification.

- b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- M. Instrument Calibration Reports:
- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.23 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. 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.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.24 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 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, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 - 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 - 7. Indoor, concealed oven and warewash exhaust.
 - 8. Indoor, exposed oven and warewash exhaust.
 - 9. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 10. Outdoor, concealed supply and return.
 - 11. Outdoor, exposed supply and return.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

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).
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.

4. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 1. Sheet Form Insulation Materials: 12 inches square.
 2. Sheet Jacket Materials: 12 inches square.
 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 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.

1.6 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.

1.7 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.
- C. Coordinate installation and testing of heat tracing.

1.8 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. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Owens Corning; SOFTR All-Service Duct Wrap.
- G. 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.

- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied [FSK jacket] complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; CrimpWrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 1 & 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Johns Manville; Super Firetemp M.

- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1 & 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; FlameChek.
- b. Johns Manville; Firetemp Wrap.
- c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
- d. Thermal Ceramics; FireMaster Duct Wrap.
- e. 3M; Fire Barrier Wrap Products.
- f. Unifrax Corporation; FyreWrap.

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. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - b. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - c. Mon-Eco Industries, Inc.; 44-05.
 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. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. 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."

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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.9 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. ABI, Ideal Tape Division; 491 AWF FSK.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
- c. Compac Corporation; 110 and 111.
- d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

- 2. Width: 3 inches.
- 3. Thickness: 6.5 mils.
- 4. Adhesion: 90 ounces force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. ITW Insulation Systems; Gerrard Strapping and Seals.
- b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

- 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. 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. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) AGM Industries, Inc.; CHP-1.
- 2) GEMCO; Cupped Head Weld Pin.
- 3) Midwest Fasteners, Inc.; Cupped Head.
- 4) Nelson Stud Welding; CHP.

2. 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. Products: Subject to compliance with requirements, provide one of the following:

- 1) AGM Industries, Inc.; RC-150.
- 2) GEMCO; R-150.
- 3) Midwest Fasteners, Inc.; WA-150.
- 4) Nelson Stud Welding; Speed Clips.

- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 3. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon 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, provide products by one of the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 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.

2.11 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation 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 Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: 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" firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. 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 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 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. 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.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

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 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Outdoor, concealed supply and return.
10. Outdoor, exposed supply and return.

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.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, supply-air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 3.0-lb/cu. Ft. nominal density.

B. Concealed, return-air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 3.0-lb/cu. Ft. nominal density.

C. Concealed, outdoor-air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. Ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 3.0-lb/cu. Ft. nominal density.

D. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

- E. Exposed, supply-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- F. Exposed, return-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- G. Exposed, outdoor-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- H. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Outdoor, supply-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- C. Outdoor, return-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."
- D. Outdoor, outdoor-air duct and plenum insulation shall be the following:
 - 1. Internally lined per Section 233113 "Metal Ducts."

END OF SECTION

SECTION 23 07 19

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 insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors and outdoors.
 - 2. Chilled-water piping, indoors and outdoors.
 - 3. Heating hot-water piping, indoors and outdoors.
 - 4. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."
 - 2. Section 230716 "HVAC Equipment 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).
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 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 and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing 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.

1.6 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.

1.7 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.
- C. Coordinate installation and testing of heat tracing.

1.8 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 in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.
 - d. Manson Insulation Inc.; AK Flex.
 - e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Super-Stik.

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. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
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. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. 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."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. 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."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.

- c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

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.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- #### A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- #### B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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 thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 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, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 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 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 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 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 Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. 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.

3.9 FINISHES

A. Pipe 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.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 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.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

B. Chilled Water:

2. Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

B. Heating-Hot-Water Supply and Return:

1. Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

C. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

- a. Flexible Elastomeric: 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water:

1. All Pipe Sizes: Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick.

B. Heating-Hot-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 2 inches thick.

3.14 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Section 232113.13 "Underground Hydronic Piping".

3.15 INDOOR, 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. None.
- D. Piping, Exposed:
 1. None.

3.16 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. None.
- D. Piping, Exposed:
 1. Painted Aluminum, Corrugated: 0.024 inch thick.

3.17 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
 - 1. Section 230519 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
 - 2. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. MS/TP: Master slave/token passing.
- D. PC: Personal computer.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F.
 - e. Ducted Air Temperature: Plus or minus 1 deg F.
 - f. Outside Air Temperature: Plus or minus 2 deg F.
 - g. Dew Point Temperature: Plus or minus 3 deg F.
 - h. Temperature Differential: Plus or minus 0.25 deg F.
 - i. Relative Humidity: Plus or minus 5 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - l. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg.
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
 - o. Carbon Monoxide: Plus or minus 5 percent of reading.
 - p. Carbon Dioxide: Plus or minus 50 ppm.
 - q. Electrical: Plus or minus 5 percent of reading.

1.5 SEQUENCE OF OPERATION

1.6 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 3. Wiring Diagrams: Power, signal, and control wiring.
 4. Details of control panel faces, including controls, instruments, and labeling.
 5. Written description of sequence of operation.
 6. Schedule of dampers including size, leakage, and flow characteristics.
 7. Schedule of valves including flow characteristics.
 8. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - c. Written description of sequence of operation including schematic diagram.
 - d. Points list.

1.7 INFORMATIONAL SUBMITTALS

- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- B. Qualification Data: For Installer and manufacturer.
- C. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- D. Field quality-control test reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 5. Calibration records and list of set points.
- B. Software and Firmware Operational Documentation: Include the following:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
 5. Software license required by and installed for DDC workstations and control systems.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.11 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Section 281600 "Intrusion Detection" to achieve compatibility with equipment that interfaces with that system and with building master clock.
- C. Coordinate equipment with Section 281300 "Access Control" to achieve compatibility with equipment that interfaces with that system.
- D. Coordinate equipment with Section 275313 "Clock Systems" to achieve compatibility with equipment that interfaces with that system.
- E. Coordinate equipment with Section 284619 "PLC Electronic Detention Monitoring and Control Systems" to achieve compatibility with equipment that interfaces with that system.
- F. Coordinate equipment with Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" to achieve compatibility with equipment that interfaces with that system.
- G. Coordinate equipment with Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System" to achieve compatibility with equipment that interfaces with that system.
- H. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- I. Coordinate equipment with Section 260913 "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.
- J. Coordinate equipment with Section 262416 "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- K. Coordinate equipment with Section 262419 "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.
- L. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

- A. Manufacturers:
 - 1. Alerton Inc.
 - 2. Andover Controls Corporation.
 - 3. Automated Logic Corporation.
 - 4. Siemens Building Technologies, Inc.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
- D. Control system shall include the following:
 - 1. Building intrusion detection system specified in Section 281600 "Intrusion Detection."
 - 2. Building clock control system specified in Section 275313 "Clock Systems."
 - 3. Building lighting control system specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
 - 4. Fire alarm system specified in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."

2.3 DDC EQUIPMENT

- A. Operator Workstation: One PC-based microcomputer(s) with industry standard hardware.
 - 1. Application Software:
 - a. I/O capability from operator station.
 - b. System security for each operator via software password and access levels.
 - c. Automatic system diagnostics; monitor system and report failures.
 - d. Database creation and support.
 - e. Automatic and manual database save and restore.
 - f. Dynamic color graphic displays.
 - g. Custom graphics generation and graphics library of HVAC equipment and symbols.
 - h. Alarm processing, messages, and reactions.
 - i. Trend logs retrievable in spreadsheets and database programs.
 - j. Alarm and event processing.
 - k. Object and property status and control.
 - l. Automatic restart of field equipment on restoration of power.
 - m. Data collection, reports, and logs. Include standard reports for the following:
 - 1) Current values of all objects.
 - 2) Current alarm summary.
 - 3) Disabled objects.
 - 4) Alarm lockout objects.
 - 5) Logs.
 - n. Custom report development.
 - o. Utility and weather reports.
 - p. Workstation application editors for controllers and schedules.
 - q. Maintenance management.

2. Custom Application Software:
 - a. English language oriented.
 - b. Full-screen character editor/programming environment.
 - c. Allow development of independently executing program modules with debugging/simulation capability.
 - d. Support conditional statements.
 - e. Support floating-point arithmetic with mathematic functions.
 - f. Contains predefined time variables.
- B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
 3. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
 - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
 - d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - e. Remote communications.
 - f. Maintenance management.
 - g. Units of Measure: Inch-pound and SI (metric).
 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 7. Universal I/Os: Provide software selectable binary or analog outputs.
- E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
 2. Maximum response time of 10 nanoseconds.
 3. Minimum transverse-mode noise attenuation of 65 dB.
 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
 3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
 4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
 5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.5 ALARM PANELS

- A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.
- B. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
 - 1. Alarm Condition: Indicating light flashes and horn sounds.
 - 2. Acknowledge Switch: Horn is silent and indicating light is steady.
 - 3. Second Alarm: Horn sounds and indicating light is steady.
 - 4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
 - 5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.6 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
- E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
 - 1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
 - 2. Proportional band shall extend from 2 to 20 percent for 5 psig.
 - 3. Authority shall be 20 to 200 percent.
 - 4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
 - 5. Gages: 1-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.7 TIME CLOCKS

- A. Manufacturers:
 - 1. ATC-Diversified Electronics.
 - 2. Grasslin Controls Corporation.
 - 3. Paragon Electric Co., Inc.
 - 4. Precision Multiple Controls, Inc.
 - 5. SSAC Inc.; ABB USA.
 - 6. TCS/Basys Controls.

7. Theben AG - Lumilite Control Technology, Inc.
 8. Time Mark Corporation.
- B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
- C. Solid-state, programmable time control with 8 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.8 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.
 - f. RDF Corporation.
 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 5. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. MAMAC Systems, Inc.
 - c. RDF Corporation.
 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 5. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
2. Accuracy: 2 percent full range with linear output.
3. Room Sensor Range: 20 to 80 percent relative humidity.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
 - d. Duct Static-Pressure Range: 0- to 5-inch wg.
3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

G. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base where indicated in plans.

2.9 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
 - 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. I.T.M. Instruments Inc.

2.10 GAS DETECTION EQUIPMENT

- A. Manufacturers:
 - 1. Honeywell International Inc.; Home & Building Control.
 - 2. Sensidyne, Inc.
 - 3. TSI Incorporated.
 - 4. Vulcain Inc.
- B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F; with 2 factory-calibrated alarm levels at 35 and 200 ppm.
- C. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.
- D. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.11 FLOW MEASURING STATIONS

- A. Thermal Airflow Station, Air Ducted/Plenum:
 - 1. Manufacturers:
 - a. Ebtron, Inc.
 - b. Greenheck
 - c. Ruskin

2. Description:
 - a. Thermal airflow station with one or more sensor nodes mounted in a probe, and a remotely mounted microprocessor-based transmitter at each measurement location.
 - b. Sensor nodes with one self-heated and one zero power bead-in-glass thermistor at each sensing node, using the principle of thermal dispersion.
3. Airflow Station Performance:
 - a. Independent processing of up to 16 separately wired sensor node assemblies.
 - b. Airflow rate and temperature of each sensor is equally weighted and averaged by the transmitter prior to output.
 - c. Accuracy: Within 3 percent of reading for ducted applications, within 5 percent of reading for non-ducted applications, when installed in accordance with the manufacturer's recommended placement guidelines. Include the combined uncertainty of the sensor nodes and transmitter. For devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter, demonstrate compliance with the accuracy requirement over the entire operating range.
4. Sensor Node and Probe Assemblies:
 - a. Sensor Node Construction: Two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy with sensor housings constructed of glass-filled polypropylene. Construct with only the thermistor located within the sensing node and all other electronic components outside the airstream. Epoxy or glass encapsulated chip thermistors or devices with exposed leads are not allowed.
 - b. Performance rated and tested with a 100 percent survival rate in a 30-day saltwater and acid vapor test with written independent laboratory test results.
 - c. Store sensor node airflow and temperature calibration data in a serial memory chip, in the cable connecting plug. Stored data does not require matching or adjustments to the transmitter in the field.
 - d. Sensor Node Calibration: Individually calibrated at 16 measurement points to airflow standards directly calibrated at NIST to the NIST Laser Doppler Anemometer (LDA) primary velocity standard.
 - 1) Accuracy: Within 2 percent of reading over the entire calibrated airflow range of 0 to 5,000 fpm.
 - 2) Individually calibrate thermistor at a minimum of 3 temperatures to NIST-traceable temperature standards.
 - e. Sensing Node Temperature Accuracy: Within 0.15 deg F over an operating range of minus 20 deg F to plus 160 deg F and humidity range of 0 to 100 percent RH.
 - f. Provide the number of independent sensor nodes as follows:
 - 1) For Duct/Plenum Area up to 0.5 sq. ft. : 1.
 - 2) For Duct/Plenum Area Greater than 0.5 through 1.0 sq. ft. : 2.
 - 3) For Duct/Plenum Area Greater than 1.0 through 2.0 sq. ft. : 4.
 - 4) For Duct/Plenum Area Greater than 2.0 through 4.0 sq. ft. : 6.
 - 5) For Duct/Plenum Area Greater than 4.0 through 8.0 sq. ft. : 8.
 - 6) For Duct/Plenum Area Greater than 8.0 through 12.0 sq. ft. : 12.
 - 7) For Duct/Plenum Area Greater than 12.0 through 14.0 sq. ft. : 14.
 - 8) For Duct/Plenum Area Greater than 14.0 sq. ft. : 16.
 - g. For an aspect ratio of 1.5 or less, and an area of 25 sq. ft. or greater, 4 probes are required.
 - h. Sensor Probe Construction: Gold anodized, 6063 aluminum alloy tube, with each sensor probe containing one or more independently wired sensing nodes.
 - i. Sensor Probe Mounting Bracket Construction: Type 304 stainless steel.
 - j. Internal Probe Wiring: Kynar coated copper between the connecting cable and sensor nodes.
 - k. Internal Probe Wiring Connections: Solder joints and spot welds, sealed and protected from the elements, so that direct exposure to water will not affect instrument operation.

- l. Sensor Probe Jacket: Integral, FEP jacket, plenum rated CMP/CL2P, UL/cUL-Listed cable, rated for exposures from minus 67 deg F to plus 392 deg F , and for continuous and direct UV exposure.
 - m. Sensor Probe Cable Connector Plug: Gold plated pins for connection to the transmitter.
5. Transmitter:
- a. Transmitter determines the average airflow rate and temperature of connected sensor nodes in an array for a single location.
 - b. User Interface: 16-character, alpha-numeric, LCD display, with two field selectable analog output signals and network output capability.
 - 1) Two field selectable 0-5/0-10 V dc, or 4-20 mA, scalable, isolated, over-current protected analog output signals. The first output (AO1) provides the total airflow rate. The second output (AO2) is field configurable for temperature or low and/or high airflow set point (user defined) or system status alarm. The RS-485 (BACnet MS/TP, or Modbus RTU) network connection provides the average airflow rate, temperature, high and/or low airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures.
 - c. Printed Circuit Board Interconnects: Gold plated edge fingers, receptacle plug pins, and printed circuit board test points.
 - d. Printed Circuit Boards: Electroless nickel immersion gold (ENIG) plated.
 - e. Integrated Circuitry: Temperature rated, industrial-grade.
 - f. Integration Buffers: Separate integration buffers for display of airflow output, airflow signal output (analog and network), and individual sensor output (IR-interface).
 - g. Transmitter Features and Functions:
 - 1) High and/or low airflow alarm with user-defined set point and percent of set point tolerance.
 - 2) Manual or automatic alarm reset, and low-limit cutoff value may be selected to disable the alarm.
 - 3) Alarm delay function, field defined.
 - 4) Sensor node malfunction via the system status alarm and ignore the sensor node that is in a fault condition.
 - 5) Field configuration, diagnostics, and Field Output Adjustment Wizard that allows for a one- or two-point field adjustment to factory calibration for installations that require adjustment.
 - 6) Automatic reset after power disruption, transients, and brown-outs through a watchdog timer circuit.
 - 7) Operating temperature range of minus 20 deg F to plus 120 deg F and humidity range of 5 to 95 percent RH.
 - 8) Electrical Power Requirement: 24-V ac (between 22.8- and 26.4-V ac under load) at 20-VA maximum, using a switching power supply that is over-current and over-voltage protected.
6. Listing and Certifications:
- a. UL/cUL Listing: UL/cUL 873 Listed as an assembly.
 - b. BTL Listing: BTL Listed, network-capable, airflow stations supplied with RS-485 interface and BACnet protocol.

2.12 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - 1. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 3. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 4. Coupling: V-bolt and V-shaped, toothed cradle.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 7. Power Requirements (Two-Position Spring Return): 24-V ac.
 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 10. Temperature Rating: Minus 22 to plus 122 deg F.
 11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
 12. Run Time: 30 seconds.

2.13 CONTROL VALVES

- A. Manufacturers:
1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
 2. Erie Controls.
 3. Hayward Industrial Products, Inc.
 4. Magnatrol Valve Corporation.
 5. Neles-Jamesbury.
 6. Parker Hannifin Corporation; Skinner Valve Division.
 7. Pneuline Controls.
 8. Sauter Controls Corporation.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 5-psig maximum pressure drop at design flow rate or the following:
 - a. Two Position: Line size.
 - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
 - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Lug.
2. Disc Type: Epoxy-coated ductile iron.
3. Sizing: 1-psig maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.14 DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

- B. Dampers: AMCA-rated, parallel-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
 - 1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring- stainless-steel blade bearings, and thrust bearings at each end of every blade.
 - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
 - 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
 - 4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.15 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Section 271500 "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that power supply is available to control units and operator workstation.
- B. Verify duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
 - 1. Entrances.
 - 2. Public areas.
 - 3. Where indicated.
- E. Install automatic dampers according to Section 233300 "Air Duct Accessories."
- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Section 230553 "Identification for HVAC Piping and Equipment."

- H. Install hydronic instrument wells, valves, and other accessories according to Section 232116 Hydronic Piping Specialties."
- I. Install steam and condensate instrument wells, valves, and other accessories according to Section 232216 Steam and Condensate Piping Specialties."
- J. Install refrigerant instrument wells, valves, and other accessories according to Section 232300 "Refrigerant Piping."
- K. Install duct volume-control dampers according to Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts."
- L. Install electronic and fiber-optic cables according to Section 271500 "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Section 260533 "Raceways and Boxes for Electrical Systems."
- B. Install building wire and cable according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Section 271500 "Communications Horizontal Cabling."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

4. Pressure test control air piping at 30 psig or 1.5 times the operating pressure for 24 hours, with maximum 5-psig loss.
5. Pressure test high-pressure control air piping at 150 psig and low-pressure control air piping at 30 psig for 2 hours, with maximum 1-psig loss.
6. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
7. Test each point through its full operating range to verify that safety and operating control set points are as required.
8. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
9. Test each system for compliance with sequence of operation.
10. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
 6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
 7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
 8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
 9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
 10. Provide diagnostic and test instruments for calibration and adjustment of system.
 11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 23 23 00

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. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type L.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8.

2.2 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed 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. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. 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.
- K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- L. 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.
- M. When brazing, 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.
- N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

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. 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.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet 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.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 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 to the system design temperature.

- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Verify that compressor oil level is correct.
 2. Open compressor suction and discharge valves.
 3. Open refrigerant valves except bypass valves that are used for other purposes.
 4. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 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. Duct liner.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.
 - 7. 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 PERFORMANCE REQUIREMENTS

- A. 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.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

- 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Seismic-restraint devices.

- B. LEED Submittals:

- 1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
5. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
6. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Ductmate Industries, Inc.
 - 3. Hilti Corp.
 - 4. Mason Industries.
 - 5. TOLCO; a brand of NIBCO INC.
 - 6. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by the Office of Statewide Health Planning and Development for the State of California.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.
 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.

- E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 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 totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply, Return, Outdoor Air, Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Test for leaks before applying external insulation.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with 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.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.
- B. Supply Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.

- d. SMACNA Leakage Class for Round and Flat Oval: 12
- 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 2-inch wg.
 - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: 3.
 - 4. Ducts Connected to Dishwasher Hoods:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - d. Welded seams and flanged joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 2-inch wg.
 - f. SMACNA Leakage Class: 3.
 - 5. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
 - a. Type 316, stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2D finish.
 - b. Pressure Class: Positive or negative 2-inch wg.
 - c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - d. SMACNA Leakage Class: 3.
 - 6. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.

- d. SMACNA Leakage Class for Round and Flat Oval: 12
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
- F. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
- G. Liner:
 - 1. Supply and Return Air Ducts and Plenums: Fibrous glass, Type I, 1-1/2 inches thick.
 - 2. Transfer Ducts: Fibrous glass, Type I, 2 inches thick.
- H. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- I. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 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. Control dampers.
 - 5. Fire dampers.
 - 6. Ceiling radiation dampers.
 - 7. Combination fire and smoke dampers.
 - 8. Flange connectors.
 - 9. Duct silencers.
 - 10. Turning vanes.
 - 11. Remote damper operators.
 - 12. Duct-mounted access doors.
 - 13. Flexible connectors.
 - 14. Flexible ducts.
 - 15. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
- C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.

- c. Control-damper installations.
- d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
- e. Duct security bars.
- f. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

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. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 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, provide products by one of the following:
 - 1. Greenheck Fan Corporation.

2. Pottorff.
 3. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2500 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: Hat-shaped, 18-gage 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: Extruded vinyl, mechanically locked.
- I. Blade Axles:
1. Material: Plated steel.
 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: 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. Chain pulls.
 4. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 5. Screen Mounting: Rear mounted.
 6. Screen Material: Galvanized steel.
 7. Screen Type: Bird.
 8. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Pottorff.
 3. Ruskin Company.
- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 2000 fpm.

- D. Maximum System Pressure: 2-inch wg.
- E. Frame: Hat-shaped, 16-gage, galvanized sheet steel with welded corners or mechanically attached and mounting flange.
- F. Blades:
 - 1. Multiple, 0.025-inch- thick, roll-formed aluminum.
 - 2. Maximum Width: 6 inches.
 - 3. Action: Parallel.
 - 4. Balance: Gravity.
 - 5. Eccentrically pivoted.
- G. Blade Seals: Vinyl.
- H. Blade Axles: Plated steel.
- I. Tie Bars and Brackets:
 - 1. Material: Galvanized steel.
 - 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Bearings: Ball.
- 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, provide products by one of the following:
 - a. Nailor Industries Inc.
 - b. Pottorff.
 - c. Ruskin Company.
 - d. Trox USA Inc.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 20-gage, galvanized sheet 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: Plated steel.

7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

2.6 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Greenheck Fan Corporation.
 2. Pottorff.
 3. Ruskin Company.
 4. Young Regulator Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
 1. Hat shaped.
 2. 16-gage, galvanized sheet steel.
 3. Reinforced corners.
- D. Blades:
 1. Multiple blade with maximum blade width of 6 inches.
 2. Opposed-blade design.
 3. Aluminum.
 4. 0.063 inch thick single skin.
 5. Blade Edging: TPE.
- E. Blade Axles: 1/2-inch- diameter; plated steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
 1. Molded synthetic.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.7 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Greenheck Fan Corporation.
 2. Pottorff.
 3. Ruskin Company.
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream, fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.138 inch thick, and of length to suit application.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.8 CEILING RADIATION DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff.
 - 3. Ruskin Company.
- B. General Requirements:
 - 1. Labeled according to UL 555C by an NRTL.
 - 2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."
- C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.
- D. Blades: Galvanized sheet steel with refractory insulation.
- E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- F. Fire Rating: 1 hour.

2.9 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff.
 - 3. Ruskin Company.
- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

- F. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.
- G. Smoke Detector: Integral, factory wired for single-point connection.
- H. Blades: Roll-formed, horizontal, interlocking, 16-gage, galvanized sheet steel.
- I. Leakage: Class II.
- J. Rated pressure and velocity to exceed design airflow conditions.
- K. Mounting Sleeve: Factory-installed, 0.039-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- L. Master control panel for use in dynamic smoke-management systems.
- M. Damper Motors: Two-position action.
- N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- O. Accessories:
 - 1. Test and reset switches, remote mounted.

2.10 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.11 DUCT SILENCERS

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

1. Dynasonics.
2. Industrial Noise Control, Inc.
3. McGill AirFlow LLC.
4. Ruskin Company.
5. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.05 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Film-lined type with fill material.
 - a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression.
 - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
3. Lining: Mylar.

- J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
 - 1. Joints: Lock formed and sealed.
 - 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 3. Reinforcement: Cross or trapeze angles for rigid suspension.
- K. Accessories:
 - 1. Factory-installed end caps to prevent contamination during shipping.
 - 2. Removable splitters.
- L. Source Quality Control: Test according to ASTM E 477.
 - 1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
 - 2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.12 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.

2.13 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff.
 - 2. Ventfabrics, Inc.
 - 3. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Galvanized spiral wire sheath.
- D. Cable: Stainless steel.

- E. Wall-Box Mounting: Recessed.
- F. Wall-Box Cover-Plate Material: Steel.

2.14 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Pottorff.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
- C. Pressure Relief Access Door:
 - 1. Door and Frame Material: Galvanized sheet steel.
 - 2. Door: Single wall or double wall with insulation fill with metal thickness applicable for duct pressure class.
 - 3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 - 4. Factory set.
 - 5. Doors close when pressures are within set-point range.
 - 6. Hinge: Continuous piano.
 - 7. Latches: Cam.
 - 8. Seal: Neoprene or foam rubber.
 - 9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.15 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.

- C. Panel and Frame: Minimum thickness 11-gage carbon steel.
- D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.16 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - 1. Minimum Weight: 16 oz./sq. yd..
 - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd..
 - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.17 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, polyethylene film supported by helically wound, galvanized-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 5500 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:
 1. 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.
 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.18 DUCT SECURITY BARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carnes.
 2. KEES, Inc.
 3. Lloyd Industries, Inc.
 4. Metal Form Manufacturing, Inc.
 5. Price Industries.
- B. Description: Factory-fabricated and field-installed duct security bars.
- C. Configuration:
 1. Frame: 2-1/2 by 2-1/2 by 1/4 inch angle.
 2. Sleeve: 0.1345-inch, continuously welded steel frames with 1-by-1-by-3/16-inch angle frame factory welded to 1 end. To be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.
 3. Horizontal Bars: 1/2 inch.
 4. Vertical Bars: 1/2 inch.
 5. Bar Spacing: 6 inches.
 6. Mounting: Bolted or welded.
- D. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

- E. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers rigidly.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.

3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
-
- L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
 - M. Install flexible connectors to connect ducts to equipment.
 - N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
 - O. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
 - P. Connect flexible ducts to metal ducts with draw bands.
 - Q. Install duct test holes where required for testing and balancing purposes.
 - R. 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.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Utility set fans.
 - 2. Centrifugal roof ventilators.
 - 3. Ceiling-mounted ventilators.
 - 4. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators 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. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Loren Cook Company.
 3. Aerovent; a division of Twin City Fan Companies, Ltd.

- B. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
 - 1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
 - 1. Blade Materials: Steel.
 - 2. Blade Type: Backward inclined.
- D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L₅₀ of 200,000 hours.
 - 1. Extend grease fitting to accessible location outside of unit.
- F. Belt Drives:
 - 1. Factory mounted, with final alignment and belt adjustment made after installation
 - 2. Service Factor Based on Fan Motor Size: 1.5.
 - 3. Motor Pulleys: Adjustable pitch for use with motors through **5** hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 5. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- G. Accessories:
 - 1. Inlet and Outlet: Flanged.
 - 2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - 3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
 - 4. Access Door: Gasketed door in scroll with latch-type handles.
 - 5. Inlet Screens: Removable wire mesh.
 - 6. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
 - 7. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. Aerovent; a division of Twin City Fan Companies, Ltd.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
 - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. .

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: As required to maintain 12" above finish roof.
3. Sound Curb: Curb with sound-absorbing insulation.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.

2.3 CEILING-MOUNTED VENTILATORS

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

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic or painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.4 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. Aerovent; a division of Twin City Fan Companies, Ltd.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 3. Companion Flanges: For inlet and outlet duct connections.
 - 4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
 - 6. Vibration Isolators:
 - a. Type: Spring hangers.
 - b. Static Deflection: 1 inch.

2.5 MOTORS

- A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.

- B. Equipment Mounting:
 - 1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections.
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.
- D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- F. Install units with clearances for service and maintenance.
- G. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 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 power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

- 10. Shut unit down and reconnect automatic temperature-control operators.
- 11. Remove and replace malfunctioning units and retest as specified above.

- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Modular core, square ceiling diffusers.
3. Perforated diffusers.
4. Linear bar diffusers.
5. Linear slot diffusers.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Round Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, color selected by Architect.
5. Face Style: Three cone.
6. Mounting: Duct connection.
7. Pattern: Two-position horizontal.

B. Modular Core, Square Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, color selected by Architect.
5. Face Style: Modular Core.
6. Mounting: Surface.
7. Pattern: Adjustable.

C. Perforated Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, color selected by Architect.
5. Duct Inlet: Square.
6. Face Style: Flush.
7. Mounting: T-bar.
8. Pattern Controller: Adjustable with louvered pattern modules at inlet.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.

- b. Titus.
 - c. Anemostat Products; a Mestek company.
 - 2. Devices shall be specifically designed for variable-air-volume flows.
 - 3. Material: Steel.
 - 4. Finish: Baked enamel, color selected by Architect.
 - 5. Narrow Core Spacing Arrangement: 1/8-inch-thick blades spaced 1/4 inch apart, zero-degree deflection.
 - 6. One-Way Deflection Vanes: Extruded construction fixed louvers with removable core.
 - 7. Mounting: Concealed bracket.
 - 8. Accessories: Blank-off strips.
- B. Linear Slot Diffuser:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
 - 2. Devices shall be specifically designed for variable-air-volume flows.
 - 3. Material - Shell: Aluminum.
 - 4. Material - Pattern Controller: Steel.
 - 5. Finish: Baked enamel, color selected by Architect.
 - 6. Slot Width: As indicated on plans.
 - 7. Number of Slots: As indicated on plans.
 - 8. Length: As indicated on plans.

2.3 REGISTERS AND GRILLES

- A. Adjustable Bar Grille:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat Products; a Mestek company.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, color selected by Architect.
 - 4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
 - 5. Core Construction: Integral.
 - 6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
 - 7. Mounting: Concealed.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 37 23

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof hoods.
 - 2. Goosenecks.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which roof curbs and ventilators will be attached.
 - 2. Sizes and locations of roof openings.
- B. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

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

1.7 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.
- E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
- F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aerovent.
 - 2. Greenheck Fan Corporation.
 - 3. Loren Cook Company.
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.
- C. Materials: Galvanized-steel sheet, minimum 0.064-inch- thick base and 0.040-inch- thick hood; suitably reinforced.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: 12 inches.
- E. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.
- F. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.
- G. Galvanized-Steel Sheet Finish:
 - 1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
 - 2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
 - 3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.4 GOOSENECKS

- A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.
- B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: 18 inches.
- C. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.
- D. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.
- E. Galvanized-Steel Sheet Finish:
 - 1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
 - 2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
 - 3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.
- F. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

END OF SECTION

SECTION 23 74 13

PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Heat-pump refrigeration components.
 - 3. Hot-gas reheat.
 - 4. Gas furnace.
 - 5. Economizer outdoor- and return-air damper section.
 - 6. Integral, space temperature controls.
 - 7. Roof curbs.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- H. VVT: Variable-air volume and temperature.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. LEED Submittals:
 - 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
 - 2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
 - 3. Roof curbs and flashing.
- B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.
- E. Warranty: Special warranty specified in this Section.

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 described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

1.8 QUALITY ASSURANCE

- A. ARI Compliance:

1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

- B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

- E. UL Compliance: Comply with UL 1995.

- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Carrier Corporation.
2. Trane; American Standard Companies, Inc.
3. YORK International Corporation.

2.2 CASING

- 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. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - 1. Exterior Casing Thickness: 0.052 inch thick.
- C. Inner Casing Fabrication Requirements:
 - 1. Inside Casing: Galvanized steel, 0.034 inch thick.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1. Materials: ASTM C 1071, Type I.
 - 2. Thickness: 1/2 inch
 - 3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 - 4. Liner Adhesive: Comply with ASTM C 916, Type I.
- E. Condensate Drain Pans: Formed sections of galvanized steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.
 - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 - 2. Drain Connections: Threaded nipple.
 - 3. Pan-Top Surface Coating: Corrosion-resistant compound.
- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

- A. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
- D. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

2.4 COILS

- A. Supply-Air Refrigerant Coil:
 - 1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

3. Coil Split: Interlaced.
4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1.

B. Hot-Gas Reheat Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: Minimum 95 percent arrestance, and MERV 13.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented.

E. Safety Controls:

1. Gas Control Valve: Modulating.

2. 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.

2.8 DAMPERS

- A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 1. Damper Motor: Modulating with adjustable minimum position.
 2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

- A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

- A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC."
- B. Basic Unit Controls:
 1. Control-voltage transformer.
 2. Wall-mounted thermostat or sensor with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Exposed set point.
 - g. Exposed indication.
 - h. Degree F indication.
 - i. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.
 3. Remote Wall-Mounted Annunciator Panel for Each Unit:
 - a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
 - c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
- C. DDC Controller:
 1. Controller shall have volatile-memory backup.
 2. Safety Control Operation:
 - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.

- b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."
 - c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.
- 3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
- 4. Unoccupied Period:
 - a. Heating Setback: 50 deg F.
 - b. Cooling Setback: System off.
 - c. Override Operation: Two hours.
- 5. Supply Fan Operation:
 - a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
- 6. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
 - c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
- 7. Hot-Gas Reheat-Coil Operation:
 - a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
 - b. Unoccupied Periods: Reheat not required.
- 8. Gas Furnace Operation:
 - a. Occupied Periods: Modulate burner to maintain room temperature.
 - b. Unoccupied Periods: Cycle burner to maintain setback temperature.
- 9. Economizer Outdoor-Air Damper Operation:
 - a. Occupied Periods: Open to minimum position as determined during air balancing procedure to obtain code required minimum outside air quantities. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F. Use outdoor-air temperature to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
 - b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- 10. Carbon Dioxide Sensor Operation:
 - a. Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
 - b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- 11. VVT Relays:
 - a. Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system required in Section 233600 "Air Terminal Units" and Section 230900 "Instrumentation and Control for HVAC."

D. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
 - d. Monitoring occupied and unoccupied operations.
 - e. Monitoring constant and variable motor loads.
 - f. Monitoring variable-frequency drive operation.
 - g. Monitoring cooling load.
 - h. Monitoring economizer cycles.
 - i. Monitoring air-distribution static pressure and ventilation air volume.

2.11 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Coil guards of painted, galvanized-steel wire.
- D. Hail guards of galvanized steel, painted to match casing.

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 C 1071, Type I or II.
 - b. Thickness: 1 inch.
 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
- C. Curb Height: 14 inches.

- D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

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. Equipment Mounting:
 - 1. Install RTUs on cast-in-place concrete equipment bases.
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install piping adjacent to RTUs to allow service and maintenance.
 - 1. 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.
- C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, coils, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean condenser coil and inspect for construction debris.
 - 10. Clean furnace flue and inspect for construction debris.
 - 11. Connect and purge gas line.
 - 12. Remove packing from vibration isolators.
 - 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. Compressor refrigerant suction and hot-gas pressures.
 - b. 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.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 23 74 23

PACKAGED, INDIRECT-FIRED, OUTDOOR, HEATING-ONLY MAKEUP-AIR 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 indirect-fired makeup-air units.

1.3 DEFINITIONS

- A. BAS: Building automation system.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and configuration of outdoor, indirect-fired makeup-air unit.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: For each type and configuration of outdoor, indirect-fired heating and ventilating unit.
 - 1. Signed, sealed, and prepared by or under the supervision of a qualified professional engineer.
 - 2. Include plans, elevations, sections, and attachment details.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Detail fabrication and assembly of gas-fired heating and ventilating units, as well as procedures and diagrams.
 - 5. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 6. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - 7. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Startup service reports.
- B. Sample Warranty: For manufacturer's special warranty.

- C. Seismic Qualification Certificates: For outdoor, indirect-fired makeup-air units, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For indirect-fired makeup-air units 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) for each unit.
 - 2. Fan Belts: One set(s) for each unit.

1.8 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of indirect-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AbsolutAire, Inc.
 - 2. Applied Air.
 - 3. ARES.
 - 4. Bananza; Div. of Roberts-Gordon LLC.
 - 5. BessamAire, Inc.

6. Cambridge Engineering, Inc.
7. CaptiveAire Systems.
8. CES Group.
9. Des Champs Technologies.
10. Energy Jet U.S.
11. Engineered Air.
12. Greenheck Fan Corporation.
13. Hastings HVAC; Division of Eric, Inc.
14. I.C.E. Manufacturing Ltd.; Industrial Commercial Equipment - I.C.E. (US), Inc.
15. Jackson & Church.
16. LCSysytems.
17. Modine Manufacturing Company.
18. Powrmatic, Inc.
19. Rapid Engineering, Inc.
20. Reznor/Thomas & Betts Corporation.
21. Sterling HVAC Products.
22. Temprite.
23. Titan Air Incorporated.
24. Trane Inc.
25. Weather-Rite, Inc.

2.2 SYSTEM DESCRIPTION

- A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and indirect-fired gas burner to be installed exterior to the building.
- 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 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
 1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 2. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
 3. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.
 4. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
 - a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling-unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when air-handling-unit frame is anchored to building structure.
 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Cabinet: Galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Duct flanges at inlet and outlet. Pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
- C. Outer Casing: 0.0598-inch-thick steel with enamel-painted.
- D. Inner Casing:
 1. Burner Section Inner Casing: 0.0299-inch- thick steel.

2. Internal Insulation: Fibrous-glass duct lining, neoprene coated, comply with ASTM C 1071, Type II, applied on complete unit.
 - a. Thickness: 1 inch.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.
 - c. Density: 1.5 lb/cu. ft.
 - d. Mechanical Fasteners: Galvanized steel suitable for adhesive, mechanical, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.
- E. Casing Insulation and Adhesive:
1. Materials: ASTM C 1071, Type I.
 2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the heating-coil section.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive, mechanical, 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.
 3. Location and Application: Encased between outside and inside casing.
- F. Inspection and Access Panels and Access Doors:
1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
 2. Inspection and Access Panels:
 - a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 3. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Fabricate windows in fan section's doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
 - d. Size: At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.
 4. Locations and Applications:
 - a. Fan Section: Doors.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection and access panels.
 - d. Damper Section: Doors.
 - e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - f. Mixing Section: Doors.

5. Service Light: 100-W vaporproof fixture with switched junction box locate inside adjacent to door.

a. Locations: Each section accessed with door.

G. Condensate Drain Pans:

1. Fabricated with one percent slope in at least two planes to collect condensate from condensate-producing heat exchangers and from humidifiers, and to direct water toward drain connection.

a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

b. Depth: A minimum of 2 inches deep.

2. Formed sections.

3. Single-wall, stainless-steel sheet.

4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

a. Minimum Connection Size: NPS 1.

5. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.4 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Coil guards of painted, galvanized-steel wire.

D. Hail guards of galvanized steel, painted to match casing.

2.5 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard hood or louver.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Filter: Aluminum, 1 inch cleanable.

E. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.6 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 C 1071, Type I or Type II.

- b. Thickness: 1 inch.
- 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
- C. Curb Height: 14 inches.
- D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match unit, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

2.7 SUPPLY-AIR FAN

- A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings. Bearing rating: L10 of 60,000 hours.
- B. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
- C. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric isolators.
- D. Fan-Shaft Lubrication Lines: Extended to a location outside the casing.

2.8 AIR FILTERS

- A. Disposable Panel Filters: Factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a MERV 13 according to ASHRAE 52.2.
 - 1. Thickness: 2 inches.
 - 2. Media: Interlaced polyester fibers.
 - 3. Frame: Galvanized steel.

2.9 DAMPERS

- A. Outdoor-Air and Return-Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at a differential pressure of 2-inch wg.
- B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.10 INDIRECT-FIRED GAS BURNER

- A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and with NFPA 54, "National Fuel Gas Code."
 - 1. CSA Approval: Designed and certified by and bearing label of CSA.
 - 2. Burners: Stainless steel.
 - a. Gas Control Valve: Modulating.
 - b. Fuel: Natural gas.
 - c. Minimum Combustion Efficiency: 80 percent.
 - d. Ignition: Electronically controlled electric spark with flame sensor.
- B. Venting: Gravity vented.
- C. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.
- D. Heat Exchanger: Stainless steel.
- E. Heat-Exchanger Drain Pan: Stainless steel.
- F. Safety Controls:
 - 1. Vent Flow Verification: Differential pressure switch to verify open vent.
 - 2. Control Transformer: 24-V ac.
 - 3. High Limit: Thermal switch or fuse to stop burner.
 - 4. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - 5. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 - 6. Gas Manifold: Safety switches and controls complying with ANSI standards and FM Global.
 - 7. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
 - 8. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - 9. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

2.11 UNIT CONTROL PANEL

- A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
- B. Control Panel: Surface-mounted or recessed, with trim ring, remote panel, with engraved plastic cover and the following lights and switches:
 - 1. On-off-auto fan switch.
 - 2. Heat-vent-off switch.
 - 3. Supply-fan operation indicating light.
 - 4. Heating operation indicating light.
 - 5. Thermostat.
 - 6. Damper position potentiometer.
 - 7. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - 8. Safety-lockout indicating light.
 - 9. Enclosure: NEMA 250, Type 3R for outdoor and Type 12 for indoor.

2.12 CONTROLS

- A. Comply with requirements in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls" for control equipment and sequence of operation.
- B. Control Devices:
 - 1. Remote Thermostat: Adjustable room thermostat with temperature readout.
 - 2. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
 - 3. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - 4. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature.
 - 5. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
 - 6. Timers: Solid-state, programmable time control with four separate programs; 24-hour battery carryover; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; and system fault alarm.
 - 7. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.
- C. Fan Control: Interlock fan to start with exhaust fan(s) to which this heating and ventilating unit is associated for makeup air.
- D. Fan Control: Timer starts and stops indirect-fired heating and ventilating unit and exhaust fan(s).
 - 1. Smoke detectors, located in supply and return air, shall stop fans when the presence of smoke is detected.
- E. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
- F. Mixed Outdoor- and Return-Air Damper Control: When fan is running, outdoor- and return-air dampers shall modulate to supply minimum outdoor air as follows:
 - 1. Outdoor-air quantity to maintain minimum building static pressure.
- G. Temperature Control: Operates gas valve to maintain supply-air temperature.
 - 1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
 - 2. Operates gas valve to maintain space temperature with wall-mounting, field-wired sensor with temperature adjustment and adjustment on remote-control panel.
 - 3. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F.
 - 4. Burner Control: 20 to 100 percent modulation of the firing rate. 10 to 100 percent with dual burner units.
- H. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display status and alarms of heating and ventilating unit.
 - 1. Hardwired Points:
 - a. Room temperature.
 - b. Discharge-air temperature.
 - c. Burner operating.

2. Industry-accepted, open-protocol communication interface with the BAS shall enable the BAS operator to remotely control and monitor the heating and ventilating unit from an operator workstation. Control features and monitoring points displayed locally at heating and ventilating unit control panel shall be available through the BAS.

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. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Verify cleanliness of airflow path to include inner-casing surfaces, filters, coils, turning vanes, fan wheels, and other components.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment Mounting:
 1. Install heating and ventilating units on cast-in-place concrete equipment bases where indicated.
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Unit Support: Install heating and ventilating unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.
- C. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
- D. Install controls and equipment shipped by manufacturer for field installation with indirect-fired heating and ventilating units.
- E. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 1. Gas Piping: Connect gas piping with shutoff valve and union, and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless-steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.
- B. Drain: Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for traps and accessories on piping connections to condensate drain pans under condensing heat exchangers. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.

- C. Duct Connections: Connect supply and return ducts to indirect-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Units will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Inspect for visible damage to burner combustion chamber.
 - 2. Inspect casing insulation for integrity, moisture content, and adhesion.
 - 3. Verify that clearances have been provided for servicing.
 - 4. Verify that controls are connected and operable.
 - 5. Verify that filters are installed.
 - 6. Purge gas line.
 - 7. Inspect and adjust vibration isolators and seismic restraints.
 - 8. Verify bearing lubrication.
 - 9. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 10. Adjust fan belts to proper alignment and tension.
- C. Start unit according to manufacturer's written instructions.
 - 1. Complete startup sheets and attach copy with Contractor's startup report.
 - 2. Inspect and record performance of interlocks and protective devices; verify sequences.
 - 3. Operate unit for run-in period recommended by manufacturer.
 - 4. Perform the following operations for both minimum and maximum firing, and adjust burner for peak efficiency:
 - a. Measure gas pressure at manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - 5. Calibrate thermostats.
 - 6. Adjust and inspect high-temperature limits.
 - 7. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.
 - 8. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - 9. Measure and record airflow. Plot fan volumes on fan curve.

10. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:
 - a. High-limit heat.
 - b. Alarms.
11. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
12. Verify drain-pan performance.
13. Verify outdoor-air damper operation.

3.6 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. 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.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION

SECTION 23 81 26

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. LEED Submittals:
 - 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set for each air-handling unit.
 - 2. Gaskets: One set for each access door.

3. Fan Belts: One set for each air-handling unit fan.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: One year from date of Substantial Completion.
 - c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
 2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
 3. Trane; a business of American Standard companies.
 4. YORK; a Johnson Controls company.

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. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. 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.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

B. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - f. Mount unit-mounted disconnect switches on exterior of unit.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Filters: Permanent, cleanable.
7. Condensate Drain Pans:
 - a. Fabricated with **one** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. 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.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.3 INDOOR UNITS (6 TONS OR MORE)

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. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
7. 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. Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.
 - d. Wiring Terminations: Connect motor to chassis wiring with plug connection.
8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
9. Filters: 1 inch thick, in fiberboard frames.
10. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches deep.

- b. Single-wall, galvanized-steel sheet.
- c. 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.
- d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.4 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.5 OUTDOOR UNITS (6 TONS OR MORE)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.6 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."
- B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - 1. Compressor time delay.
 - 2. 24-hour time control of system stop and start.
 - 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 - 4. Fan-speed selection including auto setting.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. 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.
- E. Drain Hose: For condensate.
- F. Additional Monitoring:
 - 1. Monitor constant and variable motor loads.
 - 2. Monitor variable-frequency-drive operation.
 - 3. Monitor economizer cycle.
 - 4. Monitor cooling load.
 - 5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.1 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 other sections.
 - 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. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

1. PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 01.
- B. Related Requirements:
 - 1. Division 01 - General Requirements.
- C. Applicable Standards
 - 1. ASTM D 709 (2017) – Laminated Thermosetting materials.
 - 2. ANSI/NEMA FB-1 (2014) – Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
 - 3. ANSI/NEMA 250 (2014) – Enclosure for Electrical Equipment (1000 Volts Maximum).
 - 4. California Electrical Code (CEC).
 - 5. IEEE C57.12.28 (2014) – Standard for Pad-Mounted equipment (Enclosure Integrity).
 - 6. UL 1 (2012) – Standard for Flexible Metal Conduit.
 - 7. UL 1242 (2014) – Standard for Electrical Intermediate Metal Conduit.
 - 8. UL 506 (2012) – Specialty Transformers.
 - 9. UL 6 (2014) – Electrical Rigid Metal Conduit-Steel.
 - 10. UL 797 (2007) – Electrical Metallic Tubing-Steel.
 - 11. UL 870 (2016) – Standard for Wireways, Auxiliary Gutters, and Associated Fittings

1.2 BASIC ELECTRICAL REQUIREMENTS

- A. Quality Assurance:
 - 1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.
 - 2. Refer to other sections of the Specifications for other qualification requirements.

B. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.
2. Verify final locations for rough-ins with field measurements and with the requirements of the equipment to be connected.
3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.
4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.
5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.
6. Coordinate electrical equipment and materials installation with building components and the Work of other trades
7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
8. Coordinate connection of electrical systems with existing underground utilities and services.

C. Terminology:

1. Signal Systems: Applies to telephone, data and emergency blue phone systems.
2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.
3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:

1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to CBC, Part 2, Title 24, Section 1906.3 for conduits and pipes embedded in concrete and Sections 2308.9.10 and 2308.9.11 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.
2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.
3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:

1. Furnished Equipment and Appliances:
 - a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.
 - b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.
2. Equipment and Appliances Furnished by Others:
 - a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

- b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.
- c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.
- d. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

- 1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

- 1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.
- 2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.
- 3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

1.3 WARRANTIES

- A. Provide one year warranty on all material and labor performed, unless noted otherwise in specific sections.

2. PART 2 PRODUCTS - NOT USED

3. PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Advise the Inspector before starting the Work of this Division.
- B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

- C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.
- D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the Inspector. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.
- E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be three inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.
- F. Electrical equipment shall be braced and anchored for CBC Seismic Design requirements, or as otherwise indicated on the Drawings.

3.2 DELIVERY STORAGE AND HANDLING

- A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.3 CUTTING AND PATCHING

- A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.
- B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
- C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.4 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose off the Project site.
- B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.5 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

1. PART1 GENERAL

1.1 SUMMARY

- A. Section includes electrical connections to equipment.
- B. Related Sections:
 - 1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Submittal procedures.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

- A. Division 01- Administrative Requirements: Coordination and project conditions.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- E. Sequence electrical connections to coordinate with start-up of equipment.

2. PART2 PRODUCTS

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1. PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable; service entrance cable; and wiring connectors and connections.
- B. Related Sections:
 - 1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. CEC - California National Electrical Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
 - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Stranded conductor for feeders and branch circuits 10 AWG and smaller.
 - 2. Stranded conductors for feeders and branch circuits 8 AWG and larger.
 - 3. Stranded conductors for control circuits.
 - 4. Conductor not smaller than 12 AWG for power and lighting circuits.
 - 5. Conductor not smaller than 14 AWG for control circuits.
 - 6. 10 AWG conductors for 20 ampere, 120 volt branch circuits larger than 75 feet.
 - 7. 10 AWG conductors for 20 ampere, 277 volt branch circuits larger than 200 feet.
 - 8. All conductors regardless of size will be ordered and installed in their corresponding phase color. Phase tape is not acceptable.

B. Wiring Methods: Provide the following wiring methods:

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
3. Above Accessible Ceilings: Use only building wire , Type THHN/THWN insulation, in raceway.
4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
5. Exterior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
6. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper type THHN/THWN 600V insulation rated 75 degrees C.

1.5 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit for building wire and each cable assembly type.
- C. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.
- B. Perform Work in accordance with State of California Public Work's standard.
- C. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

2. PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. General Cable Co.
 - 2. Southwire.
 - 3. Superior Essex.
 - 4. Substitutions: Division 01- Product Requirements.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.

2.2 WIRING CONNECTORS

- A. Split Bolt Connectors:
 - 1. ILSCO, Model SK.
 - 2. Blackburn, Model HPS.
 - 3. Burndy, Model KSU.
 - 4. Substitutions: Division 01- Product Requirements.
- B. Solderless Pressure Connectors:
 - 1. ILSCO, Model SLUH.
 - 2. Burndy, Model KA-U.
 - 3. Panduit, Model LAM.
 - 4. Substitutions: Division 01- Product Requirements.
- C. Compression Connectors:
 - 1. ILSCO, Model CRL.
 - 2. Blackburn, Model ATL.
 - 3. Burndy, Model HYLUG/HYLINK.

4. Substitutions: Division 01 - Product Requirements.

2.3 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
- B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Identify wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- D. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.
- E. Special Techniques - Cable:
 - 1. Protect exposed cable from damage.
 - 2. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
 - 3. Use suitable cable fittings and connectors.
- F. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- G. Install stranded conductors for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, then install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
 - H. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
 - I. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

A. General:

1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
 - c. Brown, orange and yellow for circuits at 277/480 volts single or three phase.
2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
 - c. Brown, orange and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:

1. For 6 AWG and smaller: Green.
2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

F. Switch leg/travelers shall be pink or purple color conductor insulation.

3.5 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. CEC - California Electrical Code
2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Ground ring specified on drawings.
2. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

- C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.
- B. Perform Work in accordance with CSU standards.
- C. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01- Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.
- B. Complete grounding and bonding of equipment and infrastructure.

2. PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. Erico, Inc.
 - 2. Harger.

3.3 INSTALLATION

- A. Install rod electrodes at locations as indicated on Drawings. Install one additional rod electrode six feet from the first electrode if grounding resistance test fails.
- B. Install grounding and bonding conductors concealed from view.
- C. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.
- D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings.
- E. Bond together metal siding not attached to grounded structure; bond to ground.
- F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- G. Connect to site grounding system.
- H. Permanently ground entire light and power system in accordance with CEC, including service equipment, distribution panels, lighting panelboards, switch enclosures, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- I. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with CEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.
- J. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with CEC.
- K. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.4 FIELD QUALITY CONTROL

- A. Division 01- Quality Requirements and Division 01- Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground resistance testing in accordance with IEEE 142.
- E. Perform leakage current tests in accordance with NFPA 99.
- F. Perform continuity testing in accordance with IEEE 142.
- G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1. PART1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit supports.
 - 2. Formed steel channel.
 - 3. Spring steel clips.
 - 4. Equipment bases and supports.

1.2 REFERENCES

- A. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- B. California Electrical Code
 - 1. CEC – California Electrical Code.
- C. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Division 01- Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- E. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Engineering Judgements: For conditions not covered by UL listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.5 PRE-INSTALLATION MEETINGS

- A. Division 01- Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

2. PART2 PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Manufacturers:
 - 1. Cooper B-Line Systems
 - 2. Panduit Corp.
 - 3. Unistrut Corp.
 - 4. Substitutions: Division 01 - Product Requirements.
- B. Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or rod. Set screw: hardened steel.
- D. Conduit clamps for hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Cooper B-Line Systems.
 - 2. Panduit Corp.

- 3. Unistrut Corp.
 - 4. Substitutions: Division 01 - Product Requirements.
 - B. Product Description: Galvanized (12 gage) thick steel. With holes 1-1/2 inches on center.
- 2.3 SPRING STEEL CLIPS
- A. Manufacturers:
 - 1. Cooper B-Line Systems
 - 2. Substitutions: Division 01 - Product Requirements.
 - B. Product Description: Mounting hole and screw closure.
- 2.4 SLEEVES
- A. Furnish materials in accordance State of California Public Work's standard.
 - B. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
 - C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
 - D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

3. PART 3 EXECUTION

3.1 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide expansion anchors.
 - 2. Steel Structural Elements: Provide beam clamps.
 - 3. Concrete Surfaces: Provide expansion anchors.
 - 4. Hollow Masonry, Plaster Partitions: Provide toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- C. Install conduit and raceway support and spacing in accordance with CEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
 4. Support vertical conduit at every floor.

3.2 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment as indicated on Drawings.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.3 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.4 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1. PART 1 GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 4. Section 26 05 53 - Identification for Electrical Systems.
 - 5. Section 26 27 16 - Electrical Cabinets and Enclosures.
 - 6. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 5. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 6. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

- B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes.
- C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit. Provide cast metal boxes.
- D. Under Slab on Grade: Provide rigid steel conduit. Provide cast metal boxes.
- E. Outdoor Locations, Above Grade: Provide PVC coated rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- F. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- G. Provide PVC schedule 80 installed under roadways.
- H. Exposed Dry Locations: Provide electrical rigid conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch above grade and once unless otherwise specified.

1.5 SUBMITTALS

- A. Division 01- Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
 - 1. Metal conduit.
 - 2. PVC coated metal conduit.
 - 3. Flexible metal conduit.
 - 4. Liquidtight flexible metal conduit.
 - 5. Nonmetallic conduit.
 - 6. Raceway fittings.
 - 7. Conduit bodies.
 - 8. Pull and junction boxes.
 - 9. Handholes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inches.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.8 COORDINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.
- C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

2. PART 2 PRODUCTS

2.1 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
 - 6. Substitutions: Division 01 - Product Requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1.

2.2 PVC COATED METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Division 01 - Product Requirements.

B. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil thick.

C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Division 01 - Product Requirements.

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Division 01 - Product Requirements.

- B. Product Description: Interlocked steel construction with PVC jacket.
- C. Fittings: NEMA FB 1.

2.5 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Allied Tube.
 - 2. Hubbell Wiring Devices .
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co..
 - 6. Substitutions: Division 01 - Product Requirements.
- B. Product Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 OUTLET BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices .
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co..
 - 6. Substitutions: Division 01 - Product Requirements.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
- C. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.7 PULL AND JUNCTION BOXES

A. Manufacturers:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Division 01 - Product Requirements.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Cast aluminum.
2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: "POWER" or "SIGNAL" or as otherwise noted on drawings.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.
- L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.
- R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- E. Do not fasten boxes to ceiling support wires or other piping systems.
- F. Support boxes independently of conduit.
- G. Install gang box where more than one device is mounted together. Do not use sectional box.
- H. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Division 07.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes utilizing Myers hub.

3.7 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Conduit markers.
 - 5. Stencils.
 - 6. Underground Warning Tape.
 - 7. Lockout Devices.

1.2 SUBMITTALS

- A. Division 01- Submittal Procedures: Submittal procedures.
- B. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
- C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

- A. Division 01- Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Division 01- Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Install products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.7 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.

2. PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Furnish materials in accordance with CSU standards. Obtain copy of CSU guidelines and standards from owner.
- B. Product Description: Laminated three-layer plastic with engraved black letters on white background color.
- C. Letter Size:
 - 1. 1/8 inch high letters for identifying individual equipment and loads.
 - 2. 1/4 inch high letters for identifying grouped equipment and loads.
- D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

- A. Furnish materials in accordance with CSU standards.
- B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

- A. Furnish materials in accordance with CSU standards.
- B. Description: Split sleeve type wire markers.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
 - 2. Low voltage and Control Circuits: Wire number as indicated on shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

- A. Furnish materials in accordance CSU standards.
- B. Description: Labels fastened with adhesive black lettering on white background.
- C. Legend:
 - 1. 480 Volt System: 480 VOLTS.
 - 2. 208 Volt System: 208 VOLTS.

2.5 STENCILS

- A. Furnish materials in accordance with CSU standards.
- B. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.
- C. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors conforming to the following:
 - 1. Black lettering on white background.

2.6 UNDERGROUND WARNING TAPE

- A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

2.7 LOCKOUT DEVICES

- A. Lockout Hasps:
 - 1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

3. PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
 - 1. Install nameplate parallel to equipment lines.
 - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
 - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using adhesive.
 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 6. Install nameplates for the following:
 - a. Switchboards.
 - b. Panelboards.
 - c. Transformers.
 - d. Service Disconnects.
- C. Label Installation:
1. Install label parallel to equipment lines.
 2. Install label for identification of individual control device stations.
 3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.
- E. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

1. PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution and branch circuit panelboards.
2. Electronic grade branch circuit panelboards.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
5. NEMA PB 1 - Panelboards.
6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
7. NEMA A1 - Molded Case Circuit Breakers and Molded Case Switches.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:

1. CEC - California Electrical Code.

E. Underwriters Laboratories Inc.:

1. UL 50 - Cabinets and Boxes
2. UL 67 - Safety for Panelboards.
3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
4. UL 1283 - Electromagnetic Interference Filters.
5. UL 1449 - Transient Voltage Surge Suppressors.
6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit catalog data showing specified features of standard products.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.
- D. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance products.
- B. Extra Stock Materials:
 1. Furnish two of each panelboard key. Panelboards keyed alike.

1.6 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

2. PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Manufacturers:

1. Square D, Model I-Line as basis of design.
2. General Electric.
3. Eaton.
4. Siemens.
5. Substitutions: Division 01 - Product Requirements.

B. Description: NEMA PB 1, circuit breaker type panelboard.

C. Operation:

1. Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 208 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.

D. Materials

1. Panelboard Bus: Copper, tin or silver plated, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
3. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
4. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturer List:

1. Square D, Model NFP as basis of design.
2. Eaton.
3. General Electric.
4. Siemens.
5. Substitutions: Division 01 - Product Requirements.

- B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- C. Materials:
1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
 2. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical for 208 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings].
 3. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
 4. Enclosure: NEMA PB 1, Type 1 or Type 3R.
 5. Cabinet Box: 6 inches deep, 20 inches wide.
- D. Cabinet Front: Flush or surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

2.3 ELECTRONIC GRADE PANELBOARD

- A. Description:
1. Integral Surge Suppressor: Component recognized in accordance with UL 1449 and UL 1283.
 2. Panelboard: UL 67 listed and TVSS device UL 1449 Component Recognized. TVSS device meets UL 1449. Furnish panelboard markings with clamp voltage at TVSS terminals and clamp voltage at panelboard line terminals.
- B. Performance:
1. Integral Surge Suppressers:
 - a. Meet or exceed the following criteria:
 - 1) Maximum single impulse current rating not less than 80 kA for each phase or as noted on drawings.
 - 2) Pulse Lift Test: Capable of protecting against and surviving 5000 IEEE C62.41 Category C transients without failure or degradation.
 - 3) Clamping voltage not exceeding the following:

Voltage	L-N	N-G	L-G
208Y/120	500 V	500 V	500 V
480Y/277	1000 V	1000 V	1000 V

C. Fabrication:

1. Integral Surge Suppressor:

- a. Furnish copper bus bars for surge current path.
- b. Construct using surge current modules (MOV based). Each module fused with user replaceable fuses. Status of each module monitored on front cover of panelboard enclosure and on module.
- c. Furnish with audible alarm activated when one of surge current modules has failed. Furnish alarm on/off to silence alarm and alarm push-to-test switch to test alarm. Locate switches and alarm on front cover of panelboard enclosure.
- d. Furnish response time no greater than five nanoseconds for individual protection modes.
- e. Designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
- f. Furnish visible indication of proper suppresser connection and operation. Lights indicate operable phase and module.
- g. Furnish minimum EMI/RFI filtering of 34 dB at 100 kHz with insertion loss ratio of 50: 1 using Mil Std. 220A methodology.
- h. All circuit breakers that has rating over 70A, 1, 2 or 3 pole shall have permanently installed provisions to lock the breakers in the off position.

2. Panelboards

- a. Top or bottom feed as indicated on Drawings. Furnish circuit directory inside door.
- b. Construct box of galvanized steel. Box size as indicated on Drawings.
- c. Main bus constructed of copper (tin or silver plated) and rated for load current.
- d. Furnish interior with branch circuit breakers. Furnish one 60 amp circuit breaker, or as noted on panel schedules, with appropriate number of poles, as dedicated disconnect for TVSS.
- e. Furnish 200 percent rated neutral assembly with copper neutral bus.
- f. Furnish with insulated ground bus and safety ground bus.
- g. Furnish wiring gutters in accordance with CEC.
- h. Field connections to panelboard: main lug or main breaker type as noted on panel schedules.
- i. Construct with flush or surface mounted trim and NEMA Type 1 enclosure for indoor or Nema 3R for outdoors.
- j. Furnish with branch breaker positions and nominal current rating as indicated on Drawings.

- k. All breakers ranging from 5A to 100A and ranging from 1 pole to 3 poles shall have trip indication shall be located in the breaker and in the form of illuminated LED or a florescent flag and will be visible when the breaker is on a trip mode.

2.4 SOURCE QUALITY CONTROL

- A. Division 01 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Independently test integral surge suppressers with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb.
- C. Install recessed panelboards flush with wall finishes.
- D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- E. Install filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.
- G. Install engraved plastic nameplates in accordance with Section 26 05 53.
- H. Install spare conduits out of each panelboard to accessible pullbox location. Minimum spare conduits: 5 empty ¾ inch. Identify each as SPARE.
- I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Division 01- Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.
- D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.
- E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

1. PART 1 GENERAL

1.1 SUMMARY

- A. Section includes hinged cover enclosures, cabinets, terminal blocks, and accessories.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
 - 3. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
 - 4. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
- B. CEC – California Electrical Code.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

1.5 EXTRA MATERIALS

- A. Division 1 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two of each key.

2. PART 2 PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Reliance Electric.
 - 4. Hamnond.
 - 5. Circle AW.
 - 6. Substitutions: Not Permitted.
- B. Construction: NEMA 250, Type 1, indoor; Type 3R, outdoor galvanized steel enclosure.
- C. Covers: Continuous hinge, held closed by flush latch operable by key.
- D. Furnish interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
- E. Enclosure Finish: Manufacturer's standard grey enamel.

2.2 CABINETS

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Reliance Electric.
 - 4. Hamnond.
 - 5. Circle AW.
 - 6. Substitutions: Not Permitted.
- B. Boxes: Galvanized steel with removable end walls.
- C. Box Size: 24 inches wide x 30 inches high x 6 inches deep.
- D. Backboard: Furnish 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.
- E. Fronts: Steel, flush or surface type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

- F. Knockouts: Factory standards as required for conduit entry.
- G. Furnish metal barriers to form separate compartments wiring of different systems and voltages.
- H. Furnish accessory feet for free-standing equipment.

2.3 TERMINAL BLOCKS

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Reliance Electric.
 - 4. Square D.
 - 5. Substitutions: Not Permitted.
- B. Terminal Blocks: NEMA ICS 4.
- C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- E. Furnish ground bus terminal block, with each connector bonded to enclosure.

2.4 PLASTIC RACEWAY

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Reliance Electric.
 - 4. Wiremold.
 - 5. Panduit.
 - 6. Substitutions: Not Permitted.
- B. Product Description: Plastic channel with hinged or snap-on cover.

3. PART 3 EXECUTION

3.1 EXISTING WORK

- A. Remove abandoned cabinets and enclosures, including abandoned cabinets and enclosures above accessible ceiling finishes. Patch surfaces.
- B. Maintain access to existing cabinets and enclosures and other installations remaining active and requiring access. Modify installation or provide access panel.

- C. Extend existing cabinets and enclosures using materials and methods compatible with existing electrical installations, or as specified.
- D. Clean and repair existing cabinets and enclosures to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.
- B. Install cabinet fronts plumb.
- C. Verify that surfaces are ready to receive work.
- D. Install products in accordance with manufacturer's instructions.

3.3 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Final cleaning.
- B. Clean electrical parts to remove conductive and harmful materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

1. PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.5 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish 2 of each style, size, and finish wall plate.

2. PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.

- 4. Pass and Seymour.
- 5. Substitutions: Division 01 - Product Requirements.
- B. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.
- C. Body and Handle: Ivory plastic with toggle handle.
- D. Indicator Light: Separate pilot strap; red color lens.
- E. Locator Light: Lighted handle type switch; red color handle.
- F. Ratings: Match branch circuit and load characteristics.

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Pass and Seymour.
 - 5. Substitutions: Division 01- Product Requirements.
- B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
- C. Device Body: Ivory plastic.
- D. Configuration: NEMA WD 6, type as indicated on Drawings.
- E. Convenience Receptacle: Type 5-20.
- F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

- A. Manufacturers:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Pass and Seymour.
 - 5. Substitutions: Division 01 - Product Requirements.
- B. Cover Plate: Provide standard plate for all convenience outlets, voice/data and similar outlets, equal to Hubbell 302/304 stainless steel.

- C. Jumbo Cover Plate: Provide standard plate for all convenience outlets, voice/data and similar outlets, equal to Hubbell 302/304 stainless steel.
- D. Weatherproof Cover Plate: Gasketed cast galvanized metal plate with threaded and gasketed device cover.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.
- B. Modify installation to maintain access to existing wiring devices to remain active.
- C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole on top.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- G. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified or as indicated on drawings.
- B. Install wall switch 48 inches above finished floor.
- C. Install convenience receptacle 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above counter or centered in back splash of counter.
- E. Install top of dimmer 48 inches above finished floor.
- F. Coordinate installation of wiring devices with floor box service fittings provided under Section 26 05 34.

3.6 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 13

FUSES

1. PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fuses.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 SUBMITTALS

A. Division 1 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.4 CLOSEOUT SUBMITTALS

A. Division 1 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.5 MAINTENANCE MATERIALS

A. Division 1 - Execution and Closeout Requirements: Requirements for maintenance materials

B. Spare Parts:

1. Furnish two fuse pullers.

C. Extra Materials:

1. Furnish three spare fuses of each Class, size, and rating installed.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer List:

1. Gould Shawmut.
2. Bussman
3. Reliance.
4. Substitutions: Division 1 - Product Requirements.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fuse with label oriented so manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 28 19

ENCLOSED SWITCHES

1. PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible.
2. Nonfusible switches.

B. Related Sections:

1. Section 26 05 29 - Hangers and Supports for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (610 Volts Maximum).

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

2. PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

- A. Manufacturers:
 - 1. Square D.
 - 2. Eaton.
 - 3. General Electric.
 - 4. Substitutions: Division 01 – Product Requirements.
- B. Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
- C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
- D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
- E. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

- A. Manufacturers:
 - 1. Square D.
 - 2. Eaton.
 - 3. General Electric.
 - 4. Substitutions: Division 01 – Product Requirements.
- B. Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Handle lockable in OFF position.
- C. Materials:
 - 1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - a. Interior Dry Locations: Type 1.
 - b. Exterior Locations: Type 3R.
- D. Furnish switches with entirely copper current carrying parts.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install enclosed switches where indicated.
- B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.
- C. Height: 5 feet to operating handle.
- D. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.
- E. Install engraved plastic nameplates in accordance with Section 26 05 53. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.
- F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements: Requirements for inspecting, testing, adjusting, and balancing.
- B. Division 01 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.3 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

END OF SECTION

SECTION 26 51 00

INTERIOR AND EXTERIOR LIGHTING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Exit signs.
- C. Lamps.
- D. Luminaire accessories.
- E. LED power supplies, dimmable and non-dimmable.
- F. Exterior luminaires, poles and accessories.
- G. Miscellaneous lighting equipment.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- C. Section 26 27 26 - Wiring Devices.

1.3 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns.
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; Illuminating Engineering Society.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association.
- F. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2000.
- G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association.
- H. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000 (ANSI/IES RP8).

- I. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association.
- J. NFPA 70 - National Electrical Code; National Fire Protection Association.
- K. California Electrical Code - NFPA 70 National Electrical Code with State of California amendments, latest edition.
- L. NFPA 101 - Life Safety Code; National Fire Protection Association.
- M. UL 1598 - Luminaires.
- N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 PERFORMANCE REQUIREMENTS

- A. All lighting products as herein after specified shall be a standard product of the manufacturer, and shall consist of components that will be readily available for future replacement for period of (3) years.
- B. Provide all lighting fixtures as shown complete with all hardware necessary to install fixtures.
- C. Luminaire shall be free of light leaks.
- D. Luminaire suitable for use in max. ambient temperatures of 35°C (95°F) and minimum ambient operating temperature of -20°C (-4°F) for standard, 0-10V dimming driver. The Minimum ambient operating temperature for the driver is 0°C (32°F).
- E. LED package shall be designed around the lumen maintenance of 87% at 60,000 hrs. and is to be expected to achieve L70 at 100,000 hrs.
- F. All wiring shall be adequate for LEDs, Driver and Voltage requirements.

1.6 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.7 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 70 and NFPA 101.
- C. Conform to requirements of California Electrical Code.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.9 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after

1.10 WARRANTY

- A. Manufacturer shall provide a limited three (3) year warranty on luminaire and workmanship, as well as a (5) year limited warranty on LED light engine and driver when installed and operated according to the manufactures instructions. Any luminaire or workmanship found defective during the warranty period would be either repaired or replaced by the manufacturer.
- B. See Division 1 - Closeout Procedures, for additional warranty requirements.
- C. Products: Listed and classified by Underwriters Laboratories Inc. or equivalent nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

1.11 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.12 EXTRA MATERIALS

- A. See Division 1- Product Requirements, for additional provisions.
- B. Furnish two of each plastic lens type.

- C. Furnish one replacement LED strips for each lamp type.
- D. Furnish two of each driver type.
- E. Furnish two gallons of touch up paint for each different painted finish and color.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - LUMINAIRES

- A. Fixture schedule lists one or more acceptable manufacturers for each fixture type.
- B. Provide all lighting fixtures of each type from the same manufacturer or approved equal.
- C. Refer to fixture schedule on plans for acceptable manufacturers.
- D. All LED light engines (combination of diodes, driver, heat sink, housing and optics), whether screw-in or hardwired, shall meet all of the following criteria:
 - 1. The rated driver input wattage and total number of LEDs shall be published by the manufacturer for each funded Fixture Unit (driver and LED combination).
 - 2. All equipment must have model-identification that is specific and clear enough to accurately match installed equipment with equipment submittals and specific product entries in the qualification lists referred to below.
- E. LED lamps and fixtures that fall under an **Energy Star** or **Design Lights Consortium (DLC)** lighting product category must meet **at least one of the following** Measurement / Approval criteria as described below under sections 1 or 2. In general, integral lamps are more likely to fall under Energy Star, while fixtures are more likely to fall under Design Lights Consortium.
 - 1. The product is approved and listed on the **Energy Star Qualified Commercial LED Lighting List** For Lamps – (<http://www.energystar.gov/productfinder/product/certified-light-bulbs/results>) For Fixtures – (<http://www.energystar.gov/productfinder/product/certified-light-fixtures/results>)
 - 2. The product is approved and listed on the **Design Lights Consortium (DLC) List** (<http://www.designlights.org/QPL>)
- F. Linear LEDs and Linear LED Fixtures are covered by the DLC List. They must meet the requirements stated under section 2, above.
- G. LED Lamps and LED Fixtures that do not fall under equipment categories covered by sections 1 and 2 above, will be considered on a case-by-case basis.

2.2 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. or other nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Furnish products as indicated in Schedule shown on drawings.

2.3 DRIVERS

A. General Requirements:

- 1. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state driver efficiency/efficacy standards.

2.4 EXIT SIGNS

- A. Exit Signs shall be LED and shall use no more than 5 watts for the entire sign.
- B. Iridescent Exit Signs (signs that use no electricity) are not acceptable.
- C. Refer to fixture schedule on plans.

2.5 LAMPS

A. Manufacturers:

- 1. Manufacturer shall be as shown on drawings or approved equal.

B. Lamps - General Requirements:

- 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
- 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
- 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
- 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

- C. Lamp Types: As specified for each luminaire. Fixture and lamp schedule as shown on drawings shall be enforced in case of conflict with any specific lamp data noted below.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.

- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.
- F. Provide electrical grounding in accordance with NFPA 70.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) NECA 500 and 502.
- F. Provide a lighting fixture for each lighting outlet indicated.
- G. Install suspended luminaires and exit signs using pendants supported from swivel hangers which will allow a minimum of 45 degree angle for fixtures hung from sloping surfaces. Provide pendant length required to suspend luminaire at indicated height. Support pendant mounted fixtures as follows:
 - 1. Single fixtures not over 12 inches wide: Minimum of 2 single pendants.
 - 2. Single fixtures over 12 inches wide: Minimum of 2 single pendants at each end or one double pendant at each end.
 - 3. Continuous rows of fixtures not over 12 inches wide: Minimum of 1 single pendant for each fixture plus 1 for each row.
 - 4. Continuous rows of fixtures over 12 inches wide: Minimum of 2 single pendants or one double pendant for each fixture plus 1 for each row.
 - 5. Locate pendants for continuous row fixtures at each joint and each end of row.
 - 6. Rigidly fasten continuous row fixtures together with fixture manufacturer supplied joiner.

- H. Support luminaires independent of ceiling framing. EMT conduit shall not be used to support suspended fixtures of any type. Suspension shall be by means of standard hangers, where available and applicable, by rigid threaded conduit and fittings, or by rods.
- I. Recessed luminaires:
1. Provide recessed and semi recessed fixtures with plaster frames compatible with ceiling and wall systems employed and secure fixtures mechanically to frame.
 2. Install recessed luminaires to permit removal from below. Factory paint all trims for recessed ceiling fixtures in guest areas to match Owner provided custom color chip.
 3. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
 4. Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Fixtures shall fit snugly against ceiling to prevent light leakage.
- J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other at uniform elevations. Secure luminaires to prevent movement as follows:
1. Fixtures not over 12 inches wide and not over 50 inches long: Minimum 2 fastenings.
 2. Fixtures not over 12 inches wide and over 50 inches long: Minimum 3 fastenings.
 3. Fixtures over 12 inches wide and not over 50 inches long: Minimum 4 fastenings.
 4. Fixtures over 12 inches wide and over 50 inches long: Minimum 6 fastenings.
- K. Where fixtures are to be mounted on, or suspended from, concrete ceilings, provide cast in place inserts.
- L. Fixtures shall not be supported by outlet box cover screws alone. Provide a fixture stud or "hickey" for fixtures weighing greater than 25 lbs. for added support.
- M. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.
- N. Install accessories furnished with each luminaire.
- O. Connect luminaires and exit signs to branch circuit outlets provided under Section 26 05 33 as indicated.
- P. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- Q. Bond poles and metal accessories to branch circuit equipment grounding conductor.
- R. Install specified lamps in each emergency lighting unit, exit sign, and luminaire. Install each lighting fixture with lamps indicated on lamp schedule.
- S. Replace any excessively noisy fixture.
- T. Provide concrete bases for lighting poles or bollard type fixtures at locations indicated.

- U. Provide necessary hardware and connectors to make specified track lighting a complete operational system. System components shall be fabricated by the same manufacturer (i.e. fixtures, track, connectors, hanging hardware, etc.) to ensure compatibility.
- V. Install lamps in each luminaire.
- W. Install poles plumb. Install shims double nuts to adjust plumb. Grout around each base.

3.4 SYSTEM STARTUP

- A. Provide manufacturer's system startup and adjustment.
- B. Switch each load on and off. Test dimming features. Test system integration to the satisfaction of engineer. Provide a written report of test and outcomes.
- C. Perform operational testing to verify compliance with Specifications. Adjust as required.

3.5 FIELD QUALITY CONTROL

- A. See Division 1- Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Perform field inspection, testing, and adjusting in accordance with Division 1.
- D. Operate each luminaire after installation and connection to verify proper operation.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- F. Test each support for fixtures with a weight of not less than 50 lbs. or three times the weight of installed fixture, whichever is greater.
- G. Measure illumination levels to verify conformance with performance requirements. Take exterior lighting measurements during night sky, without moon or with overcast clouds effectively obscuring the moon.
- H. Manufacturer's Field Services: Qualified manufacturer's field representative to perform on-site system inspection, startup, and owner demonstration and training.
 - 1. Participation in Preinstallation Conference and pre-wire inspection.
 - 2. Owner programming conference.
 - 3. Owner demonstration and training.
 - 4. Factory authorized service representative to instruct owner's staff to adjust, operate and maintain electronic dimmable ballast systems; and provide instruction using the system software.

3.6 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.
- C. Aim and adjust fixtures as directed.
- D. Lighting, electronic control equipment, etc. must have a minimum 4 week adjustment period occurring after installation and verification of said equipment. Provide appropriate personnel (electricians, carpenters, laborers, etc.) as necessary to support Owner during this adjustment period. Adjustment is defined as orientation of adjustable lighting fixtures, installation of color filters to lighting fixtures, location adjustment of +/- 6 feet, control system setting including programming of control functions, system debugging (i.e. crosswiring). Day and night activities shall be required during this adjustment period.
- E. Egress lighting shall have an adjustment period occurring after installation and verification of said equipment to achieve the minimum required emergency lighting level of 1 fc along the egress pathway. Provide appropriate personnel (electricians, carpenters, laborers, etc.) as necessary to support this adjustment period. Adjustment is defined as orientation or aiming of adjustable fixtures or clearing of light pathway from fixture location to the egress pathway.
- F. Within 12 months of the date of Substantial Completion provide onsite service to adjust the system to account for actual occupied conditions.

3.7 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.8 CLOSEOUT ACTIVITIES

- A. See Division 1- Closeout Procedures, for closeout submittals.
- B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- C. Just prior to Substantial Completion, replace all lamps that have failed.

3.9 RELAMPING

- A. Protect installed luminaires from subsequent construction operations.

3.10 RELAMPING

- A. Relamp faulty luminaires at Substantial Completion with new LED lamp strips of same type, manufacturer and wattage. This fixture relamping effort shall include reorientation of any fixture or fixture accessory that has been moved from its aim or focus and repairing or replacing any fixture accessory that has been damaged, removed, or misaligned as a result of fixture relamping.

3.11 SCHEDULE

- A. Refer to the construction drawings.

END OF SECTION

SECTION 27 05 00

BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. CCR California Code of Regulation
- B. CBC California Building Code
- C. CFC California Fire Code
- D. CEC California Electric Code
- E. CMC California Mechanical Code
- F. CPC California Plumbing Code
- G. California Title 24 - Building Energy Efficiency Standards
- H. SCAQMD Southern California Air Quality Management Division

1.3 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the Communications Systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the Communications Systems a finished and working system.
- C. Description of Systems include but are not limited to the following:
 - 1. Complete Structured Cabling System including, but not limited to:
 - a. Voice and data backbone cabling and terminations.
 - b. Voice and data horizontal cabling and terminations.
 - c. Information outlets (IOs) including faceplates, jacks and labeling.
 - d. Equipment racks, cabinets, cable management and equipment.
 - e. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.
 - f. Cabling pathways.
 - g. Grounding and Bonding
 - h. Testing
 - 2. Complete Paging Systems designed as an expansion of the existing overhead paging system including, but not limited to:
 - a. Speakers and associated cabling
 - b. Cable terminations and testing.
 - 3. Complete Clock Systems designed as an expansion of the existing master clock system including, but not limited to:
 - a. Clocks and associated wiring.
 - b. Cable terminations and testing.

- D. Mounting and patching of wireless access points provided by others.
- E. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
- F. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
- G. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
- H. Firestopping of penetrations as described in Section 27 05 03.
- I. Seismic requirements as described in Section 26 05 48 - Seismic Requirements for Equipment and Supports.

1.4 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 - 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 - 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 - 3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
 - 4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
 - 5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling.
- C. General:
 - 1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, conduit, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
 - 2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.

3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
 4. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Sprinkler Piping and other Piping
 - f. Conduit and Wireway
 - g. Open Cabling
- D. Electrical Contractor's Responsibility:
1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
 2. Responsible for Communications Systems grounding and bonding.
 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- E. Technology Contractor's Responsibility:
1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
 2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
 3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
 4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).

- 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
 3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
 4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.

- d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
- e. When additional access panels are required, they shall be provided without additional cost to the Owner.
- 10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
- 11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
- 12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

- 1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
 - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
 - b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
 - 1) C.1 - Commercial Building Telecommunications Standard
 - 2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - 3) C.3 - Optical Fiber Cabling Components Standard
 - 4) C.4 - ANSI/TIA-569-C - Telecommunications Pathways and Spaces
 - c. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure
 - d. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - e. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard
 - f. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - g. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
 - h. NFPA 70 (NEC) - National Electrical Code (Current Edition)
 - i. UL 444 - Standard for Safety for Communications Cable
 - j. California Code of Regulation Title 24, Article E725

B. Refer to individual sections for additional Quality Assurance requirements.

C. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
6. The Contractor must have a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) on-staff serving as a project manager. Project shop drawings and test reports shall be stamped by the RCDD or CNIDP.

[***** OR *****]

7. The Contractor shall obtain the services of a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) for the project. The RCDD or CNIDP shall perform the following tasks on the project:
 - a. Review contractor's submittals and stamp the submittals stating the submittals compliance with the contract documents.
 - b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every [2 weeks] [month] during the construction period.
 - c. Provide a final written and dated confirmation of a final construction review prior to testing.
 - d. Review final testing of system and indication that the documented results or transmittal of the results stating the test results compliance with the contract documents.

D. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of California Codes, Laws, Ordinances and other regulations having jurisdiction.
2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
3. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.

4. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
5. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
6. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

F. Service Provider Requirements:

1. Secure from the telecommunications service provider all applicable requirements.
2. Comply with all service provider requirements.
3. The Owner shall make application for and pay for new telecommunications service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and service provider.

G. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

I. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.

3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
27 05 03	Through Penetration Firestopping
27 05 26	Communications Bonding
27 05 28	Interior Communications Pathways
27 05 43	Exterior Communications Pathways
27 05 53	Identification and Administration
27 11 00	Communication Equipment Rooms
27 13 00	Backbone Cabling Requirements
27 15 00	Horizontal Cabling Requirements
27 17 10	Testing
27 51 13	Paging Systems
27 53 13	Central Clock System

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Description of items submitted and relevant specification number
- e. Notations of deviations from the contract documents
- f. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Description of item submitted (using project nomenclature) and relevant specification number
- g. Notations of deviations from the contract documents
- h. Other pertinent data
- i. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor shall provide proof of RCDD or CNIDP review on the submittal.
 - d. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - e. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - f. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
- 6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
- 7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 27 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 27 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 CHANGE ORDERS

- A. A detailed material and labor take-off shall be prepared for each change order along with labor rates and mark-up percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 1. Firestopping, including mechanical firestop systems.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 CONTINGENCY

- A. Include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.

- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

- 2.1 Cable Jacket Rating: This project requires all cable jackets to carry a plenum rating.
- 2.2 Refer to individual sections.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.

- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 27 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.

2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
 3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
 2. Submitted bound copies of approved shop drawings.
 3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
 4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
 5. Submitted testing reports for all systems requiring final testing as described herein.
 6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
 7. Provide System Assurance Warranty certificate for the telecommunications system.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div27.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
 7. All text shall be searchable.
 8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.
- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Copy of final approved test and balance reports.
 5. Copies of all factory inspections and/or equipment startup reports.
 6. Copies of warranties.
 7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 8. Dimensional drawings of equipment.
 9. Capacities and utility consumption of equipment.
 10. Detailed parts lists with lists of suppliers.
 11. Operating procedures for each system.
 12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
 13. Repair procedures for major components.
 14. List of lubricants in all equipment and recommended frequency of lubrication.
 15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

- C. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- D. Refer to the individual specification sections for minimum hours of instruction time for each system.
- E. Operating Instructions:
 - 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
 - 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM COMMISSIONING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.

- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

3.10 SPECIAL REQUIREMENTS

- 1. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
- 2. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

END OF SECTION

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 75% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 25% of testing has been completed.
6. Telecommunications labeling has been provided on at least 25% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All overhead paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.

The project will be ready for final jobsite observation prior to the requested date of the observation according to the above list of requirements.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

Telecommunications – Proof of Certification

There are specific Contractor qualification requirements for this project as defined in Section 27 05 00, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer _____. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____ Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: _____ RCDD #: _____ Expiration: _____

Submit the following with the bid:

- This form.
- Proof of Manufacturer Certification indicated above.
- Proof of RCDD or CNIDP status.

SECTION 27 05 03

THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 – Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. OSHPD - Office of State Wide Health Planning and Development (California)
- J. CBC California Building Code
- K. The Building Officials and Code Administrators National Building Code
- L. 1994 1997 Uniform Building Code
- M. Wisconsin Administrative Code
- N. 2000 2003 2006 2009 2012 2015 International Building Code
- O. NFPA 5000 – Building Construction Safety Code

1.4 SUBMITTALS

- A. Submit under provisions of Section 27 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.

- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.
- F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are 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.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
 - c. Wall penetrations above corridor ceilings which are not part of a fire-resistive assembly.
 - d. Wall penetrations below any ceiling that are larger than 4" diameter or 16 square inches.
 - 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

- F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards Low Emitting Materials – Adhesives and Sealants.
1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager and General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
1. Review foreseeable methods related to firestopping work.
 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
1. Hilti, Inc.
 2. Specified Technologies Inc. (S.T.I.)

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated
 F Rating = Floor/Wall Rating
 T Rating = Floor/Wall Rating
 L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated
 F Rating = Wall Rating
 T Rating = 0
 L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated
 F Rating = Wall/Floor Rating
 T Rating (Walls) = 0 or Wall Rating
 T Rating (Floors) = Floor Rating
 L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

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

3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 27 05 05

TECHNOLOGY DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Technology demolition.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements.

1.3 REFERENCES

- A. NFPA 70 – National Electrical Code.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for terminating, patching and cross connecting of existing telecommunications and security systems shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY OUTLET, BOX, CONDUIT, OR CABLE THAT MUST BE REMOVED.
- B. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS AND SCOPE OF WORK.
- C. Where walls, ceilings, structures, etc., are indicated as being renovated on general drawings, the Contractor shall be responsible for the removal of all technology equipment including but not limited to: copper, fiber and coaxial cable, faceplates and jacks, raceways, racking and equipment mounted to the racking, etc., from the renovated area.
- D. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.
- E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area.
- F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and technology service to avoid conflicts.

3.2 PREPARATION

- A. Not all services within the building will be inactive or abandoned. Verify abandonment status with the building owner, General Contractor and Architect/Engineer prior to demolition.
- B. Prior to commencing with demolition, a proposed implementation narrative with schedule shall be submitted to the Architect/Engineer for approval.

- C. The contractor shall provide proof that only qualified personnel with extensive telecommunications experience will perform the demolition. No laborers will be allowed in the cable removal process.
- D. The contractor shall coordinate with owner to verify all cabling, patch cords and cross connects have been removed from active equipment that is to remain during the duration of the renovation.
- E. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on active equipment, use technicians experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.
- F. Existing Overhead Paging System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System downtime shall occur on an overtime basis.
- G. Existing Master Clock System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System downtime shall occur on an overtime basis.
- H. Existing Network Infrastructure System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System downtime shall occur on an overtime basis.
- I. Existing Overhead Paging System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System downtime shall occur on an overtime basis.
- J. Existing Security Systems: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. System downtime shall occur on an overtime basis.

3.3 DEMOLITION AND EXTENSION OF EXISTING TECHNOLOGY WORK

- A. Demolish and extend existing technology work under provisions of Division 1 of Architectural Specifications and this Section.
- B. Some cabling within the ceiling space may serve other building tenants; care shall be exercised to prevent service interrupts.
- C. Remove, relocate, and extend existing installations to accommodate new construction.
- D. Remove abandoned low voltage cabling and raceway to source of cabling according to the NEC. Refer to the NEC for definition of Abandoned Communications Cabling.
- E. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.
- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is removed. Disconnect and remove abandoned patch panels, blocks and other distribution equipment.

- G. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.
- H. Maintain access to existing technology installations that remain active. Modify installation or provide access panels as appropriate.
- I. Extend existing installations using materials and methods compatible with existing technology installations, or as specified.
- J. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- K. Floor slab is post-tensioned. All penetrations shall be X-rayed prior to cutting and/or drilling to avoid any tension cables or utilities encased in floor construction.
- L. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or are to be reused.
- B. Patch panels, blocks and other connectivity equipment: Clean exposed surfaces and check tightness of connections. Re-terminate any loose connections; the contractor shall notify the Architect/Engineer of any permanently damaged or unusable equipment.
- C. TECHNOLOGY ITEMS (E.G., PATCH PANELS, EQUIPMENT RACKS, JACKS, FACEPLATES, BLOCKS, CABLING, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

3.5 INSTALLATION

- A. Install relocated materials and equipment under the provisions of applicable Division 27 specifications.

END OF SECTION

SECTION 27 05 26

COMMUNICATIONS BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (TMGB and TGB)
- D. Rack-mount Telecommunications Grounding Busbar

1.2 RELATED WORK

- A. Section 26 05 33 – Conduit and Boxes
- B. Section 26 05 13 – Wire and Cable
- C. Section 26 05 26 – Grounding and Bonding
- D. Section 27 05 00 – Basic Communications Systems Requirements
- E. Section 27 05 03 – Through Penetration Firestopping
- F. Section 27 11 00 – Communication Equipment Rooms
- G. Section 27 05 28 – Interior Communication Pathways
- H. Section 27 05 53 – Identification and Administration

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.4 REFERENCES

- A. ANSI/IEEE 1100 – Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA/EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA/EIA 606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA/EIA 758 – Customer Owned Outside Plant
- F. ANSI-J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- G. IEEE 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 – National Electrical Code
- J. UL 467 – Grounding and Bonding Equipment

1.5 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Section 27 05 00 and Division 1.

- B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
 - 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Provide CAD-generated, project-specific system shop drawings as follows:
 - 1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where system equipment will be located.
 - 2. Installation details for all system components.
- D. Provide system checkout test procedure to be performed at acceptance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 27 05 00.
- B. Store and protect products under the provisions of Section 27 05 00.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.7 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
 - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-A and NFPA 70 for complete information.

2. The bonding system shall include, but not be limited to, the following major components:
 - a. Bonding Conductor for Telecommunications (BCT)
 - b. Telecommunications Main Grounding Busbar (TMGB)
 - c. Telecommunications Bonding Backbone (TBB)
 - d. Telecommunications Grounding Busbar(s) (TGB)
 - e. Rack mount Telecommunications Grounding Busbar(s)
 - f. Bonding Conductor(s) (BC)
 - g. Bonding Connectors
 - h. Bonding system labeling and administration as defined in Section 27 05 53.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
 1. Actual locations of system components, devices, and equipment.
 2. Actual conductor routing.
 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 27 05 00.
- B. Submitted data shall include:
 1. Approved shop drawings.
 2. Descriptions of recommended system maintenance procedures, including:
 - a. Inspection
 - b. Periodic preventive maintenance
 - c. Fault diagnosis
 - d. Repair or replacement of defective components

PART 2 - PRODUCTS

2.1 BONDING CONDUCTORS

- A. Bare Copper:
 1. Annealed uncoated stranded conductor.
 2. Minimum size 6 AWG.
- B. Insulated Copper:
 1. Annealed uncoated stranded conductor.

2. Insulation:
 - a. PVC insulation with nylon outer jacket.
 - b. Rated ≥ 600 volts.
 - c. Green.
3. Minimum size 6 AWG.
- C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.
- D. Bonding Conductor Sizing

1. All Communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
Greater than 66 (20)	3/0

2. The BCT shall be the same size as the TBB or larger.

2.2 BONDING CONNECTORS

- A. Acceptable Types:
 1. Two-hole compression lug
 2. Exothermic weld
 3. Irreversible compression
- B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.
- C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3 GROUNDING BUSBAR (TMGB AND TGB)

- A. Features:
 1. Wall-mount configuration.
 2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
 3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-A standards.
 4. Predrilled holes.
 5. Integral insulators.
 6. Stainless steel offset mounting brackets.
- B. Specifications:
 1. Material: Electrolytic tough pitch copper bar with tin plating.

2. Minimum Dimensions: 1/4" thick x 4" high x 12" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
 - a. A minimum of 15 sets of 5/16" holes, 5/8" on center, to accommodate "A" spaced 2-hole compression lugs.
 - b. A minimum of three (3) sets of 7/16" holes, 1" on center, to accommodate "C" spaced 2-hole compression lugs.

2.4 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR

A. Features:

1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
2. Predrilled holes.
3. Mounts in a standard 19" equipment rack.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
 - a. A minimum of eight (8) 6-32 tapped lug mounting holes on 1" centers.
 - b. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Bonding Requirements:

1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
2. A licensed electrician shall perform all bonding.
3. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Main Cross Connect and Service Entrance Room Bonding Requirements:

1. Locate the TMGB in the service entrance room unless otherwise noted on the drawings.

2. The location of the TMGB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
 3. Bond the telecommunications primary protectors to the TMGB. Maintain a minimum 1 foot (300 mm) separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.
 4. In service entrance rooms where the entrance pathway contains an isolation gap, the pathway on the facility side of the gap shall be bonded to the TMGB.
- C. Where the service entrance cable contains a shield, the shield(s) shall be bonded to the TMGB using manufacturer-approved hardware.
- D. Telecommunications Main Ground Bar (TMGB) Requirements:
1. Install TMGB such that it is insulated from its support with a minimum 2" standoff.
 2. Bond the TMGB to the electrical service ground via the BCT.
 - a. A minimum of 1 foot (300 mm) separation shall be maintained between the BCT and any DC power cables, switchboard cable, or high frequency cables.
 3. Where backbone or horizontal cabling contains a shield, the shield(s) shall be bonded to the TMGB.
 4. TMGB shall be bonded to all electrical panels located in the same room or space as the TMGB or in an immediately adjacent space within 20 linear feet of the TMGB. TMGB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TMGB.
 5. TMGB shall be bonded to accessible metallic building structure located within the same room or space as the TMGB.
 6. All metallic continuous cable pathways, including, but not limited to, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TMGB, shall be bonded to the TMGB.
 7. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TMGB, shall be bonded to the TMGB.
- E. Telecommunications Ground Bar (TGB) Requirements:
1. Provide a TGB in each telecommunications equipment room.
 2. Install TGB such that it is insulated from its support with a minimum 2" standoff.
 3. Bond each TGB to the TMGB via the TBB.
 - a. A minimum of 1 foot (300 mm) separation shall be maintained between the TBB and any DC power cables, switchboard cable, or high frequency cables.
 - b. The TBB may be routed from TGB to TGB or as a radial feed to each TGB as the layout requires.
 4. When there are multiple telecommunications equipment rooms on each floor in buildings containing more than five stories, the TGBs on the same floor shall be bonded together horizontally using a grounding equalizer (GE) on the first, last, and every third intermediate floor. GE conductors shall be the same size as the TBB.

5. If more than one (1) TGB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.
 6. TGBs shall be bonded to accessible metallic building structure located within the same room or space as the TGBs.
 7. TGBs shall be bonded to all electrical panels located in the same room or space as the TGB or in an immediately adjacent space within 20 linear feet of the TGB. TGBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TGB.
 8. All metallic continuous cable pathways, including, but not limited to, , ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TGB, shall be bonded to the TGB.
 9. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TGB, shall be bonded to the TGB.
- F. Metallic Interior Communication Pathway Bonding Requirements:
1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.
- G. Bonding Conductor Requirements:
1. Bonding conductors shall be green or marked with a distinctive green color.
 2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
 3. Bonding conductors shall not be installed in metallic conduit.
 4. All conductors, including, but not limited, to the BCT, TBB, GE(s), and BC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.
 - a. Where documented permission to splice a conductor is granted:
 - 1) The number of splices shall be limited to as few as possible.
 - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
 - 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
 - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
 5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 05 53. In addition to the requirements of Section 27 05 53:
 - a. Labels shall be nonmetallic.

- b. Labels shall be printer-generated.
 - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
 - d. Additionally, conductors shall be labeled as follows:
 - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
 - 6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
 - 7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.
- H. Bonding Connection Requirements:
- 1. Make all connections in accessible locations to facilitate future inspection and maintenance.
 - 2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
 - 3. Thoroughly clean conductors before installing lugs and connectors.
 - 4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
 - 5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
 - 6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
 - 7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of Section 27 05 00.
- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 27 05 00.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.4 TESTING

- A. Test installed system under provisions of Section 27 17 10.
- B. Measure and document resistance to ground at TMGB, each TGB, each RTGB, and each electrical distribution panel bonded to the TMGB or a TGB.
 - 1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
 - 2. Measured resistance to ground at TMGB, each TGB, and each RTGB must not exceed 5 ohms 2 ohms 1 ohm 0.5 ohm.
 - 3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- C. Measure and document voltage between screen of installed and terminated ScTP, FTP, and/or SSTP horizontal cables and electrical ground of electrical outlet(s) serving the information outlet location area.
 - 1. The voltage between the screen and the ground wire shall not exceed 1.0 V rms, and 1.0 V dc for any installed and terminated ScTP, FTP, and/or SSTP horizontal cables.
- D. Include measurement documentation in test data submitted at completion of project under provisions of Section 27 17 10.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
 - 1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
 - 2. The Architect/Engineer shall be presented with the option to attend the training.
 - 3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- B. At a minimum, the following training shall be conducted:
 - 1. A course detailing the system functions and operations that a technical user will encounter. Provide training on all aspects of using the system, including making new bonding connections to the TMGB, TGB, or RTGB. Provide training on all recommended inspection, maintenance, and repair procedures for the system.

C. Minimum on-site training times shall be:

1. Technical user: Four hours.

END OF SECTION

SECTION 27 05 28

INTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete support systems, conduits, sleeves, innerduct, etc. for an interior cabling plant as shown on the drawings.

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 27 05 00 - Basic Communications Systems Requirements
- C. Section 27 05 26 - Communications Bonding

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for requirements.

1.4 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code

1.5 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
 - 1. conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.6 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Refer to Section 26 05 33 for conduit requirements for this project.

2.2 CABLE HANGERS AND SUPPORTS

- A. Provide a non-continuous cable support system suitable for use with open cable.

B. Cable Hooks:

1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use zinc plated steel, ASTM B633 SC3 suitable for heavy duty use. Provide stainless steel AISI Type 304 hooks for corrosive locations.

PART 3 - EXECUTION

3.1 CABLE HOOK SUPPORT SYSTEM

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.2 CONDUIT AND CABLE ROUTING

- A. Refer to Section 26 05 33 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.
- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
 1. A separate pull box is required for each 90' (or greater) length section.
 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.

- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.3 ATTACHMENT TO METAL DECKING

- A. Where supports for cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION

SECTION 27 05 43

EXTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

1.2 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Precast Manufacturer (if applicable): Company specializing in precast concrete structures with three (3) years documented experience.

1.3 REFERENCES

- A. Section 27 05 00 – Basic Communications Systems Requirements.
- B. AASHTO HS-20 - Standard Specification for Highway Bridges.
- C. ANSI/ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.
- E. ASTM A48 - Gray Iron Castings.
- F. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Manhole submittal (if applicable): Indicate material specifications, dimensions, capacities, size and location of openings, reinforcing details, and accessory locations.
 - 1. Provide product data for manhole accessories.
- C. Submit shop drawings and product data under provisions of Section 27 05 00.
- D. Submit manufacturer's installation instructions under provisions of Section 27 05 00.
- E. Coordination Drawings:
 - 1. Include manholes, hand holes, and conduits 1.5" and larger in coordination files. Include all in-floor and underfloor conduit in coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.5 REGULATORY REQUIREMENTS

- A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.

PART 2 - PRODUCTS

2.1 OUTSIDE PLANT CONDUIT

A. Rigid Metallic Conduit (RMC) and Fittings:

1. Rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.
2. Fittings and Conduit Bodies:
 - a. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
 - b. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
 - c. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
 - d. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. **High impact phenolic threaded type bushings are not acceptable.**
 - e. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.
3. Acceptable Manufacturers:
 - a. Allied, LTV, Steelduct, Wheatland Tube Co, O-Z Gedney, or pre-approved equal.

B. High-Density Polyethylene (HDPE) Conduit:

1. Minimum Size: 2 inches, unless noted otherwise.
2. Acceptable Manufacturers: Carlon, Chevron Phillips Chemical Company, or pre-approved equal.
3. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute) and shall meet the following resin properties:

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	< .941
D-1238	Melt Index, g/10 min Condition E	> .55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	< 80,000
D-746	Brittleness Temperature	-75°C Max

4. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

5. Fitting and Conduit Bodies:

- a. Directional Bore and Plow Type Installation: Electrofusion or universal aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
- b. For All Other Types of Installation: Coupler must provide a watertight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.
- c. E-loc type couplings are not acceptable in any situations.
- d. Acceptable Manufacturers: ARCON, Carlon, or approved equal.

C. Fittings:

1. Sweeps: Factory manufactured RMC wrapped with 4 mil vinyl tape with a bend radius as follows:
 - a. Conduit internal diameter of 2" or less is 6 times the internal conduit diameter.
 - b. Conduit internal diameter of more than 2" is 10 times the internal conduit diameter.
2. End Caps (Plugs): Pre-manufactured and watertight. Tape is not an acceptable end cap or cover.

2.2 HAND-HOLES

A. Type:

Monolithic

B. Dimensions:

1. As indicated on the drawings.

C. Requirements:

1. Includes polymer concrete cover

D. Acceptable Manufacturers

1. Quazite
2. Old Castle Precast Christy®
3. New Basis.

2.3 TEXTILE INNERDUCT

- A. Contractor shall provide and install innerduct in each conduit identified to have copper and fiber optic cable installed.
- B. Innerduct shall have an 18 gauge solid copper core tracer wire installed into each cell to allow for detection by industry standard toning equipment.
- C. Each innerduct cell shall have a pull tape installed.
- D. Acceptable Manufacturers:
 1. Maxcell or pre-approved equal.

2.4 UNDERGROUND WARNING TAPE

- A. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
- B. Overall Thickness: 5 mils (0.125 mm).
- C. Foil Core Thickness: 0.35 mil (0.00889 mm).
- D. Orange colored tape 3-wide with 1-inch high black letters permanently imprinted with "CAUTION – BURIED COMMUNICATIONS LINE BELOW". Printing on tape shall be permanent and shall not be damaged by burial operations.
- E. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- F. Comply with ANSI Z535.1 through ANSI Z535.5.

PART 3 - EXECUTION

3.1 INSTALLATION – TEXTILE INNERDUCT

- A. Provide two (2) 3-cell innerducts per 4" conduit or as recommended by the manufacturer.
- B. Install innerduct per manufacturer's guidelines.
- C. Cut and tie off innerduct and pull tape inside each communications vault or Entrance Room.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. The Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.
- B. Excavation:
 - 1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
 - 2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.
 - 3. Excavations shall be protected against frost action and freezing.
 - 4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
 - 5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
 - 6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.

7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
 8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.
- C. Dewatering:
1. The Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep the excavation free of water at all times.
- D. Underground Obstructions:
1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.
- E. Fill and Backfilling:
1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
 2. The Contractor shall provide the necessary sand for backfilling.
 3. Dispose of the excess excavated earth as directed.
 4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
 5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.
 6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
 7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. All other conduit shall have sand backfill to 6" above the top of the conduit.
 8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
 9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
 10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
 11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

3.3 RESTORATION REQUIREMENTS

- A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching,

END OF SECTION

SECTION 27 05 53

IDENTIFICATION AND ADMINISTRATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Documentation of labeling scheme.
 - 2. Complete documentation of nomenclature for all Administration components.

PART 2 - PRODUCTS

2.1 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface and attachment method.
- D. Tag all CAT 3, CAT 5E, CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
 - 1. (Telecom Room Number) – (Patch Panel Letter) – (Patch Panel Port Number).
 - 2. "Telecom Room Number" shall be as indicated on the drawings.
 - 3. "Patch Panel Letter" shall start with 'A' for the top modular patch panel, increasing sequentially from top to bottom across the equipment rack.
 - 4. "Patch Panel Port Number" shall start with '1' for the upper left port in each modular patch panel, increasing sequentially from left to right and top to bottom across the modular patch panel face.

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling: Backbone and horizontal cables shall be labeled at each end.

1. Provide additional cable labeling at each manhole and pull box.
2. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
3. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

C. Termination Hardware Labeling:

1. An identifier shall be provided at each termination hardware location or its label.

D. Grounding/Bonding Labeling:

1. The TMGB shall be labeled "TMGB." There shall be only one TMGB in the facility.
2. Label all TBB conductors connecting to the TMGB with a unique label, located at both ends of the TBB.
3. Each TGB shall be labeled with a unique label.
4. All TBB conductors connecting to the TGB shall be labeled uniquely at each end of the cable.

END OF SECTION

SECTION 27 11 00

COMMUNICATION EQUIPMENT ROOMS (CER)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements
- B. Section 27 05 26 - Communications Bonding
- C. Section 27 05 28 - Interior Communication Pathways
- D. Section 27 15 00 - Horizontal Cabling Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for applicable standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
 - 1. Include ladder racking, equipment racks and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT GROUNDING

- A. Refer to specification section 27 05 26 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.2 EQUIPMENT RACKS AND CABINETS

- A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.
- B. The equipment rack shall conform to the following requirements:
 - 1. Standard TIA/EIA 19" Floor Rack:
 - a. Equipment rack shall be 84" in height, self-supporting and provide a useable mounting height of 45 rack units (RU) (1 RU = 1 ¾").

- b. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
- c. Equipment rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per TIA/EIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.
- d. Equipment racks shall be provided with a supply of spare screws (minimum of 24).
- e. Equipment racks shall be provided with a ground bar and #6 AWG ground lug.
- f. Provide all mounting hardware and accessories as required for a complete installation.

2. Standard TIA/EIA 19" Wall Cabinet:

- a. The equipment cabinets shall be constructed of painted steel or aluminum and offer a usable mounting height of 18 RU. Racks shall be a minimum of 26 inches deep. Access to the rear of the cabinet-mounted equipment shall be by a hinged arrangement.
- b. The equipment cabinet shall be equipped with a lockable steel front door and furnished with two (2) keys that shall be usable on all cabinets furnished under this Contract.
- c. The equipment cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be spaced to accommodate industry standard 19-inch mounting. The cabinet shall be tapped to accept 12-24 screws.
- d. The equipment cabinet shall be vented to allow for airflow through the cabinet.

2.3 CABLE MANAGEMENT – VERTICAL AND HORIZONTAL

A. Equipment Racks:

- 1. Equipment racks shall be equipped with vertical and horizontal cable management hardware in the form of rings and guides. Racks shall incorporate vertical and horizontal covers, to allow an orderly, hidden, routing of copper, optical fiber, and coax jumpers from the modular patch panels and/or 110-type termination blocks to the customer provided network electronics. Vertical and horizontal cable management hardware shall be as follows:
 - a. Horizontal cable management hardware shall be 16 gauge cold rolled steel construction with six (6) pass-thru holes and seven (7) front-mounted 3.5" steel rod D-rings. Provide with cover designed to conceal and protect cable.
 - b. At a minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of jacks on modular patch panels, and (b) above and below each optical fiber patch panel and (c) each grouping of two rows of F-type connectors on coax patch panels.
 - c. Vertical cable management hardware shall provide for cable routing on front and rear of each rack and be 14" deep x 6" wide (minimum). Where multiple equipment racks are to be installed, this hardware shall be mounted between the uprights of adjacent equipment racks. Equipment rack uprights and the spacers shall be secured together per manufacturer's recommendations. Provide with cover designed to conceal and protect cable.

2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.

B. Equipment Cabinets

1. Equipment cabinets shall be equipped with vertical and horizontal cable management hardware, in the form of rings and guides, to allow an orderly routing of optical fiber and copper jumpers from the modular patch panel and/or 110-type termination blocks to the customer provided network electronics. At a minimum, one such horizontal cable management panel shall be provided with each equipment cabinet. Horizontal cable management panels shall be 3.5" in height and have a minimum of five (5) jumper distribution rings.

C. 110-type Termination Blocks:

1. Horizontal troughs incorporating plastic distribution rings shall be provided by the Contractor to accommodate routing of jumpers. Horizontal troughs shall be positioned at the top of each column of 110-type termination blocks and between each 100-pair 110-type termination block.
2. Vertical troughs incorporating metal distribution rings shall be provided for vertical routing of jumper and/or cross-connect wire.

2.4 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 15 00.
- C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.
- E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.5 OPTICAL FIBER PANELS

- A. All terminated optical fibers shall be mated to simplex LC-type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including , LC, SC, ST,

- B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.
- C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.
- D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.
- E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1/2", whichever is larger.
- F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.

2.6 OPTICAL FIBER CONNECTORS/COUPLERS/ADAPTERS

A. Optical Fiber Connectors (LC-type) (Multimode):

- 1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
- 2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
- 3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
- 4. LC-type optical fiber connector plugs shall accept 1.6mm – 2.0mm and 3.0mm outside diameter fiber.
- 5. The average insertion loss is 0.3db for multimode and single mode connectors.
- 6. LC-type optical fiber connector plugs shall meet the following performance criteria:

<u>Test Procedure</u>	<u>Maximum Attenuation Change</u>
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

- 7. Additional Performance Requirements:
 - a. Length: 2.23 inches
 - b. Operating Temperature: -40 to 85 degrees C
- 8. Basis of Design:
 - a. Leviton LC Series

B. Optical Fiber Couplings (LC type) (Multimode)

1. LC -type optical fiber couplings shall be used to terminate optical fiber backbone cable on fiber distribution cabinet panels in communication equipment rooms. Horizontal optical fiber cables shall also be terminated using optical fiber couplings at their designated work area locations on information outlet faceplates for "fiber to the desk."
2. LC -type optical fiber couplings shall be snap-type with locking washer and nut.
3. LC atype optical fiber couplings shall incorporate domed zirconia ferrule and shall utilize a PC polish to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC -type optical fiber couplings shall accept 125-micron outside diameter multimode fiber.
5. The attenuation per mated pair shall not exceed 0.7 dB (individual) and 0.5 dB (average). Connectors shall sustain a minimum of 200 mating cycles per TIA/EIA-455-21 without violating specifications.
6. SC-type optical fiber couplings shall meet the following performance criteria:

<u>Test Procedure</u>	<u>Maximum Attenuation Change</u>
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

7. Additional Performance Requirements:
 - a. Length: 2 inches (5.08cm)
 - b. Operating Temperature: -40 to 85 degrees C
8. Basis of Design:
 - a. Leviton

2.7 TERMINATION BLOCKS

- A. Where identified on the drawings in Communication Equipment Rooms, 110-type termination blocks shall be furnished and installed by the Contractor for termination of copper cable.
- B. Each horizontal row of the 110-type termination block must be capable of terminating one (1) 25-pair binder group (backbone cables)
- C. The Mechanical Termination Shall:
 1. Have the ability of terminating 22 - 26 AWG plastic insulated, solid and stranded copper conductors.
 2. Provide a direct connection between the cable and jumper wires.
 3. Have less than 0.2 dB of attenuation from 1-16 MHz.
 4. Have less than 100 mW of DC resistance.
 5. Have less than 5 mw of resistance imbalance.
 6. Have minimal signal impairments at all frequencies up to 16 MHz.
- D. The 110-type termination block shall identify pair position by a color designation - Blue, Orange, Green, Brown and Slate (backbone only).

- E. The 110-type termination block shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.

2.8 LADDER RACK

- A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer's recommendations.
- B. Steel C-Channel Stringer Style Ladder Rack:
 - 1. Rolled steel siderail stringer, 2" stringer height, 9" spaced welded rungs.
 - 2. Steel shall meet the requirements of ASTM A1011 SS Grade 33.
 - 3. Loading limits shall be 292 lbs/ft for 4 ft spans.
- C. Ladder rack finish shall be flat black powder coat standard ASTM B633 SC3 yellow zinc dichromate Telco gray powder coat computer white powder coat.

2.9 D-RINGS

- A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
- B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
- C. Provide ¼" screw holes for wall mounting.

2.10 COPPER PATCH CORDS

- A. Modular Patch Panel:
 - 1. Provide Category 6A copper patch cords for 100% of all installed ports on the modular patch panel. Of these cords, 60% shall be 5' in length and 40% shall be 7' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
 - 2. Refer to Section 27 15 00 for cable and connector performance requirements.
 - 3. Patch cords shall not be made-up in the field.
 - 4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
 - a. Leviton Series

2.11 FIBER PATCH CORDS

- A. Optical Fiber Patch Cords (Multimode):
 - 1. Provide 50/125 µm multimode (MM) optical fiber utilizing tight buffer construction for 100% of all installed ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC -type connector on each end and shall be a minimum of 5 feet (1.5m) in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
 - 2. Channels shall be of equal length.
 - 3. Refer to Section 27 15 00 for cable and connector performance requirements.

4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS

- A. Equipment racks shall be furnished and installed as shown on the drawings.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.
- C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.
- D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.
- E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.
- F. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

3.2 LADDER RACK

- A. Provide support for ladder rack on 4 ft centers.
- B. Maintain a 1.5 safety factor on all load limits specified herein.
- C. Ladder rack support shall be by 5/8" diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

3.3 GROUNDING

- A. Provide a complete grounding system in accordance with the requirements of Section 27 05 26.

3.4 CROSS CONNECT INSTALLATION

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.

- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

3.5 OPTICAL FIBER TERMINATION

- A. All fiber slack shall be neatly coiled within fiber splice enclosures or splice trays. No slack loops shall be allowed external to the enclosure.
- B. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cable strength member shall be securely attached to the cable strain relief bracket in the enclosure.
- C. Each cable shall be clearly labeled at the entrance to all enclosures.

3.6 CONDUITS AND CABLE ROUTING

- A. Refer to Section 26 05 33 for additional requirements.
- B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3" above the floor slab 3" into the room below the raised floor.
- C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.
- D. All conduits shall be reamed and shall be installed with a nylon bushing.
- E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.

END OF SECTION

SECTION 27 13 00

BACKBONE CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Technology Systems Requirements.
- B. Section 27 15 00 - Horizontal Cabling Requirements.
- C. Section 27 17 20 - Support and Warranty.

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

- 2.1 The basis of design is listed herein. Refer to Section 27 17 20 for additional acceptable manufacturers.

2.2 OPTICAL FIBER BACKBONE – OUTSIDE PLANT

- A. Duct Bank (Multimode):
 - 1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
 - 2. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
 - 3. Temperature Range:
 - a. Storage: -40°C to +70°C (no irreversible change in attenuation).
 - b. Operating: -40°C to +70°C.
 - 4. Humidity Range: 0% to 100%.

5. Maximum Tensile Strength:
 - a. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation).
 - b. Long Term: 890 N (200 lb. force).
6. Bending Radius:
 - a. During Installation: 20 times cable diameter.
 - b. No Load: 10 times cable diameter.
- B. Basis of Design (Multimode):
 1. PANDUIT mm FIBER OM4

2.3 OPTICAL FIBER BACKBONE PERFORMANCE

- A. OM4 Multimode (MM):
 1. Fiber Type: Multimode; doped silica core surrounded by a concentric glass cladding.
 2. Index Profile: Graded Index.
 3. Transmission Windows: 850-nm and 1300-nm.
 4. Core Diameter (nom): 50- μ m (microns) \pm 2.5.
 5. Cladding Diameter: 125- μ m \pm 1.
 6. Core-clad Concentricity: \leq 1.0- μ m.
 7. Cladding Non-circularity: \leq 1.0%.
 8. Fiber Coating Diameter:
 - a. 245- μ m \pm 10 (primary coating).
 - b. 900- μ m (nominal) secondary coating (tight buffer)
 - c. All coatings shall be mechanically strippable without damaging the optical fiber.
 9. Attenuation (maximum @ 23 \pm 5°C; backbone):
 - a. @ 850-nm: 3.0 dB/km.
 - b. @ 1300-nm: 1.0 dB/km.
 - c. @1300-nm thru 1380-nm: 1.0dB/km

When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical cable shall not exceed 0.50 dB/km with 80% of the measured fibers not exceeding 0.25 dB/km.
 10. Bandwidth (minimum):
 - a. @ 850-nm: 2000 MHz*km.
 - b. @ 1300-nm: 500 MHz*km.
 11. No optical fiber shall show a point discontinuity greater than 0.2 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

12. Fiber Dispersion (maximum):
 - a. @ 1285 to 1330-nm: 3.2-ps/nm*km
 - b. @ 1550-nm: 18-ps/nm*km
13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

2.4 COPPER BACKBONE – OUTSIDE PLANT

A. CAT 5 Backbone Cable:

1. CAT 5 backbone cable shall incorporate 24 AWG solid, annealed, bare copper conductors. All conductors shall be continuous and splice free. Bridge taps shall not be allowed.
2. Conductors shall be insulated with a thermoplastic skin. Maximum diameter of the insulated conductor shall be 0.048 in (1.22 mm). Insulated conductors shall be stranded into pairs of varying lengths to minimize crosstalk.
3. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of 10 distinctive colors to identify 25-pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.
4. When CAT5 backbone cables of larger than 25 pairs are required, the core shall be assembled into 25-pair sub-units, each color-coded in accordance with ICEA publication S-80-576-1988. CAT 3 backbone cables with over 600-pair shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever CAT 5 backbone cables are spliced.
5. CAT 5 backbone cable shall meet the physical and electrical requirements of 100 Ohm "Backbone Cable" as defined by the ANSI/TIA/EIA-568 Standard for Commercial Building Wiring and shall conform to Category 5 performance specifications or better. Measurements should be in accordance with ASTM D 4566 (ref. B.17).
6. CAT 5 backbone cable shall be UL listed and be compliant with Article 800 (Communications Circuits) of the National Electrical Code (NEC) and be suitable for installation in underground duct or direct burial (REA PE-89).
7. A flooding compound shall be applied over the core and to all surfaces of the shield/armor to resist moisture entry and to inhibit corrosion.
8. The CAT 5 backbone cable core shall be filled with a waterproofing compound and wrapped with a non-hydroscopic core tape.
9. CAT 5 backbone cable shall contain an overall corrugated, coated aluminum shield, which is electrically continuous over its entire length.
10. CAT 5 backbone cable shall be finished with a black polyethylene jacket, which is sequentially printed with a footage marker at regular intervals.
11. Basis of Design:
 - a. GENERAL CABLE.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

- A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.
- B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, Telecommunications Room or main equipment room, for backbone and intra-building cable.
- C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

3.2 CROSS-CONNECTS

- A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.
- B. This Contractor shall not be responsible for cross-connects between the cabling terminations at the Entrance Room and the telephone utility network point-of-presence. It shall be the responsibility of the Contractor, to work with the Owner and provide the necessary assistance to allow Owner and/or telephone company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross-connect documentation, general wiring overview and cable pair identification.

END OF SECTION

SECTION 27 15 00

HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

- A. CAT 6A Cable:
 - 1. The horizontal cable requirements must be met, as well as the following channel requirements.
 - 2. CAT 6A cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
 - 3. Cable shall exceed transmission requirements listed in ANSI/TIA/EIA-568-C.2. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.
 - 4. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.

5. Performance data shall be provided by third-party independent testing laboratories only. Testing data shall be submitted on the third-party testing laboratory letterhead. Test data will only be accepted if it displays testing as a channel. Electrical characteristics of the performance of the cable itself will not satisfy this requirement.
6. The structured cabling and connectivity may be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed in Section 27 17 20 as an acceptable manufacturer. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
7. The 4-connector channel performance margins in the table below shall be guaranteed margins above ANSI/TIA/EIA-568-C.2:

Electrical Value (1 - 500 MHz)	Minimum Margin
Insertion Loss:	3%
NEXT:	2 dB
PS NEXT:	3 dB
PSA NEXT:	3dB
PSA NEXT (Average):	
ACR-F:	2 dB
PS ACR-F:	3 dB
PSA ACR-F:	3 dB
PSA ACR-F (Average):	3 dB
Return Loss:	2 dB

8. The jacket color for CAT 6A cable shall be and blue for all applications.
9. Basis of Design:
 - a. Hubbell C6AS
 - b. Refer to Section 27 17 20 for additional acceptable manufacturers.

B. Cat 6A Jacks:

1. CAT 6A horizontal cable shall each be terminated at its designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
4. Where standalone CAT 6A only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.

6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
 - a. Match the faceplate color used for other utilities in the building, or
 - b. When installed in surface raceway (if applicable), match the color of that raceway.
8. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:
 - a. Be a low-profile assembly.
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
 - c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
 - d. Incorporate a shroud that protects the optical fiber couplings from impact damage.
9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
10. The CAT 6A modular jacks shall be non-keyed 8-pin modular jacks.
11. The interface between the modular jack and the horizontal cable shall be an angled insulation displacement type contact and shall provide separation for ANEXT suppression. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
12. CAT 6A modular jacks shall be pinned per TIA-568B.
13. CAT 6A termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
 - a. ANSI/TIA/EIA-568-B.2-10
 - b. IEEE 802.af (PoE)
 - c. IEEE 802.an 10GBASE-T
 - d. ISO/IEC 60603-7
 - e. ISO 11801 Class E Compliant
 - f. FCC PART 68.5 SUBPART F
14. The color for CAT 6A jacks shall be white for all applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6A modular jack.

2.2 COPPER WORK AREA CORDS

A. RJ-45:

1. Provide the same quantity of Category 6A copper work area cords as copper patch panel cords specified in Section 27 11 00. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
2. Work area cords shall be 10' in length.

3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
8. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
9. Category 6A cables shall not be mixed with any other category cable in any bundle. Bundles of Category 6A cable shall maintain a 0.5" separation from bundles of cables containing different categories (e.g., Cat 6, Cat 5E).
10. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of <5-kVa.
 - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.
11. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

B. Horizontal Cabling in Modular Furniture:

1. This Contractor shall be responsible for providing and installing cable completely to the information outlet in the furniture. This Contractor's responsibility does not end at the furniture feed point.
2. Where furniture panels are installed to include contact with a wall, cabling shall be fed to the furniture panels via conduit.
3. Where modular furniture is installed without wall contact, the Contractor shall install cabling through floor fittings as shown on the drawings.
4. Cabling shall be protected in the transition from the floor or wall fittings to the modular furniture via a length of flexible plastic conduit or other approved protective means. Conduit fittings shall be compatible with the Floor and Wall Fittings proposed. There shall be no exposed cable in the transition to the modular furniture. Fill ratio (cable area vs. conduit area) in each feed shall not exceed 40%.
5. For purposes of bidding, it is to be assumed that the cable pathway shall be limited to the bottom panel of the modular furniture only. Communications cables would be run through these channels to the jack location.
6. For purposes of bidding, it is to be assumed that it will be the responsibility of the Contractor to punch and reinstall the bottom molding panels on the modular furniture as required to accommodate the communications cabling and information outlets. The panels shall be marked prior to installation by the Owner to identify the desired location of the information outlets.
7. The information outlet shall be secured to the panel via mounting tabs, pop-rivets, screws or other approved method. Use of adhesive tape is not acceptable. The method of securing the information outlet to the panel shall not result in sharp protrusions (e.g., sheet metal screw tip) into the channel behind the panel.

3.2 CABLE TERMINATION REQUIREMENTS

A. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use.
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION

SECTION 27 17 10

TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Complete information on testing procedure as described herein.
 - 2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

PART 2 - PRODUCTS

2.1 TESTING COPPER

- A. CAT 6A Cable:
 - 1. Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
 - 2. Horizontal cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
 - 3. CAT 6A horizontal cable shall be tested to 500 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link" "Channel Link", including patch cords, cabling, and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
 - a. Wire Map
 - b. Length
 - c. NEXT Loss (Pair-to-Pair)
 - d. NEXT (Power Sum)
 - e. ELFEXT (Pair-to-Pair)
 - f. ELFEXT (Power Sum)

- g. Return Loss
 - h. Attenuation
 - i. Propagation Delay
 - j. Delay Skew
- 4. The maximum length of horizontal cable shall not exceed 295 feet (90m), which allows 33 feet (10 m) for technology equipment and modular patch cords.
 - 5. To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6A modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be used during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
 - 6. CAT 6A horizontal cable testing shall be performed using a test instrument designed for testing to 500 MHz or higher. Test records shall verify "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
 - 7. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.2 TESTING FIBER

A. General Requirements:

- 1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
- 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
- 3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
- 4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
- 5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
- 6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.

7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
 - a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
 - b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.
 - c. Tests Prior to Installation:
 - 1) The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.
 - d. Tests After Installation:
 - 1) Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:
 - a) Optical Attenuation ("Insertion Loss" Method):
 - (1) Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Multimode optical fibers shall be tested at 850 ± 30 nm. Singlemode optical fibers (if applicable) shall be tested at 1300 ± 20 nm.⁷

- (2) Attenuation of optical fibers shall not exceed the values calculated as follows:

$$\text{Attenuation (max.)} = 2 * C + L * F + S \text{ dB}$$

Where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers), and F is the maximum allowable optical fiber loss (in dB/km). S is the total splice loss (# of splices * maximum attenuation per splice).

b) Verification of Link Integrity (OTDR):

- (1) All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multimode optical fibers shall be tested at 850-nm and 1300-nm (nominal). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.
- (2) Set OTDR's test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDR's range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.
- (3) OTDR traces revealing a point discontinuity greater than 0.2 dB in a multimode optical fiber or 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

2.3 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.

3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

C. Optical Fiber Media Test Data:

1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.

D. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 27 17 20

SUPPORT AND WARRANTY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Technology Systems Requirements.

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

PART 2 - PRODUCTS

2.1 MANUFACTURER REQUIREMENTS

- A. The Basis of Design for all structured cabling components is listed in the individual Division 27 sections. Alternative acceptable manufacturers will be accepted for this project.
- B. Additional acceptable manufacturers for horizontal cabling:
 - 1. Systimax
 - 2. Hubbell/Mohawk
 - 3. PANDUIT

2.2 WARRANTY

- A. A twenty-five (25) year Product Installation Warranty and System Assurance Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- C. The system assurance warranty shall cover the failure of the wiring system to support the application it was designed to support, as well as additional applications introduced in the future by recognized standards or user forums that use the TIA/EIA 568A component and link/channel specifications for cabling.
- D. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 27 51 13

PAGING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ceiling Speaker
- B. Wall-Mounted Speaker
- C. Paging System Cable
- D. Conduit
- E. Non-Continuous Cable Hangers and Supports

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 26 05 35 - Surface Raceways
- C. Section 26 05 13 - Wire and Cable
- D. Section 27 05 00 - Basic Communications Systems Requirements
- E. Section 27 05 03 - Through Penetration Firestopping
- F. Section 27 05 26 - Communications Bonding
- G. Section 27 05 28 - Interior Communication Pathways
- H. Section 27 15 00 - Horizontal Cabling Requirements
- I. Section 27 05 53 - Identification and Administration

1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have ten (10) years documented experience in the design and manufacture of paging system devices and equipment.
- B. Installer: The Contractor shall have a minimum of three (3) years documented experience in paging system installation and must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
 - 1. The Contractor shall own and maintain all tools and equipment necessary for successful installation and testing of the system and have personnel adequately trained in the use of such tools and equipment.
- C. The Contractor(s) shall provide a résumé of prior experience in similar types and scales of projects, and other projects that may have been completed with the client. The résumé shall include the project name, square footage, budget, system descriptions, and references with email addresses and phone numbers.
- D. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) month prior to the posted bid date of this project.
- E. Service: The manufacturer of the system must have local service representatives within 100 miles of the project site. The installer must be factory certified to provide service on the installed manufacturer's equipment and must have local service representatives within 100 miles of the project site.
- F. The entire installation shall comply with all applicable electrical and safety codes. All applicable devices, equipment, and cabling shall be listed by Underwriters' Laboratories, Inc.

1.4 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ADAAG - Americans with Disabilities Accessibility Guidelines

- C. NFPA 70 (NEC) – National Electrical Code
- D. UL 813 - Standards for Commercial Audio Systems
- E. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

1.5 SUBMITTALS

- A. Submit product data under the provisions of Section 27 05 00.
- B. Provide materials documenting experience requirements of the manufacturer and installing contractor.
- C. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item by item.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Heat generation for all power consuming devices.
 - 5. Wiring and connection requirements.
 - 6. Manufacturer's installation instructions, indicating application conditions and limitations of use as stipulated by product testing agency and instructions for storage, handling, protection, examination, preparation, installation, and initiating usage of product.
- D. Certification Documentation Submittal
 - 1. Provide documentation of all required certifications. All certifications shall be current and valid. Any certificate with expired dates will not be accepted. Submittal shall include documentation of the following:
 - a. System Equipment Manufacturer(s) dealer certification(s) and dealer number(s).
 - b. System Equipment Manufacturer(s) programmer certification(s).
 - c. All other applicable dealer, installation, and programming certifications.
 - 2. If an alternate manufacturer is submitted, the equivalent certifications to the basis of design manufacturer's shall be required and submitted.
- E. System Drawings:
 - 1. Project-specific system CAD-generated drawings shall be provided as follows:
 - a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical speaker zones), the diagram may show one device and refer to the others as "typical" of the device shown.
 - b. Where applicable, an equipment rack plan shall be provided showing rack elevations and dimensions in plan and elevation view. The plan shall include equipment layout within the rack.
- F. Provide voltage drop calculations for each speaker cable circuit or run, showing the drop for the specific circuit or run wattage and cable size used.

G. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

H. Quality Assurance:

1. Provide list of test equipment proposed for use in testing the installed paging system.
2. Provide system checkout test procedure to be performed at acceptance, including demonstration of specified performance and all required system features and functions listed herein and as further detailed on the drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 27 05 00.
- B. Store and protect products under the provisions of Section 27 05 00.

1.7 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey multi-zone paging system installed as an expansion of the existing Bogen overhead paging system.
- B. Performance Statement: This specification section and the accompanying design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed or every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required for a complete and operational system.
- C. This Contractor shall furnish and install a paging system as hereinafter specified and further detailed on the drawings. System shall be completely wired and ready for use including, but not limited to, outlet boxes, conduit, wire, equipment, speakers, controls, and equipment cabinets.
- D. Basic System Requirements: The system shall be capable of providing all features and functionality that is currently in operation or available through the existing system headend.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide floor plans identifying actual locations of all installed overhead paging system equipment and devices.
- C. Provide final system block diagram showing any deviations from shop drawing submittal. Block diagram shall include cable number documenting the numbers installed on both ends of the cable in the field.
- D. Provide documentation of all test results and statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described herein.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 27 05 00.

- B. Operation and Maintenance data shall be submitted in hard copy and electronic .pdf format.
- C. Operation data shall include:
 - 1. Manufacturer's full operation instructions for each piece of equipment.
 - 2. Complete documentation of all settings and programming.
 - 3. Detailed, step-by-step instructions for system operation, including accessing, initiating, and performing all required system features and functions listed herein.
- D. Maintenance data shall include:
 - 1. Description of servicing procedures:
 - a. Documentation of all manufacturers' recommended preventive and remedial maintenance procedures to be performed by the Owner.
 - b. Troubleshooting flowcharts.
 - 2. Spare parts list.

1.10 WARRANTY

- A. Unless otherwise noted, provide warranty for a minimum of one (1) year after Substantial Completion, as defined by the Contract. Certain system components may require additional manufacturer's warranty as described herein.
- B. The warranty shall:
 - 1. Ensure that all approved devices, equipment, cabling, and other components specified in this section meet or exceed the specified requirements.
 - 2. Ensure against product defects.
 - 3. Cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
 - 4. Include emergency service and repair on-site, with response times of 24 hours from time of notification. The system shall be repaired and restored to operation within 24 hours of technician's arrival on site.
- C. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - PRODUCTS

2.1 CEILING SPEAKER

- A. Features:
 - 1. 8" paper cone speaker with 10-ounce magnet
 - 2. Integral 70-volt transformer
 - 3. Circular paintable steel grille
 - 4. Recessed integral volume control

- B. Specifications:
 - 1. Transformer Taps: 4, 2, 1, 1/2, and 1/4 watt
 - 2. Frequency Response: 70 Hz to 12 kHz
 - 3. Sensitivity: ≥ 95 dB
- C. Basis of Design: Bogen S810T725PG8WVR
- D. Provide complete with manufacturer's circular paintable steel speaker enclosure and T-bar support tile bridge.

2.2 WALL-MOUNTED SPEAKER, WEATHER RESISTANT

- A. Features:
 - 1. ≥ 4 " paper cone woofer
 - 2. $\geq 1/2$ " dome tweeter
 - 3. Integral 70-volt transformer
 - 4. Weather-resistant molded black plastic enclosure with black metal mesh grille
 - 5. Integral U-bracket mount
- B. Specifications:
 - 1. Power Handling: ≥ 15 watts, minimum of 5 transformer tap settings
 - 2. Frequency Response: 105 Hz to 17 kHz
 - 3. Sensitivity: ≥ 89 dB
- C. Basis of Design: Quam FM4X1/70
- D. Provide complete with necessary manufacturer's mounting accessories.

2.3 PAGING SYSTEM CABLE

- A. Refer to Section 27 05 00 for plenum or non-plenum cable rating requirements.
- B. Backbone Speaker Cable
 - 1. Minimum 14/2 shielded with drain wire
 - a. Conductor Type: Bare copper, stranded
 - b. Voltage Capacity: 150 volts RMS
 - c. Current Capacity: 8 amps per conductor
 - d. Nominal Capacitance, Conductor to Conductor: ≤ 85 pF/ft.
 - e. Nominal Capacitance, Conductor to Shield: ≤ 153 pF/ft.
 - f. UL Temperature Rating: 75°C
 - 2. Cable shall be NEC compliant and UL listed.
 - 3. Basis of Design: Belden 6100FE (CMP)
 - 4. Provide with larger-gauge conductors where necessary to maintain acceptable voltage drop as defined herein.
- C. Speaker Cable
 - 1. Minimum 18/2 shielded with drain wire
 - a. Conductor Type: Bare copper, stranded
 - b. Voltage Capacity: 300 volts RMS
 - c. Current Capacity: 5 amps per conductor
 - d. Nominal Capacitance, Conductor to Conductor: ≤ 70 pF/ft.

- e. Nominal Capacitance, Conductor to Shield: ≤ 126 pF/ft.
- f. UL Temperature Rating: 75°C

- 2. Cable shall be NEC compliant and UL listed.
- 3. Basis of Design: Belden 6300FE (CMP)
- 4. Provide with larger-gauge conductors where necessary to maintain acceptable voltage drop as defined herein.

2.4 CONDUIT

- A. All conduit for paging system cabling shall be a minimum of 3/4" trade size.
- B. Flexible conduit shall be used only for "fixture whip" type applications at speakers in accessible ceilings, between a speaker and nearby junction box. Flexible conduit for this application shall be no longer than four (4) feet. Flexible conduit shall not be installed for any other paging system cabling.
- C. Refer to Specification Section 26 05 33 for additional requirements.

2.5 NON-CONTINUOUS CABLE HANGERS AND SUPPORTS

- A. Refer to Section 27 05 28 for requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with all manufacturer's instructions and recommendations for installation of all equipment, devices, and materials.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. Wiring:
 - 1. Refer to Sections 26 05 33 for conduit requirements and 26 05 13 for additional wiring requirements. Wiring not installed in conduit shall be plenum rated.
 - 2. All cabling shall be run in conduit "free-air" in non-continuous cable supports or cable tray above accessible ceilings, and in conduit or in a secured metal raceway in exposed areas. Supports shall be spaced at a maximum 4-foot interval. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.
 - 3. All overhead paging system audio cabling, including but not limited to speaker, line-level audio, and microphone-level audio cabling, shall be installed in its own cable pathway and shall not share any raceway or cable pathway with telephone or computer network cabling or cabling of any other system.
 - 4. Cable shall not be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires. Cables shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, ceiling supports, electrical or communications conduit, or structural elements.
 - 5. Manufacturer's minimum bend radius specifications for cables shall be observed in all instances.

6. All cable shall be installed at right angles and be kept clear of work by other trades. To reduce or eliminate EMI, the following minimum separation distances from $\leq 480V$ power lines shall be adhered to:
 - a. 12 inches from power lines of $<5\text{-kVa}$
 - b. 18 inches from high voltage lighting (including fluorescent)
 - c. 39 inches from power lines of 5-kVa or greater
 - d. 39 inches from transformers and motors
7. It shall be noted that all cables shall be installed in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.
8. All cable shall be free of tension at both ends.
9. Both ends of all cables shall be clearly labeled with an alphanumeric identifier. On speaker cables, the label shall indicate the speaker cable circuit zone or run and the telecommunications room in which the zone or run initiates; on line-level cables, the label shall indicate the signal and signal source. Record all speaker cable identifiers on record drawings.
10. No acid core or other corrosive flux solder shall be used in this system.
11. Speaker cable conductor sizes listed are minimum requirements. Actual wire size required shall be determined by the Contractor to maintain a maximum of 10% voltage drop or 0.5 dB insertion loss on any speaker zone. Actual speaker cabling installed shall meet or exceed minimum conductor sizes listed. Basis of design paging speaker cable listed herein is provided to list the minimum criteria and performance requirements for paging speaker cable.
12. The polarity of all cabling shall remain consistent throughout the project, on all equipment.
13. Do not run unbalanced audio signals over cables longer than 10 feet. Contractor shall provide a shielded transformer-based converter at signal source to convert the unbalanced signal to a balanced signal.
14. The Contractor shall provide an isolation transformer for any balanced or unbalanced audio line that exhibits hum, EMI / RFI, power line noise, or ground loops.
15. Provide all system wiring between all components as shown on project documents, as directed by the manufacturer, and/or required for proper system operation and to provide specified system functionality.

D. Equipment:

1. All necessary devices, sub-components, accessories, and incidental materials required to provide a complete, turn-key paging system that provides specified performance and all required system features and functions listed herein and as further detailed on the drawings shall be provided and installed as part of a complete system.
2. All speakers shall be connected in proper polarity.
3. Install all head end equipment and devices in a manner that allows ample air flow for cooling.
4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tools recommended by the manufacturer for that purpose. Use caution to avoid stripping or damaging connectors, terminals, or equipment by over-tightening termination fasteners.
5. The conductor color code used in terminating system cabling at system equipment and devices shall remain consistent from device to device for each unique device type throughout the project.

E. Grounding Requirements:

1. Furnish and install a minimum #6 AWG bonding conductor from each overhead paging system head end component to the nearest wall-mounted telecommunications grounding busbar. Actual bonding conductor size determined by its installed length. Refer to Section 27 05 26 for grounding and bonding conductor sizing criteria.
2. Audio cable shields for line level signals shall be connected to the metal equipment chassis at both ends of the cable. Audio cables connected to transformers shall have the cable shield connected to the transformer shield and transformer case ground.
3. Speaker cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground speaker cable shields at signal origin telecommunications room end only.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Furnished products shall be listed and classified by UL as suitable for purpose specified and indicated.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the project documents. These services do not relieve the Contractor of responsibility for compliance with the project documents.

3.3 SYSTEM SETUP, PROGRAMMING, AND ADJUSTMENT

- A. The Contractor shall provide all system programming, startup, balancing, tuning, and adjustment required as part of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments that may be required.
- B. Complete all necessary programming to provide the indicated functionality.
- C. Paging system shall be adjusted to provide 70 dBA of sound 6 dBA of sound above the ambient sound level in the space in which they are installed measured at one (1) meter from each speaker when voice pages are made. Sound shall be clear, even, and undistorted and free of any hum, noise, or sonic anomalies. Where speakers are controlled via local volume controls, adjustments shall be made with the volume control set at 70%.
- D. Paging system shall be adjusted to achieve a minimum Speech Transmission Index (STI) of 0.50 or a Common Intelligibility Scale (CIS) rating of 0.7 at representative points within all areas of coverage.
- E. Paging system zone output equalization shall be adjusted to achieve +/- 3 dB over entire published effective frequency range of installed speakers, measured on axis at a distance of 1 meter from 10% of each speaker type installed +/- 4 dB over the 2,000 Hz octave band throughout all corridors, open treatment areas, and public spaces. All efforts shall be made to adjust the audible system output's average frequency response in all areas covered by each speaker zone to be as equal as possible when measured at ISO R 266-1997 / ANSI S1.6-1984 1/3 octave preferred frequencies from 20 Hz to 20 KHz.

3.4 TESTING

- A. The Contractor shall conduct all system testing as part of the requirements of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments or corrective action that may be required to provide a complete system that provides the specified performance and all required system features and functions listed herein and as further detailed on the drawings.

- B. At a minimum, the installer shall perform the following inspections and tests of the installed overhead paging system:
 - 1. Verify that all features and functionality are operating properly.
 - 2. Verify that the system receives signal from all sources and routes those signals as specified.
 - 3. Verify that priority override hierarchy functions properly and according to the hierarchy specified.
 - 4. Verify that system output meets specified sound level at each speaker.
 - 5. Verify that system output meets specified minimum STI and/or CIS rating at representative points within all areas of coverage.
 - 6. Verify that system output meets specified equalization requirements in all coverage areas.
 - 7. Verify that all controls are properly labeled and interconnecting wires and terminals are identified.
- C. Document all test results and submit as part of final system documentation package.

3.5 TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two week's advanced notice of training to the user.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. Users:
 - a. Provide training on the system functions and operations that a daily user will encounter, including navigation of the user interface to accomplish common operations.
 - 2. Maintenance Staff:
 - a. Provide training on the system functions and operations that a daily user will encounter, including navigation of the user interface to accomplish all common operations.
 - b. Provide training on all system components and the basic configuration of the system.
 - c. Identify and describe preventive and remedial maintenance procedures to be performed by the Owner.
 - d. Review troubleshooting flow charts and describe troubleshooting procedures for common issues.
- E. Minimum on-site training times shall be:
 - 1. Maintenance Staff: Two (2) hours.

END OF SECTION

SECTION 27 53 13

CENTRAL CLOCK SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing a Central Clock System designed as an expansion of the existing master clock system.

1.2 RELATED WORK

- A. Section 26 05 33 – Conduit and Boxes
- B. Section 26 05 13 – Wire and Cable
- C. Section 27 05 00 – Basic Communications Requirements

1.3 QUALITY ASSURANCE

- A. The system equipment manufacturer shall maintain a service organization within 60 miles of the project site consisting of direct full-time employees under the supervision of a qualified service manager, whose name shall be furnished to the Owner. A part-time serviceman or a Sales Office only shall not be considered a qualified service organization.
- B. The entire installation will comply with all applicable electrical and safety codes.
- C. The Contractor shall have a minimum of three (3) years documented experience in sound masking installation and commissioning. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of system and have personnel adequately trained in the use of such tools and equipment.
- D. Resume of qualification shall be submitted with the Contractor's proposal indicating the following:
 - 1. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
 - 2. List of test equipment proposed for use in verifying the installed integrity of sound masking systems.
 - 3. Technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.

1.4 REFERENCES

- A. TIA/EIA 526-18 – Systematic Jitter Generation Measurement
- B. UL 863 – Time Indicating and Recording Appliances

1.5 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Shop Drawings:
 - a. Provide a detailed drawing and system block diagram noting system components and interconnection between components. The inter-connection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration, the diagram may show one device and refer to the others as "typical" of the device shown.

2. Manufacturer's data covering all products proposed, indicating construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 3. Manufacturer's installation instructions.
- B. Contractor qualification documentation.
 - C. System commissioning procedure description.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to and receive products at the site under provisions of Division 1, General Requirements.
 - B. Equipment must be stored according to manufacturer's recommendations.
 1. Equipment must be stored in a location protected from weather. If equipment is stored outside, it must be covered with opaque plastic or canvas, with provision for ventilation to prevent condensation and for protection from weather. If air temperature at equipment storage location will be below 40°F, the equipment shall be moved to a heated (50°F minimum) location.
- 1.7 SYSTEM DESCRIPTION
- A. Performance Statement: This specification section and the accompanying Central Clock specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
 - B. Furnish and install complete with all accessories, a Central Clock System. Furnish all materials, labor, tools, and system commissioning necessary to complete the installation of the clock system described in the Contract Documents.
 1. The existing central clock system includes but not limited to: master clock, secondary clock, power, seven-day battery backup, controls, and all other equipment necessary to provide a complete and operating system. The scope of work for this project includes relocating the system headend and rerouting associated cabling as required for a complete and operation system.
 2. Commissioning of system includes settings.
 3. Documenting functionality, wiring, and settings.
- 1.8 WARRANTY
- A. Provide a one (1) year product and installation warranty for the Central Clock System.
 - B. The product warranty shall ensure against product defects and that all approved cabling and other components specified in this section meet or exceed the specified requirements.
 - C. The product warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- 1.9 PROJECT RECORD DOCUMENTS
- A. Submit documents under the provisions of Section 27 05 00.
 - B. Provide final system block diagram showing any deviations from shop drawing submittal.

- C. Provide statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 - 1. All terminal block wiring, including cable numbers.
 - 2. Clock numbers and location.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described below.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 27 05 00.
- B. Operation Data: Provide full system operation instructions for each piece of equipment.
- C. Maintenance Data: Document any manufacturer's recommended preventative maintenance procedures to be performed by the Owner.

PART 2 - PRODUCTS

2.1 EXISTING SYSTEM

A. SYMPLEX TIME CONTROL CENTER

2.2 SYSTEM EQUIPMENT

- A. The system utilizes low voltage clocks.
- B. Master Clock Controller (Existing):
 - 1. Microprocessor-based circuitry.
 - 2. "User-friendly" programming from keyboard.
 - 3. Non-volatile memory for protection of all programs.
 - 4. Up to 350 events may be scheduled for any combination of zones and schedules.
 - 5. Minimum of four zones and four schedules available.
 - 6. LED digital display of mode time, zones and schedules.
 - 7. 12- or 24-hour display on 12-hour operation.
 - 8. 1 to 59 second programmable signal duration zone.
 - 9. Latched zone operation for controlling lights or devices if desired.
 - 10. Output zone relays rated at 5 amps with built-in noise suppression.
 - 11. Correction of three (3) different clock systems simultaneously.
 - 12. Accumulation of down-time during power outage to reset slave clocks, minute impulse, synchronous and digitals, immediate correction shall begin after the power has been restored.
 - 13. Crystal control time base for assured accuracy.
 - 14. Five (5) year Lithium Battery Backup for master clock operation.
 - 15. Electronic keyboard lock-out.
 - 16. Speed Dial Keys.
 - 17. Auxiliary Data Jack.
- C. Secondary Analog Clocks:
 - 1. Flush mounted.
 - 2. Full 12" face for exceptionally high readability.
 - 3. 24 VAC synchronization correcting.
 - 4. All metal case with convex glass crystal.

5. Finished in satin aluminum enamel.
6. Character height = 1-1/4".
7. Provide wire guards where noted on the drawings.
8. 12-hour display.
9. Red sweep secondhand.
10. Provide wall box.

PART 3 - EXECUTION

3.1 SYSTEM INSTALLATION REQUIREMENTS

A. General Requirements:

1. Contractor shall furnish and install all cables, connectors and equipment as shown on the drawings and as specified above.
2. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
3. The Contractor shall provide adequate labels so that the function of each cable can be determined by visual inspection.

3.2 INSTALLATION PROCEDURES

A. Cabling:

1. All cabling shall comply with Sections 26 05 33 and 26 05 13.
2. Cabling and control wiring shall be stranded copper.
 - a. Clock wiring shall be at least #18 AWG for +24V clocks.
 - b. If the requirements of Division 26 do not require low voltage cabling to be in conduit, provide plenum rated cable.

3.3 IDENTIFICATION AND LABELING

- A. Each cable terminated at the equipment shall be marked for identification purposes and this mark shall be shown on the record drawings.
- B. Labeling: The Contractor shall provide adequate labels so that the function of each cable can be determined by visual inspection.

3.4 SYSTEM TESTING

- A. Make sure ALL system components are working correctly.
- B. Make sure all labels reflect the correct operation.
- C. If the results of these tests require changes to the system, record the changes on the Contractor's record drawings.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two weeks advanced notice of training to the Owner.

- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. Building System Engineer: A course detailing the system functions and operations. Provide configuration training on all aspects of the system.
- E. Minimum on-site training times shall be:
 - 1. Building System Engineer: Two (2) hours.

END OF SECTION

SECTION 28 05 00

BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. CCR California Code of Regulation
- B. CBC California Building Code
- C. CFC California Fire Code
- D. CEC California Electric Code
- E. California Title 24 - Building Energy Efficiency Standards
- F. SCAQMD Southern California Air Quality Management Division

1.3 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the security systems a finished and working system.
- C. Description of systems include but are not limited to the following:
 - 1. Electronic intrusion detection system
 - 2. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
 - 3. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
 - 4. Firestopping of penetrations of fire-rated construction as described in Specification Section 28 05 03.

1.4 DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.
4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.

C. General:

1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Security Wiring, the installation shall not begin until the Security Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Sprinkler Piping and other Piping
 - f. Conduit and Wireway
 - g. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Responsible for Security Systems grounding and bonding.

3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Security Contractor's Responsibility:

1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of security equipment which is required to be bonded to the telecommunications bonding system.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.

5. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
- B. Compliance with Codes, Laws, Ordinances:
 1. Conform to all requirements of the State of California Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
 3. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
 4. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
 5. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
 6. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
- C. Permits, Fees, Taxes, Inspections:
 1. Procure all applicable permits and licenses.
 2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
 3. Pay all applicable charges for such permits or licenses that may be required.
 4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
 7. All equipment, and materials shall be as approved or listed by the following: (Unless approval or listing is not applicable to an item by all acceptable manufacturers.)
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

D. Examination of Drawings:

1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

E. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing AutoCAD MEP Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

F. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
28 05 03	Through-Penetration Firestopping
28 16 00	Intrusion Detection System
28 23 00	Video Surveillance

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 28 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 28 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 1. Firestopping, including mechanical firestop systems.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 REFER TO INDIVIDUAL SECTIONS

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

- A. General:
 - 1. Refer to specific Division 28 sections for further requirements.
 - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
 - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
 - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of Section 27 05 00 for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site insert address here; submit receipt to Architect/Engineer prior to final payment being approved.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div28.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- C. Refer to the individual specification sections for minimum hours of instruction time for each system.
- D. Operating Instructions:
 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff that can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM COMMISSIONING

- A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

3.10 SPECIAL REQUIREMENTS

- 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
- 2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.

3. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

END OF SECTION

SECTION 28 05 03

THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 – Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. OSHPD - Office of State Wide Health Planning and Development (California)
- J. CBC California Building Code
- K. The Building Officials and Code Administrators National Building Code
- L. 1994 1997 Uniform Building Code
- M. Wisconsin Administrative Code
- N. 2000 2003 2006 2009 2012 2015 International Building Code
- O. NFPA 5000 – Building Construction Safety Code

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 Section 28 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

- F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are 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.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
 - c. Wall penetrations above corridor ceilings which are not part of a fire-resistive assembly.
 - d. Wall penetrations below any ceiling that are larger than 4" diameter or 16 square inches.
 - 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.
 - 1. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards: LEED [v4] [] – Low Emitting Materials – Adhesives and Sealants.
 - 2. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

3. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
4. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 1. Review foreseeable methods related to firestopping work.
 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
 1. 3M; Fire Protection Products Division
 2. Hilti, Inc.
 3. RectorSeal Corporation, Metacaulk
 4. Tremco; Sealant/Weatherproofing Division
 5. Johns-Manville
 6. Specified Technologies Inc. (S.T.I.)
 7. Spec Seal Firestop Products
 8. AD Firebarrier Protection Systems
 9. Wiremold/Legrand: FlameStopper
 10. Dow Corning Corp
 11. Fire Trak Corp
 12. International Protective Coating Corp

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

- 1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated
 - F Rating = Floor/Wall Rating
 - T Rating = Floor/Wall Rating
 - L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

- 2. Non-Combustible Framed Walls - 1 or 2 Hour Rated
 - F Rating = Wall Rating
 - T Rating = 0
 - L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

- 3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated
 - F Rating = Wall/Floor Rating
 - T Rating (Walls) = 0 or Wall Rating
 - T Rating (Floors) = Floor Rating
 - L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999

<u>Penetrating Item</u>	<u>UL System No.</u>
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 28 13 53.11

IP NETWORK COMPATIBLE INTERCOM (IX SYSTEM)

GENERAL

1.1 SECTION INCLUDES

- A. IP Video Intercom. (Aiphone IX Series s system)

1.2 RELATED SECTIONS

- A. Section 23 10 00.1 - Ethernet Cabling

1.3 REFERENCES

- A. Standards Institute (ANSI/TIA/EIA) 568 - Commercial Building Telecommunications Cabling Standard.
- B. International Organization for Standards (ISO) 9001:2000 - Quality Management Systems - Requirements.

1.4 SYSTEM DESCRIPTION

- A. IP Network Compatible Video Intercom System: A network-based communication and security system featuring video entry security, internal communication, emergency stations, and paging. All units and app in the systems shall be able to unlock doors remotely on a network, view and assist onsite visitors from an offsite location, broadcast emergency announcements, and communicate using a PoE network.
 - 1. Power Source: Power over Ethernet (802.3af).
 - 2. Network Interface: 10 BASE-T / 100 BASE-TX Ethernet CAT 6a (RJ-45).
 - 3. Network Protocols: IPv4, IPv6, TCP, UDP, SIP, HTTP, HTTPS, MJPEG, RTSP, RTP, RTCP, IGMP, MLD, SMTP, DHCP, NTP, DNS.
 - 4. Bandwidth Usage:
 - a. G.711: 64Kbps x 2 per video call.
 - b. 64Kbps per monitor.
 - c. H.264: 24Kbps ~ 2,048Kbps.
 - 5. Communication: Hands-free (VOX), push-to-talk (simplex), or handset (full-duplex).
 - 6. Video Display: 7 inches color LCD.
 - 7. Camera: Type:
 - a. 1/4 inch (6 mm) color CMOS.
 - b. View Area: 2 feet 2 inches (660 mm) vertical x 3 feet 1 inch (940 mm) horizontal at 20 inches (508 mm).
 - c. Resolution: VGA or higher
 - 8. Video Stream: ONVIF Profile S.
 - 9. Door Release: Programmable Form C dry contact, 24V AC/ DC, 500mA (which requires 24V DC power supply).
 - a. District standard electric strike: HES model 9600 Series 24 V DC.

10. Power Source for electric strike: Atop AD1048-24FS 48W/24DIN-Rail 24V DC.
11. Wire Type: CAT-6a. (District standard: Panduit)
12. Distance:
 - a. Base Bid to include up to 100 l. f. of cabling
 - b. Maximum allowable to any station to Network Node: not to exceed 330 feet (100 meters).

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings: Submit the following:
 1. Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.
 2. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- D. Installation and Operation Manuals:
 1. Submit manufacturer's installation and operation manual, including operation instructions and component wiring diagrams.
 2. Provide detailed information required for Owner to properly operate equipment.
- E. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001:2008 certified company.
- B. Installer Qualifications: Factory trained and experienced with system installations of scope and size required for the Project.
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- D. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- E. Handling: Protect materials during handling and installation to prevent damage.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. IP Video Intercom System: IX Series Intercom System as manufactured by Aiphone Corporation. Web site: www.aiphone.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.1 – Request for Substitution.

2.2 SYSTEM DESIGN

- A. Master Station(s): Provide one master station at each campus.
 - 1. Aiphone Model IX-MV7-HW Provide one per campus at designated location.
- B. Audio Video Door Stations:
 - 1. Model IX-DA - Surface Mount: Provide one per campus at designated location.
or
 - 2. Model IX-DF - Flush Mount: Provide one per campus at designated location.
 - 3. Option: Model IX-DV – Surface Mount.
- C. Signage:
 - 1. At each Door Station/Wall Box Contractor shall provide weatherproof signage Signage: “ASSISTANCE” (English) and “ASISTENCIA” (Spanish).
- D. Functional Components: As indicated on the drawings or as required to complete system.
 - 1. Video Master Station Model IX-MV7-HW:
 - a. An IP addressable video master station with a 7 inch color LCD monitor. It can be wall or desk mounted (desk stand included. This station requires a 802.3af compliant Power-over-Ethernet network.
 - 2. Audio/Video Door Station: Model IX-DA, IX-DF, or IX-DV
 - a. Station connects to a PoE network using CAT-6a cable.
 - 3. Optional Components (Unit price items to be used at District option):
 - a. RY-IP44 IP Programmable Relay Adaptor:
 - b. 45 Degree Mullion Mounting Bracket Model KMB-45:
 - c. Stainless Steel Security Lock Box Model LB-SDVF: for IX-DF, IX-DF-HID, & IX-DF-RP10.
 - d. Stainless Steel Enclosure Model SBX-ISDVF:
 - 1) 18-Guage stainless steel enclosure designed for surface mounting the IX-DF door stations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive integrated security and communication system.
- B. Notify District of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION

- A. Verify the following compliance before starting installation.
 - 1. The unit turns inoperative during power failure.
 - 2. Keep the intercom wires at least 1 foot (30 cm) away from strong electrical wiring (AC 100-240 V) including, in particular, wiring for inverter electrical appliances. Noise and malfunction could result.
 - 3. If a strong light shines on the main unit screen, the picture may turn white or only silhouettes will be visible.
 - 4. Other manufacturer's devices (such as sensor, detectors, door releases) used with this system, comply with the manufacturer's installation requirements.
 - 5. The LCD panel is manufactured with very high precision techniques, inevitably will have a very small portion of its picture elements always lit or not lit at all. This is not considered a unit malfunction. Please be aware of this in advance.

3.3 INSTALLATION

- A. Install integrated security and communication system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Mount equipment plumb, level, square, and secure. For video entrance stations and video door stations, comply with manufacturer's design requirements to provide optimum picture quality of station monitoring.

3.4 SET-UP AND ADJUSTING

- A. Adjust integrated security and communication system for proper operation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION AND TRAINING

- A. Demonstration:
 - 1. Demonstrate that integrated security and communication system functions properly.
 - 2. Perform demonstration at final system inspection by qualified representative of manufacturer.
- B. Instruction and Training:
 - 1. Provide instruction and training of Owner's personnel as required for operation of integrated security and communication system.
 - 2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
 - 3. Provide instruction and training by qualified representative of manufacturer.
 - 4. Provide DVD copy of video recorded training session(s)

3.6 PROTECTION

- A. Protect installed integrated security and communication system from damage during construction.

END OF SECTION

SECTION 28 16 00

INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Security Control Panel.
- B. Access Control.
- C. Initiation Devices.
- D. Notification Devices.
- E. Request to Exit Devices.

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 26 05 13 - Wire and Cable
- C. Section 28 05 00 - Basic Electronic Safety and Security System Requirements
- D. Section 28 31 00 - Fire Detection and Alarm Systems
- E. Section 28 23 00 - Video Surveillance

1.3 QUALITY ASSURANCE

- A. Manufacturer: The access control system shall be a single-source manufacturer such that the single vendor distributes, supports, warranties and services all components. The manufacturer shall have a minimum of five (5) years documented experience.
- B. Installer: The installing dealer must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
- C. Servicing Contractor: The manufacturer of the system must have local service representatives within 60 miles of the project site.

1.4 REFERENCES

- A. CCR California Code of Regulation
- B. CBC California Building Code
- C. CFC California Fire Code
- D. CEC California Electric Code
- E. California Title 24 - Building Energy Efficiency Standards
- F. SCAQMD Southern California Air Quality Management Division
- G. UL 294 - Standard for Access Control Systems.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 28 05 00.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Wiring requirements.

- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 - 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (i.e., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
 - 2. Provide schedules describing each system input location by an architecturally familiar reference (i.e., Door 312A). The architectural door schedule shall be used as the basis.
- D. Submit detailed description of Owner training to be conducted at project end, including specific training times.
- E. Quality Assurance:
 - 1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor.
 - 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.
- F. Coordination Drawings:
 - 1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 28 05 00 for coordination drawing requirements.

1.6 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey security management system installed as a modification to the existing security management system. Basic scope of work is to relocate the existing security management system headend to a new location and add applicable devices to new Administration Building.
- B. Performance Statement: This specification section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- C. Basic System Description: The security management system shall provide an integrated hardware and software solution for access control.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 28 05 00.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 - 1. Controller installation locations including specific door numbers being controlled.
 - 2. All terminal block wiring, including cable numbers.
- E. Warranty: Submit written warranty and complete all Owner registration forms.

- F. Complete all operation and maintenance manuals as described below.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 28 05 00.
- B. Operation Data: Provide full system operation instructions for each piece of equipment.
- C. Maintenance Data: Document any manufacturer's recommended preventative maintenance procedures to be performed by the Owner.

1.9 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.
- B. The warranty shall include emergency service and repair on-site, with acknowledgment response time of one (1) hour from time of notification and on-site response within four (4) hours. The system shall be repaired and restored to operation within twenty-four (24) hours of notification.
- C. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - INTRUSION DETECTION PRODUCTS

2.1 EXISTING INTRUSION DETECTION SYSTEM

- A. GE EST3

2.2 SECURITY CONTROL PANEL

- A. Control Panel: Modular construction with surface wall-mounted enclosure.
- B. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, relays, and alarm signaling devices. Include battery operated emergency power supply with capacity for operating system in standby mode for 24 hours.
- C. System Supervision: Provide electrically-supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.
- D. Initiating Circuits: Supervised zone module with alarm and trouble indication.
- E. Signal Circuits: Supervised zone coded signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm.
- F. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
- H. Lamp Test: Manual lamp test function causes alarm indication at each zone at control panel and at annunciator panel.

2.3 ACCESS CONTROL

- A. Keypad:
 - 1. Industry standard Wiegand output keypad. 8-Bit word.

2. Vandal and impact resistant construction. Weatherproof design, including in 100% humidity.

B. Card Reader:

1. Proximity Readers: Operable at 125 kHz, FCC Certified, 26-bit H10301 format.
 - a. Provide with a multi-colored LED and audible device that shall change state on presentation of a valid proximity card.
 - b. All readers shall perform an internal self-diagnostic procedure at power-up.
 - c. Provide tamper switch for notification to the system of reader tampering.
 - d. Readers shall employ compensation circuitry or other process that allows it to be mounted directly to metal surfaces. The reader shall be immune to metallic distortion from keys, coins and other metallic objects.
 - e. Operating Range: -22°F to 150°F.
 - f. The maximum dimensions of the standard proximity reader shall be 5" x 5" x 1" deep. Provide all necessary backboxes and mounting brackets required for installation of the reader where shown on the plans.
 - g. Range: Read range of 5" to 9" standard.
 - h. Readers shall be constructed in a weatherproof Lexan or polycarbonate housing suitable for indoor or outdoor use.
 - i. Readers shall be provided with a lifetime warranty.
2. Proximity Cards:
 - a. Proximity Cards: 125 kHz radio frequency identification electronics, multi-technology card, passive design, in a thin durable credit card sized package. Card read range shall not be affected by body shielding or environmental conditions.
 - b. Maximum dimensions: 3.4" x 2.2" x 0.05". Construction to be of flexible PVC laminate with a high coercivity magnetic strip rated 4000 Oersted.
 - c. Card shall support formats up to 37-bit.
 - d. Cards shall be capable of having a photo and/or other graphical images printed directly on to the surface of the card.
 - e. Provide optional slot punch-outs on the short and long edge of the card.

2.4 INITIATION DEVICES

A. Door Contacts:

1. Contacts shall be single-pole, double-throw (SPDT) suitable for use in a line supervision circuit. Gap length shall be 1" on the latch side.
2. Provide magnetic alarm contacts at each door (recessed in the door header) where shown on the plans. Contacts shall provide a signal to the controller when the contact status changes.

3. The contacts shall have the capability of being shunted by a request-to-exit device. When the system grants access at a controlled point, the system shall shunt the door alarm input for that point.
- B. Motion Detectors:
1. Passive infrared, ceiling mounted, 12 VDC.
 2. Adaptive technology for humidity and temperature stability.
 3. 360-degree coverage, 60' coverage range.
 4. Fresnel pattern lens with a minimum of a 30-zone pattern.

2.5 NOTIFICATION DEVICES

- A. Alarm Horn:
1. Ceiling mounted, location above the ceiling adjacent to the security point.
 2. Piezo siren type, with alternating high/low sound.
 3. 106 dB at 10'.
 4. 6 to 13.8 VDC operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as directed by the manufacturer.
- C. Mount all readers where shown on plans in accordance with Americans with Disabilities Act (ADA) requirements.
- D. Locate all request to exit motion detectors directly above the door frame, centered on the door opening. Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.
- E. Provide wiring to the request-to-exit devices located in the electrified door hardware.
- F. Install, terminate and test all door alarm contacts. Contacts shall be recessed in the door header.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor Installer.

- B. The Installer shall provide a comprehensive, site-specific customer planning guide for the system. The installer shall conduct a conference with the Owner prior to any installation to discuss the programming options of the system and the planning guide. The result of this planning guide shall be the determination of the system access policies for each point.
- C. The Installer shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point. Any software programmable access policy, within the bounds of the hardware specified, shall be included.
- D. It shall be the responsibility of the Contractor/Installer to provide a complete, functional system as described by the Contract Documents. These responsibilities include:
 - 1. Complete hardware setup, installation and wiring, and software configuration of the system.
 - 2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference.
 - 3. Manual data entry of 50 cardholders based on a printed roster provided by the Owner.
 - 4. Programming of all cardholder database screens including cardholder information screens, report templates, queries, etc. Encoding of 50 proximity cards shall be included.
 - 5. Complete system diagnostic verification.
- E. The Installation Contractor shall be present at two (2) four-hour meetings in project location to coordinate all door hardware requirements with the door hardware vendor.

3.4 SYSTEM ACCEPTANCE

- A. The SMS Vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components and software, including but not limited to all system computers, field controllers, card reader devices, biometric readers and remote system interfaces. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's system engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

3.5 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system.
 - 2. Complete documentation of programming and access policies.
 - 3. All data sets.
 - 4. Complete operating instructions for all hardware and software.
- B. The following sections shall be provided in the system documentation:
 - 1. User Manual: A step-by-step guide and instructions detailing all system user functions.
 - 2. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.

3.6 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two weeks advanced notice of training to the Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. Alarm Monitoring Users: Provide a detailed course outlining the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control and general overview of the report hardware.
- E. Minimum on-site training times shall be:
 - 1. Alarm Monitoring Users: One day.

END OF SECTION

SECTION 28 31 00

FIRE ALARM SYSTEMS

1. PART 1 GENERAL

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
 - 1. Fire alarm system shall consist of one fire alarm control panel or networked nodes, of the same make and CSFM (California State Fire Marshall) listed for the application as indicated in drawings.
 - 2. All labor, equipment, materials, connections, testing, and performance of operations in the installation of fire alarm system as indicated on Drawings or as specified herein.
- C. Related Sections:
 - 1. Section 16010: Basic Electrical Provisions.
 - 2. Section 16050: Basic Electrical Materials and Methods.
 - 3. Section 16111: Conduit and Wire

1.2 SYSTEM REQUIREMENTS

- A. Fire detection system shall continually supervise and monitor the following initiating, signaling, and monitoring circuits:
 - 1. Manual fire-pull stations.
 - 2. Smoke detectors, duct detectors, including those installed under other sections.
 - 3. Fire sprinkler flow and tamper switches. In existing installations also include PIV tamper switches.
 - 4. Alarm signaling circuits including alarm bells, speakers and visual alarm units.
 - 5. Annunciators.
 - 6. Power supplies and batteries.
 - 7. Interconnection with HVAC system where applicable, kitchen fire suppression system, and elevator equipment for control of recall function.
 - 8. Provide intrusion detection sensors, type and location as shown on the drawings.
 - 9. Provide security keypads as shown on the drawings.
- B. System controls shall be UL listed for power limited applications in accordance with California Electrical Code.

- C. The fire alarm devices and equipment shall be listed for installation for the fire alarm control panel to which they are being connected.
- D. Complete installation shall conform to the latest NFPA 72, California Fire Code, California Building Code (CBC), and California Electrical Code (CEC) as approved by DSA on stamped drawings.
- E. System labels and devices programming addresses shall be based on final signage and building labeling submittals. For existing facilities contractor shall obtain from Owner Authorized Representative a copy of the current site layout and building labeling designations.

1.3 CERTIFICATION

- A. Certification: Installation of fire alarm system shall not begin until Shop Drawings, including State Fire Marshal listing numbers of fire alarm components, are submitted and reviewed by the Architect. Written certification by fire alarm equipment distributor or manufacturer shall be submitted to the Architect stating that system and its component parts are as approved and listed by the State Fire Marshal, and that the design conforms to requirements set forth in CBC.

1.4 PERFORMANCE

- A. System shall be fully programmable, configurable, and expandable in the field without special tools or PROM programmers and shall not require replacement of memory ICs. Installer shall provide a CD of all system installed software, site specific system programming and all information and tools required to re-program or modify the system.

1.5 SYSTEM FUNCTIONAL OPERATION

- A. When a fire alarm condition is detected by one of the system alarm initiating devices, the following functions shall occur:
 - 1. System alarm LED shall flash.
 - 2. Local sounding device in panel shall be activated.
 - 3. The LCD display shall indicate type of device, custom label location label and point status alarm condition.
 - 4. Appropriate change of status message shall be transmitted to remote annunciator(s).
 - 5. Automatic programs assigned to alarm point shall be executed and associated indicating devices and relays activated.
 - 6. UDACT (Universal Digital Alarm Communicator Transmitter) shall activate.
- B. Trouble and Supervisory Conditions.
 - 1. When any trouble condition is detected the following functions shall occur:
 - a. System trouble LED shall flash.
 - b. Local sounding device in panel shall be activated.
 - c. The LCD display shall indicate the type of trouble and custom label location associated with the trouble condition and its location. Unacknowledged alarm messages shall have priority over trouble messages. If such an alarm is displayed, then trouble messages shall not be displayed.

- d. Appropriate message shall be transmitted to remote annunciators.
 - e. UDACT shall activate.
- 2. When any supervisory condition occurs such as a sprinkler valve tamper, the following function shall occur:
 - a. System supervisory LED shall flash.
 - b. Local sounding device in panel shall be activated.
 - c. Appropriate message shall be transmitted to remote annunciators.
 - d. UDACT shall activate.
- C. Activation of control panel ACKNOWLEDGE switch in response to a single new alarm, trouble or supervisory condition shall silence panel sounding device and change system alarm, trouble, or supervisory LED from flashing to steady-ON. If additional new alarm, trouble, or supervisory conditions exist in the system; activation of this switch shall advance display to next alarm, trouble, or supervisory condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm, trouble, or supervisory condition shall cause panel to resound, and sequences as described above, shall repeat.
- D. Activation of the signal silence switch shall cause appropriate notification (indicating) appliances and relays to return to normal condition. Selection of notification appliance circuits and relays silenced by this switch shall be fully programmable.
- E. Activation of system reset switch shall cause electronically latched initiating devices or zones, as well as associated output devices and circuits, to return to normal condition after sixty seconds of alarm. If alarm conditions exist in system after system reset switch activation, system shall then re-sound alarm conditions as indicated hereafter.
- F. Activation of lamp test switch shall turn on LED indicators, LCD display, and local sounding device in panel, and then return to previous condition.
- G. Fire alarm indicating appliances may be silenced, after one minute, by operating signal silence switch at the FACP or by use of key supervised alarm silence switch at remote annunciators. A subsequent zone alarm shall reactivate signals. Fire alarm indicating appliances shall be automatically silenced after 4 minutes of operation; visual indicating appliances shall be extinguished at system reset or automatically after 4 minutes of operation. Fire sprinkler flow alarm bells shall not silence until the contacts in the fire sprinkler flow switch return to the normal non-alarm state. Appropriate signage must be installed on or next to the sprinkler alarm bell.
- H. Initiation and indicating circuits shall be monitored for open/short circuit and ground fault conditions, these conditions shall be indicated on the Fire Alarm Control Panel and Annunciator displays while remaining circuits continue to operate normally.
- I. All notification appliance circuits shall be silenceable for testing purposes by authorized persons. Protected pass-codes, keys, or another secure method that does not require entering into the system programming shall be used.

- J. The system supplied under this specification shall utilize node to node, direct wired, multi-priority peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors, input/output modules, intrusion detection and card reader controllers as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional member of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between a nodes.
- K. All integrated life safety system equipment shall be arranged and programmed to provide an integrated system for the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants. In all operating modes, the processing of fire alarms shall have the highest priority.
- L. Devices shall be listed for both fire and security applications. System performance shall not be degraded fire and security devices are installed in the same system. Fire alarm, intrusion, access control and video functions shall be partitioned to permit virtual-independent operation.
- M. All integrated system operation shall be based on application programming in order to provide the greatest flexibility in integrating fire, intrusion, access control and video functions, and assure compliance with all required codes and standards.
- N. Interior Security - Activation of any armed interior security device shall perform the following operations:
1. Notify the location and type of alarm sensor on the keypad display.
 2. Notify the remote central monitoring station(s) with the group, system location, and device location of the alarm event.
 3. Activate local sounders or voice communication system.
 4. Notify the building command center with the group, system location, and device location of the alarm event.
 5. Display a graphic representation of the alarm location, device type, operator instructions on the event driven graphic workstation.
 6. Send a digital message to an alphanumeric pager(s) for designated employees.
 7. Log and record the alarm event.

1.6 POWER REQUIREMENTS

- A. The fire alarm control panel and remote power supply shall receive 120 VAC power, 60 Hz, through a dedicated 20 amps circuit. Circuit breaker protection for the dedicated fire alarm power circuits shall be equipped with a handle lock-on device, the breaker handle shall be colored red and labeled "FIRE ALARM". Clearly label the Electrical panel name, location and circuit number on the inside of the fire alarm control panel and all remote power supplies using a p-touch style labeling system. Transient voltage surge suppression shall be provided at the 120VAC input terminal.

- B. System shall be provided with sufficient battery capacity to operate entire system upon loss of normal 120 VAC power, in a normal quiescent mode, for a period of 24 hours with 5 minutes of alarm indication at end of this period. System shall automatically transfer to standby batteries upon power failure. Battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70 percent capacity in 12 hours.
- C. Circuits requiring system operating power shall be 24 VDC and shall be individually protected at control panel.

1.7 SUBMITTALS

- A. Provide in accordance with Division 01.
- B. Component Plan Submittal: Availability and listing for its application shall be verified for all system components before presentation of the submittal. Include the following information and details as applicable:
 - 1. Installer name, address, telephone number.
 - 2. List of system components, equipment and devices, including manufacturer model numbers, quantity and California State Fire Marshal listing numbers, mounting heights, and symbols.
 - 3. Copies of manufacturer specification sheets for equipment and devices indicated. Highlight or identify the specific components on Catalog cut sheets.
 - 4. Voltage Drop Calculations: Include the following information for the worst case:
 - a. Point-to-point or Ohms law calculations.
 - b. Zone used in calculations.
 - c. Voltage drop percent. Voltage drop shall not exceed manufacturer's requirements. If voltage drop exceeds 10 percent, indicate manufacturer listed operating voltage ranges for equipment and devices.
 - 5. Battery types, amp hours, and load calculations including the following:
 - a. Normal operation: 100 percent of applicable devices for 24 hours to equal control panel amps plus list of amps per device that draw power from the panel during standby power condition including, but not limited to, zone modules, detectors and devices as identified.
 - b. Alarm condition: 100 percent of applicable devices for 5 minutes to equal control panel amps plus list of amps per device that draw power from panel during alarm condition including, but not limited to, the following:
 - 1) Zone modules.
 - 2) Signal modules.
 - 3) Detectors.
 - 4) Signal devices.
 - 5) Annunciator.

- 6) Other devices as identified.
 - c. Normal operation plus alarm operation load calculation shall include total amp hours required and total amp hours provided.
 6. Provide one copy of testing procedures.
- C. Shop Drawings: Provide Shop Drawings, in the same size as the design Drawings, Shop Drawings shall include the following:
 1. Provide drawing scale, elevations of all system enclosures, and actual layout of the Fire Alarm Control Panel, power supply, annunciator, and all main system components.
 2. Site Plan indicating PIV and all related fire sprinkler system devices and equipment to be monitored or supervised; such as water flow valves, and main equipment such as control panels, power supplies, annunciators, and components such as outdoor wall-mounted speakers, sprinkler bells, pull boxes, underground pull boxes , wiring routes on buildings exterior and underground locations. In each conduit or raceway run indicate conduit sizes, and quantities and type of wires.
 - a. In existing facilities make a distinction between existing and new installation.
 3. Complete battery calculations, and voltage drop calculation shall be included; these calculations shall be based on the devices maximum UL current rating.
 4. One line drawing for the entire system network indicating all system components and wiring. The one line diagram shall show but not be limited to panel to panel interconnections, conductors gauge and quantity, conduit size and type (designation) and specific function.
 5. System panel one-line drawings indicating the quantity and type (designation) of conductors entering and exiting the fire alarm terminal cabinet in each building (enclosure) for initiating, notification, or other command control functions required for complete system operation:
 - a. Individual floor/building plan view drawings indicating all device locations including end of line resistors "EOLR" in accordance with the legend provided.
 - b. Individual point addresses for all initiation and notification devices.
 - c. Device "typical" wiring diagrams. These drawings shall indicate specific termination details for all peripheral equipment and/or interface devices.
 6. Provide interfacing with equipment furnished by others including voltages, and other required coordination items. Refer to 3.01-B.
 7. Each of the pictorial diagrams included shall appear identical to the products they are intended to depict, in order to speed installation of the system, and to enhance the accuracy of the installation Work. Typical wiring diagrams or catalog sheets are not permitted.

8. Background Drawings with device locations of DSA approved drawings are available in electronic format and may be obtained from the Architect. Contractor is solely responsible for the accuracy and completeness of shop drawings. Buildings that are not part of the contract shall be clearly identified "NOT IN CONTRACT". Shop Drawings shall be prepared in the latest version of AutoCAD with 3 – CD ROM electronic copies submitted along with full sized Shop Drawings.
 9. Other installation and coordination drawings specifically related to this section shall be included as follows:
 - a. Size A (8-1/2 inch x 11 inches) and size B (11 inch x 17 inch) shall be bound into the manual.
 - b. Larger drawings shall be folded and inserted into transparent envelopes and bound into the manual.
 10. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit blue line copies and one reproducible copy of installation and coordination drawings.
 11. Samples: Provide Samples of material and equipment as required by the Architect. If Samples are requested, they shall be submitted within 10 days from date of request.
- D. In addition to the above requirements, provide submittals to meet any additional requirements of DSA.

1.8 QUALITY ASSURANCE

- A. Installer shall have successfully completed at least 5 projects of equal scope in the past 5 years, and have been in business of furnishing and installing fire alarm systems of this type for at least 5 years.
- B. Installer shall be a factory authorized distributor and service provider for the brand of equipment offered and shall provide documentation to the Architect upon request.
- C. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment and shall maintain a spare set of major parts for the system at all times.
- D. Installer shall furnish a letter from manufacturer of equipment certifying equipment has been installed according to factory standards and that system is operating properly.
- E. Certifications: Installer shall submit certification from the equipment manufacturer indicating that installer is an authorized representative of the equipment manufacturer and is trained on network applications.
- F. All materials and equipment installed shall be new.
- G. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. Furnish a letter from the manufacturer of all major equipment, which certifies that the installer is an authorized distributor and that the equipment has been installed according to factory intended practices. Furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

- H. Installer shall be Underwriters Laboratory (UL) listed company under the UUJS classification, and shall certify that the installation has been made in accordance with UL requirements.
- I. The fire alarm contractor shall have a NICET II Certified Technician on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.
- J. Contractor/Installer's electricians and fire/life safety technicians shall be certified in accordance with Labor Code sections 3099, and 3099.2, and section 209.0 of the California Code of Regulations.
- K. System startup and testing shall be performed under the direct observation of the DISTRICT. The Contractor at this time shall provide a legible half size reproduction of the original completed fire alarm red-line drawings (this copy will be retained by the Owner), an accurate copy of the fire alarm system points list, and a copy of the construction drawings on CD in AutoCad format,
- L. Provide and install the most current software package available at the time of installation. At the time of Owner Acceptance of the installation, all equipment, including any and all updated software which is to include the appropriate operating system, pass-codes, electronic keys and program disks, manuals and cables employed in the installation of the system, shall be delivered to the District who will, in turn, forward the items to the appropriate maintenance area Electrical Department. In addition, when the programming software is available in disk format, a backup copy of the most up to date revision, in disk format, shall be delivered to the District at the completion of the project. A software license agreement shall be made available for the responsible Owner representative to sign at the time of training.

1.9 WARRANTY

- A. The Fire Alarm Equipment Manufacturer shall provide a 3 year material warranty. Installer shall provide a 3 year labor warranty.
- B. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer for a period of 5 years after expiration of the warranty.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The existing main Fire Alarm Control Panel (FACP) is Edwards Systems Technology Model EST-3, District Board approved Standard. Catalog and model numbers listed are intended to establish type and quality of equipment and system design as well as operating features required. Deviations from intended functions of specified system are not permitted. Equipment shall not be ordered or installed until such equipment has been reviewed and approved by the Architect.

2.2 EXISTING FIRE ALARM CONTROL PANEL (FACP)

- A. Edwards Systems Technology Model EST-3 (CSFM 7165-1657:186) Fire Alarm Control Panel as indicated on drawings.

B. Operator Control:

1. Acknowledge Switch: Activation of control panel acknowledge switch in response to a single new trouble or alarm condition shall silence panel sounding device and change system alarm or trouble LED from flashing to steady-ON. If additional new alarm or trouble conditions exist in system, activation of this switch shall advance display to next alarm or trouble condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm or trouble condition shall cause panel to resound, and sequences as described above, shall repeat.
2. Signal (Alarm) Silence Switch: Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. Alarm Activate (Drill) Switch: Alarm activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. System Reset Switch: Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zone, as well as all associated output devices and circuits, to return to their normal condition.
5. Lamp Test Switch: Switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personnel.

C. System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to 2500 intelligent, addressable devices for the Edwards Systems Technology Model EST-3.
2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notifications Appliance Circuits.
3. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
4. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
5. The system shall allow the programming of any input to activate any output or group of outputs. The FACP shall support up to 20 logic equations, including "and" "or" and "not", or timed delay equations to be used for advanced programming. Logic equations shall require the use of a PC with software utility designed for programming.
6. The FACP or each network node shall provide the following features:
 - a. Drift compensation to extend detector accuracy over life. Drift Compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

- b. Detector Sensitivity test, meeting requirements of NFPA 72 Chapter 7.
 - c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
 - d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advance detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Pre- alarm, selected by detector, to indicate impending alarms to maintenance personnel.
 - e. Circuit boards, programming, and interconnecting cables to enable the system to display or print system reports.
 - f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
 - g. PAS pre-signal, meeting NFPA 72 requirements.
 - h. Rapid manual station reporting (less than 3 seconds) shall meet 2002 NFPA 72 Chapter 1 requirements for activation of notification circuits within 10 Seconds of initiating device activation.
 - i. Periodic detector test, conducted automatically by the software.
 - j. Self optimizing pre-alarm for advance fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
 - k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
 - l. Walk test, with a check for two detectors set to same address.
 - m. Control-by-time for non-fire operations, with holiday schedules.
 - n. Day/night automatic adjustment of detector sensitivity.
 - o. RS 232 serial port to support a District supplied printer to be used for silent testing and certification of the system.
7. The FACP shall be capable of coding main panel(s) node notification circuits in temporal code (NFPA 72 A-2-2.2.2).The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse".
8. Network Communication
- a. The network architecture shall be based on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol. The protocol shall be based on ARCNET or equivalent non-proprietary protocol.

- b. Failure of any node shall not cause failure or communication degradation of any other node or change the network communication protocol among surviving nodes located within distance limitations. A node may be an intelligent Fire Alarm Control Panel (FACP), Network Control Station PC (NCS) or Network Control Annunciator (NCA).
- c. Each network node address shall be capable of storing Event Equations which shall be used to activate outputs on one network node from inputs on other network nodes.

D. System Display

- 1. Utilize the 640-character display option. The design of the CPU shall provide for a configuration with the 640-character display mounted on the front of the unit in place of the standard 80-character display.
- 2. The 640-character display shall provide all the controls and indicators used by the system operator:
 - a. The 640-character display shall include the following operator control switches: Acknowledge, Alarm, Silence, Alarm Activate (drill), System Reset, and Lamp Test.
- 3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detector, addressable modules, internal panel circuits, and software zones.
- 4. The 640-character display shall provide 10 Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC Power and Network Communication, Fire Alarm, Pre alarm Warning, Security Alarm, Supervisory Event, System Trouble, Alarm Silence, Disabled Points, CPU failure.
- 5. The 640-character display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility. The programming utility shall be provided to the OAR who will forward it to the local maintenance area representative.
- 6. The system shall support the display of battery charging current and voltage on the LCD display.

E. Signaling Line Circuits (SLC)

- 1. Each FACP or FACP network node shall support a minimum of ten SLC's for the Edwards Systems Technology Model EST-3. Each SLC interface shall provide power to and communicate with up to 125 intelligent detectors (ionization, photoelectric or thermal) and 125 intelligent modules (monitor or control) for a loop capacity of 250 devices.
- 2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors including the accumulation of dust in each detector. The analog information shall also be used for automatic detectors testing and for the automatic determination of detector maintenance requirements.

F. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.030 steel with provisions for electrical conduit connections into the sides and top.
3. The supplied door shall include a key lock and shall include glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

G. Power Supply:

1. An off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for control panel and peripheral devices.
2. Provisions shall be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
 - a. Ground Fault LED
 - b. AC Power Fail LED
5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP or network node(s).
6. The main power supply shall provide a battery charger using dual rate charging techniques for fast battery recharge and be capable of charging batteries up to 60 AH.

2.3 EXISTING REMOTE ANNUNCIATORS

- A. A non-networked fire alarm system annunciator is required when there is only one FACP in the system. Edwards Systems Technology 3-LCDANN (CSFM 7120-1657:193) alphanumeric display remote annunciator. Provide the following functions:
1. Control switches for system acknowledge, signal silence and system reset via a touchpad.
 2. Time/date display field.
 3. Local piezo sounder with alarm/trouble resound.
 4. On-line green LED (flashing).
 5. Evacuation/drill switches, via a touchpad.
 6. Pre-signal hold via a touchpad.

7. System test at control panel and CTR.
- B. Following additional features shall be furnished:
1. Device Fire Annunciation.
 2. Device Trouble Annunciation.
 3. System Operation Annunciation.
 4. "Power On" LED.
- C. Typewritten operating instructions and a site map shall be posted adjacent to all remote annunciator(s). The site map shall be sized and include all designations and devices as described in section 3.02 N. of this specification. Project site map shall depict all fire alarm devices in the building(s) in which they are installed. The instruction and site map shall be mounted in suitable document frames and attached to the wall with a minimum of two screws each. Contractor's name and telephone number shall not be placed on either the instruction or the site map.

2.4 EXISTING POWER SUPPLIES

- A. Remote Notification Appliance Circuit (NAC) extender power supplies shall be Edwards Systems Technology Model BPS10A-7AH (CSFM 7300-1657:229), or equal. Unit shall be furnished with main printed circuit board, transformers, lockable cabinet, and batteries. Unit shall be configured to drive 4 notification appliance circuits. The remote power supplies shall be configured with a monitor module to report trouble conditions to the controlling FACP via an SLC.

2.5 PERIPHERAL DEVICES AND EQUIPMENT

- A. Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. When fixed-temperature portion is activated, units shall provide visual evidence of such operation (LED). Addressable Heat detectors shall be Edwards Systems Technology Model No. SIGA-HRD (CSFM 7270-1657:0333) or equal. Provide base Model No. SIGA-SB. (CSFM 7300-1657:120) The location of the heat detector must be clearly marked and the detector must be readily accessible. The heat detector shall have its electronic address permanently and clearly labeled onto the device and be readily accessible. The heat detector shall have its loop number and electronic address permanently and clearly labeled onto the device using a p-touch labeling system. The label shall be visible without removing the detector head.
- B. Horns and Strobes: All horns and strobes shall be products of the same manufacturer. In order to establish a standard of quality, items are specified from the products manufactured by System Sensor, acceptable manufacturers are Edwards Systems Technology or District approved equal. Addressable or multifunction 2 wire indicating (Audible/Visual) appliances shall not be acceptable.
1. Alarm horns shall be Edwards Systems Technology Genesis WG4 Series (CSFM 7135-1657:0311) or equal, and shall be polarized and operated by 24 VDC. Entire unit shall be red finish. Horn assemblies shall be furnished with separate wire leads for in/out wiring for legs of associated signal circuits. Tapping of signal device conductors to signal circuit conductors is not permitted. Suitable gaskets shall be provided for weatherproof installation. Horns shall provide a minimum sound pressure level of 100 dB at 10 feet. Horns shall be mounted on manufacturer's recommended outlet boxes. Weatherproof horns shall be Genesis WG4 Series (CXFM 7135-1657-0311); provide and install a Model No. 757A-WB back box skirt on all outdoor surface mount outlet boxes.

2. Horn/strobe shall be wall mounted Edwards Systems Technology No. Genesis WG4 Series standard candela output (CSFM 7125-1657:0311); or equal. Horn/strobe shall operate on two separate 2 wire 24 VDC polarized circuits and shall be provided with a semi-flush mounting plate. Entire unit shall be red finish. Strobe light shall have a clear Lexan lens. The word "FIRE" shall be printed on the 2 sides of the strobe body. Horn shall provide a minimum sound output of 100 dB at 10 feet. The strobe shall provide a selectable minimum light intensity of 15, 30, 75, 90, 110, 135, 150, or 185 Candela as indicated on Drawings to meet or exceed requirements of ADA and UL 1971. Horn/Strobes shall be mounted on manufacturer recommended outlet boxes. Weatherproof horn/strobe shall be model No. 7578A. Provide and install a model No. 757A-WB back box skirt on all outdoor surface mount outlet boxes.

C. Existing Digital Alarm Communicator Transmitter Edwards Systems Technology:

1. The DACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the DACT shall have the ability for remote mounting, up to 6000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status.
2. The DACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events between up to three different telephone numbers.
3. It shall be completely field programmable from a built in keypad or laptop computer, and shall be capable of transmitting events in multiple formats.
4. Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory
 - b. Independent Addressable Device Status
 - c. AC (Mains) and Earth Fault
 - d. System Off Normal
 - e. 12 and 24 Hour Test Signal
 - f. Abnormal Test Signal (per UL requirements)
 - g. EIA-485 Communications Failure
 - h. Phone Line Failure
5. The DACT shall support independent zone/point reporting when used in the Contact ID format. This enables the central station to have exact details concerning the origin of the fire or response emergency.

6. The DACT shall be supplied with two eight conductor, 2 to 6 foot long line cords. One end of the cords shall plug into the jacks on the UDACT. The other end of the cords shall plug into industry standard RJ-31X surface mounted telephone jacks. Install jacks in a screw cover box adjacent to the FACP if sufficient space is not available within the FACP, or adjacent fire alarm terminal cabinet. The line cords shall be installed in conduit when it is necessary to locate the jacks remotely from the FACP enclosure. The jacks shall be mounted to the rear of the box. The telephone number for each line shall be labeled on its respective jack.
- D. Network Cables/SLC/Annunciator Data/Audio Output Cables: The construction and physical characteristics such as aqua-seal water block, wire gage, insulation and jacket types, etc. shall not be altered. Equivalent cables must be specifically approved and recommended by the manufacturer of the fire alarm system equipment. Any and all substitutions will require approval from the Architect/Engineer of Record.

3. PART 3 - EXECUTION

3.1 GENERAL

- A. Fire alarm system shall not be used for any purpose other than fire alarm functions.
- B. Fire alarm shall be interconnected but not limited to the following systems:
 1. All systems required by code to be connected to the fire alarm systems shall be connected.
 2. Ventilation systems where required for the purpose of fan shutdown
 3. Damper control or smoke management systems.
 4. Water based fire sprinkler systems.

3.2 SYSTEM INSTALLATION

- A. Install required conductors to devices indicated on Drawings. Provide required conductor terminations to devices for a complete system to function as specified and indicated on Drawings.
- B. Splices are not allowed in junction boxes. Terminations shall be in terminal cabinets or on equipment terminals.
- C. Conductors shall be installed within conduits, boxes, and terminal cabinets in a totally enclosed installation. Furnish and install conductors required to connect incoming and outgoing circuits, including spare conductors, to terminal strips within terminal cabinets.
- D. Wiring within equipment and terminal cabinets shall be installed to conform to contract documentation and 2002 NFPA 72 standards, and shall be terminated on terminal blocks having terminals for required connections. Wiring shall be cabled, laced, and securely fastened in place so that no weight is imposed on equipment or terminals.
- E. Install required terminal blocks within terminal cabinets. Terminal blocks shall be installed on inside back of cabinets only, not on side. Incoming wiring shall be terminated on the left side of terminal blocks; outgoing wiring shall be terminated on the right side of the terminal blocks.
- F. Conductors shall be color-coded per plans and tagged with code markers at terminal cabinets, and equipment. A wire index shall be typed and installed on terminal cabinet doors. Index shall be covered with clear plastic adhesive covers. Wiring shall be identified as to building and location of devices in the index.

- G. Wiring within equipment and terminal cabinets shall be carefully strapped, and shall be formed in rectangular configuration. Wires shall be properly numbered in numerical order and shall maintain same number throughout the Project site.
- H. Complete installation shall comply with local building codes and applicable provisions of the California Electrical Code, California Fire Code and the 2002 NFPA 72 National Fire Alarm Code.
- I. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Do not scale Drawings to determine locations and routing of conduits and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place, and must be ascertained in the field before the start of Work.
- J. Drawings generally indicate Work to be provided, but do not indicate all bends, transitions or special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits are to be installed, and furnish and install required fittings.
- K. Provide p-touch label of approximately 1 inch wide with red lettering for each initiating device that is hidden from view. Tags shall indicate the name and type of device: Heat Detector, or HVAC Shut-down modules and relays. Tags shall be permanently attached on access panel or t-bar grid which is used to access a hidden device.

3.3 SYSTEM PROGRAMMING

- A. The contractor shall follow Attachment A- Fire Alarm Programming Guidelines to program the system with the functions and features required by the District, the local authority having jurisdiction or applicable codes.

3.4 SYSTEM OPERATION

- A. Unless otherwise specified, but not limited to actuation of manual stations, smoke detectors, heat detectors, linear heat or smoke detectors, or water-flow switches shall cause the following operations to occur:
 1. Activate audible circuits.
 2. Actuate strobe units until the panel is reset or strobe circuit time-out.
 3. Release magnetic door holders to doors to adjacent zones on the floor from which the alarm was initiated.
 4. Where required, return elevators to the primary or alternate floor of egress.
 5. Smoke detectors in elevator lobbies shall, in addition to the above functions, return elevators to the primary or alternate floor of egress.
 6. Smoke detectors in elevator machine rooms or tops of hoist-ways shall return elevators to the primary or alternate floor. Smoke detectors or heat detectors installed to shut down elevator power shall perform this function in accordance with ANSI A 17.1 requirements and shall be coordinated.
 7. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as required.
 8. Activation of fire sprinkler system low-pressure switches, post indicator valve or tamper switches shall initiate a system supervisory alarm indication.

9. UL listed central station shall be notified via –Digital Alarm Communicator Transmitter (DACT).

3.5 TESTING

- A. A 48 hour notice shall be provided to the District before final testing.
- B. Testing of fire detection system shall be as required by the State Fire Marshal and local authorities having jurisdiction. Installer is responsible for identifying required testing, coordinating, scheduling, and conducting tests before Substantial Completion. Tests shall include the following:
 1. Operation of all signal-initiating devices (smoke detectors, heat detectors, pull stations etc.).
 2. Operation of all indicating devices (alarm speakers, alarm bells and alarm strobes).
 3. Operation of all system features under normal operation.
 4. Operation of all system supervisory features.
 5. Operation of all system features on standby power, with primary power turned off.
 6. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 7. Close sprinkler system flow valves and verify proper supervisory alarm at the FACP.
 8. Verify activation of flow switches.
 9. Open initiating device circuits and verify that trouble signal actuates.
 10. Open signaling line circuits and verify that trouble signal actuates.
 11. Open and short notification appliance circuits and verify that trouble signal actuates.
 12. Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.
 13. Ground initiating device circuits and verify response of trouble signals.
 14. Ground signaling line circuit and verify response of trouble signals.
 15. Ground notification appliance circuit and verify response of trouble signals.
 16. Check alert tone to alarm notification devices.
 17. Check installation, supervision, and operation of intelligent smoke detectors.
 18. Alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
 19. When the system is equipped with optional features, consult the manufacturer manual to determine proper testing procedures.

- C. Upon completion of installation of fire alarm equipment, provide to the District a signed, written statement confirming that fire alarm equipment was installed in accordance with the Specifications, Shop Drawings, instructions and directions provided by the manufacturer.
- D. Demonstrate in presence of the District that circuit and wiring tests are free of shorts and grounds and that installation performs as specified herein and within manufacturer's guidelines.
- E. Software Modifications:
 - 1. Provide the services of a factory trained and authorized technician to perform system software modification, upgrades or changes. Response time of the technician to the Project site shall not exceed 24 hours.
 - 2. Provide hardware, software, programming tools, and documentation necessary to modify the fire alarm network on the Project site. Modification includes: addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modification on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being provided.
- F. Complete the inspection and testing form as required by 2002 NFPA 72, and submit one copy of the completed certificate to DSA, local fire official and the Architect and District.

3.6 OPERATING/SERVICE MANUALS

- A. Deliver to District, 3 copies of service manuals including the following:
 - 1. Installation manuals, programming manuals and user manual if applicable for every control panel, control panel power supply, FACP input/output/relay or control module, auxiliary power supply, UDACT, remote NAC extender power supply, door holder power supplies, all installed annunciators, initiating and indicating devices and all addressable monitor, relay and control modules. Catalog cut sheets are not acceptable.
 - 2. A printed copy of the system configuration as programmed, including all system labeling codes, and passwords.
 - 3. An electronic copy on compact disk of the system configuration program
 - 4. Final test report.
 - 5. Detailed explanation of the operation of the system.
 - 6. Instructions for routine maintenance.
 - 7. Detailed wiring diagram for the connection of relays, addressable monitor, control or relay modules as applied in the interfacing of peripheral systems or equipment to the fire alarm system.
 - 8. An electronic copy (CD) of the posted site/fire alarm map in Auto-Cad and PDF formats.
 - 9. A single reproducible set of record drawings reflecting the system exactly as it was installed including exact location of components.
 - 10. Provide codes and passwords for fire alarm system at testing.

3.7 SPARE PARTS

A. The following new spare parts shall be furnished in unopened boxes:

1. 5% spare pull stations including the associated monitor module (minimum one spare pull station per type).
2. 5% spare smoke and heat detectors (minimum five spare smoke and heat detector per type).
3. 5% spare audible devices (minimum one spare audible device per type).
4. 5% spare strobe devices (minimum one spare strobe device per type).

3.8 SYSTEM USER AND MAINTENANCE PERSONNEL TRAINING

A. Before Substantial Completion, provide one instruction period for the Project site based Owner operators and system users.

1. Refer to Attachment B - Fire Alarm System Site Based Staff User Training for complete details.
2. The instruction period shall be scheduled and coordinated by the District.

B. All training materials and required deliverables shall be submitted to the District for distribution to District's Electrical Department.

C. Provide the NFPA Certificate to the owner, local fire official, architect and DSA.

3.9 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

ATTACHMENT A - FIRE ALARM PROGRAMMING GUIDELINES

The following functions and features as required by the site/system configuration and installed peripheral equipment and systems shall be programmed into all DISTRICT fire alarm systems. The definition of programming shall include but not be limited to the use of a built in keyboard, the use of a connected PC with the appropriate software, dip or rotary switches, wiring or installable or removable jumpers as required or provided in the fire alarm equipment.

A. Signal Silence Switch Inhibit:

The audible signal silence switch located on the remote fire alarm annunciator(s) or any fire alarm control panel(s) shall be programmed to not silence the audible or extinguish the visual alarm circuits during the first minute (60 seconds) of the fire alarm speaker/strobe activation. Activation of this switch after the initial 60 seconds signaling shall silence only the audible signals. Enabling or disabling this feature shall be allowed only by authorized District maintenance personnel and shall be protected by a maintenance level password.

B. Audible Signal Auto Silence:

The audible coded signals throughout the site, unless silenced by the above switch, shall be programmed to automatically self-silence in no less than 5 minutes (300 seconds) and no more than 10 minutes (600 seconds). This feature shall not apply to the fire sprinkler water flow audible appliance.

C. Fire Sprinkler Water Flow Switch:

All fire sprinkler water flow switches shall be programmed in a manner that shall prevent the above Signal Silence Switch from silencing the audible coded signals or visual signals after the initiation of an alarm by a fire sprinkler flow switch.

D. Notification Appliance Circuits: (Audible)

All audible notification appliance circuits shall be programmed to emulate the temporal code (ANSI S 3.41) from all fire alarm audible appliances (speakers). This coding shall originate and be controlled by a single coder residing within the FACP(s). The use of coders within remote power supplies either mounted adjacent to an FACP or at a remote location or directly by an audible notification appliance will not be permitted. All programmable audible notification appliances shall be configured to emulate a steady tone at approximately 1000 Hz. These NACs shall be programmed to be silenced as described above. Notification appliance circuits throughout the site shall be activated by any alarm initiating device. *(It is desired by the District and is required by the local AHJ to keep all coded audible signals controlled by a single synchronized FACP).*

E. Notification Appliance Circuits: (Visual)

All visual notification appliance circuits shall be programmed to provide steady non-coded power to the visual appliances (strobes). As required by code and/or the system configuration, a synchronization signal shall be superimposed onto the NAC by the FACP, a remote power supply or an add-on synchronization module. Visual appliance circuits shall be programmed to self-extinguish the strobes in no less than 5 minutes (300 seconds) and no more than 10 minutes (600 seconds) or when the system is reset. Notification appliance circuits throughout the site shall be activated by any alarm initiating device.

F. System Reset Button:

The system reset button located on all FACPs and all remote annunciators in addition to resetting the fire alarm system and silencing or extinguishing all notification appliances except for the sprinkler water flow appliances shall be programmed to reset all analog and addressable smoke detectors, duct detectors, beam detectors and all relays, addressable control modules and addressable relay modules used to interface to other systems and equipment. Each installed system reset button shall be programmed to operate as a "single point of reset" for the complete system.

G. HVAC Shutdown:

All relays and addressable relay modules used to interface to HVAC equipment dampers, and/or supply and exhaust fan motors shall be programmed to shut down this equipment only within the same building where the detection of smoke, heat or fire sprinkler water flow has taken place. Manual pull stations within any building shall not effect the operation of the HVAC equipment. These relays shall return to normal only after the system is reset.

H. Smoke Detector Maintenance Alert:

All addressable smoke detectors shall be programmed with the capability of initiating a maintenance alert when any one detector becomes obscured by dust or any other contaminates at approximately 10 percent below the level of obstruction that would initiate an alarm.

I. DACT:

The FACP and the associated Digital Alarm Communication Transmitter shall be programmed to transmit to the central monitoring station separate indications for General Alarm, Fire Sprinkler Water Flow Alarm, System Trouble and Supervisory Conditions. These indications shall be in addition to any indications initiated by the UDACT itself.

Device Descriptors:

- A. Descriptors shall enable responding personnel to identify the location of a fire quickly and accurately, and shall indicate the status of emergency equipment or fire safety functions that might affect the safety of occupants. The minimum required information for devices intended to report smoke, fire, or fire sprinklers water flow include, but may not be limited to:

Building, floor (if multiple floors exist in the building), room or space description, and device type and digital address (Smoke detector, Heat detector, Fire sprinkler water flow switch, etc).

a. BUILDING

The building must always be included in the descriptor, even if there is only one building on the site. Additional building(s) may be added at a later date creating the possibility of confusion by similar designated spaces, such as "Work room" or "Staff restroom" if more than one building has these similar designated spaces. The building designation in the descriptor must be what the site-based personnel call the building. The building should be provided with signage to aid fire department personnel in the identification of the building.

b. FLOOR

In multi-floor buildings the floor designation (1st, 2nd, etc) must be included in the descriptor.

c. ROOM DESCRIPTION

The room or space description must be unique. Using the same designation for multiple spaces, such as "Workroom", "Counselor's Office", or "Men's restroom", etc. is not acceptable. If, during a project, the room numbers or the use of the room changes then the room or space descriptor must be changed to agree with the change. Proper signage should be provided for each space to aid fire department personnel in the identification of the room or space.

d. DEVICE TYPE, ADDRESS AND COMPASS DESIGNATIONS

The device type and digital address must be included with the descriptor, such as smoke detector or heat detector, etc. Some systems provide this information automatically in the descriptor. Compass designations, (N, S, E, and W) are required in spaces such as corridors where there are multiple detectors and this information would be helpful to responding fire department personnel in locating the device reporting alarm. It is not necessary to include compass designations in smaller spaces where there are multiple detectors located in close proximity to each other.

B. ACCEPTABLE ABBREVIATIONS

Rm.- Room	Bldg.- Building	Smk. - Smoke
Corr.- Corridor	Lby- Lobby	Asst. - Assistant
Eng.- English	N – North	Nrs. - Nurse
Flr.- Floor	S – South	Cnclr - Counselor
Ht.- Heat	E – East	Off. - Office
Lib.- Library	W – West	PE – Physical Education
MPR.- Multi-Purpose room	Kit- Kitchen	Lkr. - Locker
RR- Rest Room	Stu Str – Student Store	Sci - Science
By = near	Stor Rm – Store Room	Café - Cafeteria
1 st - First	Hopr Rm – Hopper Room	Det - Detector
2 nd - Second	PM – Plant Manager	Elev - Elevator
3 rd - Third	Prin – Principal	Blr Rm – Boiler Room
Conf – Conference	Park – Parking	Bsmt – Basement

ATTACHMENT B - FIRE ALARM SYSTEMS STAFF USER TRAINING GUIDELINES

Prior to beginning the operational demonstration, notify Central monitoring Station that an instructional activity is beginning; inform them that it includes setting and resetting the system in test mode. After the demonstration is completed and the system restored, notify the Central Monitoring Station that the system has been restored and it is back on line for continuous monitoring.

User Instruction & Training

A. Before substantial completion and with a fully functional fire alarm system installed at the site, the contractor shall provide a minimum of four hours of user training for site based staff. The date and time for this training shall be coordinated by the District.

B. Instruction period training for site based staff shall consist of all the following:

1. Overview:

- a) Explain the fire system is “addressable” which means every device-smoke detector, heat detector, sprinkler water flow switch, manual pull station, etc. has a unique address or identity. This makes it possible to positively identify the exact device causing an alarm, trouble or supervisory condition.
- b) Explain the fire alarm control panel also controls the speakers and strobes throughout the campus or building.
- c) Explain that the fire alarm system is interconnected to various other systems and equipment through out the site such as:
 - Elevators to recall them to the main floor or to an alternate floor and as an option dependent circumstances turn off the power to the elevators.

- Heating and air conditioning equipment to turn off fans and close dampers to stop the spread of smoke through out a building.
- d) Explain the fire system has a battery backup in case of power failure and that it will continue to function for a minimum of 24 hours after a total power failure.
 - e) Explain that the fire alarm system components and wiring are monitored to report a malfunction, damage or vandalism. When this occurs, a trouble indication will appear on the fire alarm annunciator and FACP and this indication will be transmitted to the central monitoring station.
 - f) Explain that other equipment and systems are monitored for abnormal conditions such as the fire sprinkler water being turned off. When this occurs, a supervisory condition is created. A supervisory indication will appear on the fire alarm annunciator and FACP and this indication will be transmitted to the central monitoring station.
 - g) Explain that the fire system besides notifying the occupants of a possible fire condition also transmits an alarm indication to the central monitoring station that will in turn notify and dispatch the local fire department to your site.

2. Basic:

- a) Hand out the SYSTEM OPERATION instructions to all attendees.
- b) Point out the Fire Alarm Control Panel and have them observe the normal LED status (one green LED only should be on)
 1. GREEN = Normal
 2. YELLOW = Trouble
 3. RED = ALARM

Have the attendees observe the LCD display that should be indicating a SYSTEM NORMAL message.

- c) Point out the Fire Alarm System Annunciator and have attendees observe the LCD display that should be indicating a SYSTEM NORMAL message.

3. Operation & Demonstration:

After putting the system or having someone put the system central station monitoring into the test mode demonstrate the following:

- a) Activate a Manual Pull Station to demonstrate ALARM.
 - 1. Demonstrate audible & visual notification appliances and if installed the voice evacuation signal announcement.
 - 2. Demonstrate panel / annunciator sounder tone for ALARM.
 - 3. Have staff SILENCE system.
 - 4. Show LCD display & LED of alarm.
 - 5. Demonstrate and have staff reset the manual pull station.
 - 6. Have staff RESET fire system.
- b) Activate Smoke Detector with canned smoke to demonstrate address identification
 - 1. Have staff SILENCE system.
 - 2. Show LCD display & LED of ALARM.
 - 3. Have staff RESET fire system.
- c) Remove Smoke Detector to demonstrate SYSTEM TROUBLE.
 - 1. Demonstrate panel / annunciator sounder tone for TROUBLE.
 - 2. Have staff SILENCE system.
 - 3. Show LCD display & LED of TROUBLE.
 - 4. Replace the smoke detector.
 - 5. Have staff RESET fire system.
- d) Remove power to demonstrate function during power failure.
 - 1. Have staff SILENCE system.
 - 2. Show LCD display & LED of TROUBLE.

3. Activate Manual Pull station to demonstrate audible/visual functions in power failure mode.
4. Reset manual pull station.
5. Reset fire system.
6. If applicable, point out sprinkler riser and shut off valves.
7. Show location of a water flow switch.
8. Show location of a valve tamper switch.
9. Point out valves must always be OPEN or fully counter clock wise.
10. Point out PIV (Post Indicator Valves) if applicable.
11. Have water through the inspectors test valve and point out the ringing water flow bell.
12. After the speakers are silenced by an assistant, show that the water flow bell is ringing continuously indicating water flow.
13. Have the assistant turn off the inspectors test valve to show that water flow alarm bell turns off.
14. Reset system.
15. Unlock and turn off a PIV or riser valve to show a supervisory condition.
16. Turn valve back on, lock the valve open and demonstrate the end of the indication of a supervisory condition.

4. Training documentation.

- a) Insure fire panel is reset and indicates normal and central station monitoring is taken off of the test mode.
- b) Have all staff attendees sign off training sheet and provide a copy to the DISTRICT.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Remove surface debris.
- B. Remove indicated paving, curbs, and concrete.
- C. Clear site of plant life and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Erosion and sedimentation control measures.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable code for dust control and disposal of debris.
- B. Coordinate clearing Work with utility companies.
- C. Obtain required permits from authorities.
- D. Do not close or obstruct roadways and sidewalks without permits.

1.3 DEFINITIONS

- A. Remove: Removal of existing construction and legally dispose of items off-site.
- B. Disposal: Removal off-site of demolition waste and subsequently deposit in landfill acceptable to authorities having jurisdiction.
- C. Existing to Remain: Items of construction that are not to be removed and that are not indicated to be removed.

1.4 SUBMITTALS

- A. Preclearing Photographs: Show conditions of existing adjacent construction and site improvements that might be misconstrued as damaged by clearing operations. Submit before work begins.
- B. Record Documents: Submit under provisions of Section 01 77 00. Accurately record locations of capped utilities and other subsurface conditions.

1.5 QUALITY ASSURANCE

- A. Perform best management practice techniques for given site conditions as defined in Section 3 of the Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.
- B. Coordinate work of this section with permit provisions of State Water Resources Control Board Order No. 2010-0014-DWQ and the Storm Water Pollution Prevention Plan.
- C. Comply with City of San Bernardino and the City of Highland Dust Control Ordinance.

2. PART 2 PRODUCTS

NOT USED

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Correlate existing conditions with requirements indicated.
- B. Inventory and record condition of items to be removed and salvaged.
- C. Execute predemolition photographs.

3.2 PREPARATION

- A. Verify that existing plant life and features designated to remain are tagged or identified.

3.3 EROSION AND SEDIMENTATION CONTROL

- A. Provide 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 requirements of Storm Water Pollution Prevention Plan.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during clearing operations.

3.4 PROTECTION

- A. Protect utilities that remain, from damage.
- B. Protect trees, plant growth, and features designated to remain as final landscaping.
- C. Protect bench marks and existing structures from damage or displacement.

3.5 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs indicated. Remove stumps, main root ball.
- C. Clear undergrowth and deadwood without disturbing subsoil.
- D. Remove debris, rock, and extracted plant life.
- E. Remove paving, curbs, and other items as indicated. Neatly saw cut edges at right angle to surface.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items indicated to remain, remove demolished materials from Project site and legally dispose of them in an EPA – approved landfill.
- B. Do not burn or bury materials on site.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt and debris caused by clearing.
- B. Return adjacent areas to condition existing before clearing operations began.
- C. Leave site in a clean condition.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Top soil excavation.
- B. Site rough grading.
- C. Building excavation, backfill and compaction.
- D. Excavation for pavements and site structures.
- E. Consolidation and compaction.
- F. Fill for overexcavation.
- G. Utility trenches, backfill and compaction.
- H. Subgrade preparation of pavement areas.
- I. Finish grading.
- J. Erosion and sedimentation control measures.

1.2 REFERENCES

- A. CBC - California Building Code, Title 24, Part 2, Chapter 18A and Appendix J.
- B. San Bernardino County Code.
- C. City of San Bernardino Dust Control Ordinance.
- D. Storm Water Quality Association - Stormwater Best Management Practice Handbook (BMP Handbook) Construction Edition.
- E. State Water Resources Control Board Order No. 2010-0014-DWQ.
- F. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- G. ASTM D448 - Sizes of Aggregate for Roadway and Bridge Construction.
- H. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- I. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.
- J. ASTM D2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods. (Shallow Depth).
- K. ASTM D2937 – Test Method for Density of Soil in Place by the Drive-Cylinder Method.
- L. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Submit samples under provisions of Section 01 33 00.
- B. Submit 10 lb. sample of each type of fill to testing laboratory in air-tight containers.
- C. Submit name of imported materials source. Provide materials from same source throughout the work. Change of source requires Architect's approval.
- D. Submit test reports under provisions of Section 01 45 29.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of utilities remaining, rerouted utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Comply with California Building Code (CBC), Title 24, Part 2, Chapter 18A and Appendix J.
- B. Comply with San Bernardino County Code.
- C. Comply with City of San Bernardino Dust Control Ordinance.
- D. Perform best management practice dust control techniques for given site conditions as defined in Section 3 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.
- E. Coordinate work of this section with Permit provisions of State Water Resources Control Board Order No. 2010-0014-DWQ and the Storm Water Pollution Prevention Plan.

1.6 FIELD CONDITIONS

- A. Verify that survey benchmark and intended elevations for the work areas are as indicated.
- B. Notify Architect of unexpected subsurface conditions and discontinue work in area affected until notified to resume work.
- C. Perform site assessment to identify any contaminated soils which may occur on site.

1.7 PROTECTION

- A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping.
- B. Protect bench marks, fences, roads, sidewalks, paving, and curbs.
- C. Underpin adjacent structures, including utilities and pipe chases, which may be damaged by excavation work.
- D. Protect above or below grade utilities which are to remain.
- E. Barricade open excavations and post warning lights. Operate lights from dusk to dawn.
- F. Protect facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- G. Repair or replace all damage.

2. PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Existing Subsoil: Excavated and re-used material, graded free of lumps and rocks larger than 2 inches in any dimension.
- B. Imported Subsoil: Non-expansive predominantly granular soils such as a silty sand, free of lumps and rocks larger than 2 inches in any dimension, and debris. Expansion index less than 20, and no more than 50 percent of the material shall pass a No. 200 sieve. Material shall contain sufficient fines (binder) to result in a stable subgrade.
- C. Existing Topsoil: Excavated and re-used material, graded free of roots, rocks larger than one inch, subsoil, debris and large weeds.
- D. Imported Topsoil: Friable loam, free of subsoil, roots, grass, excessive amounts of weeds, stones and foreign matter; acidity range (ph) of 5.5 to 7.5; containing an amount of organic matter normal to the region.
- E. Sand: Natural river or bank sand: Free of silt, clay, loam, friable or soluble materials or organic matter, graded in accordance with ASTM C136, all passing the No. 4 sieve and only 5 percent passing the No. 200 sieve.
- F. Gravel: Coarse aggregate; free of clay, shale and organic matter; ASTM D448, grading size 6 with 100 percent passing a 1 inch sieve and not more than 5 percent passing a No. 4 sieve.
- G. Pea Gravel: Natural Stone; washed, free of clay, slate, organic matter, graded in accordance with ASTM C136, 1/4 inch to 5/8 inch.
- H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, graded in accordance with ASTM C136, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.
- I. Crushed Stone Base: Permeable base meeting California Department of Transportation 3/4 inch Permeable Class II Base designation according to the following gradation:

Mesh Size	% Passing
1 inch	100
3/4 inch	90-100
3/8 inch	40-100
#4	25-40
#8	18-33
#30	5-15
#50	0-7
#200	0-3

- J. Concrete: Structural concrete conforming to Section 03 30 00 with a compressive strength of 2,000 psi for fill to correct over-excavation.
- K. Materials (existing and import) shall be free of any toxic materials listed (by the federal or state EPA or federal or state health agencies) as hazardous material.
- L. Materials (existing and import) are subject to the approval of the Soils Engineer for use in the project.

- M. Provide imported materials when sufficient satisfactory soil materials are not available from on site sources.

2.2 ACCESSORIES

- A. Permeable Geotextile Fabric: Non-woven filter fabric, 60 mil thick, weighing 4.5 oz/sq yd; 14ON fabric manufactured by Mirafi Inc., www.tcmirafi.com, GN100 Green Geotextile fabric manufactured by American Engineering Fabrics, Inc., www.boomenviro.com.
- B. Impermeable Geotextile Fabric: Reinforced liner, 20 mils thick; Hercuscrim 20 Fabric manufactured by In-Line Plastics, LC, www.in-lineplastics.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.3 EQUIPMENT

- A. Equipment: Capable of excavating subsoil, mixing and placing materials, wetting, consolidation, grading, and compaction of material.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify agreement of existing site conditions with indicated conditions.
- B. Notify Architect of discrepancies found.
- C. Beginning work of this Section constitutes acceptance of existing conditions.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known below grade utilities. Stake and flag locations.
- C. Identify and flag above grade utilities.
- D. Maintain and protect existing utilities remaining which pass through work area.
- E. Notify utility company and pay all costs to remove and relocate utilities.
- F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Architect.

3.3 EROSION AND SEDIMENTATION CONTROL

- A. Provide erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during earthwork operations.

3.4 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded.
- B. Stockpile in area designated on site.
- C. Stockpile topsoil to depth not exceeding 8 feet. Place, grade, and shape stockpile for proper drainage.

3.5 GRADING

- A. Uniformly grade areas within limits of grading including adjacent transition areas.

- B. Make such cuts or fills as may be required to bring subgrade to elevations shown and to tolerances specified.
- C. Plow or otherwise break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond to existing surface.
- D. Where grades are not indicated, grade uniformly level or slope between points for which elevations are given.
- E. In absence of more specific grading information, slope ground away from building for a distance of 20 feet at 2 percent.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Compact each layer of fill to required density.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate subsoil required to accommodate building foundation, site structures and construction operations.
- B. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot.
- C. Extend a sufficient distance from footings and foundations to permit placing and removal of formwork, installation of services, other construction, and for inspection.
- D. Overexcavate a minimum depth of 3.5 feet beneath all footings.
- E. Extend overexcavation a minimum distance of 5 feet horizontally beyond exterior face of foundation wall.
- F. Hand trim excavation. Remove loose matter.
- G. Remove lumped subsoil, boulders and rock up to 1/3 cu yd measured by volume. Replace with approved fill material and compact as specified.
- H. Do not disturb bottom of excavations intended for bearing surface.
- I. Scarify bottom of excavation to a depth of 10 inches, moisture-condition to optimum moisture content and compact as specified.

3.7 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown, to subgrade elevations required and to grade tolerances specified.
- B. Overexcavate a minimum depth of 24 inches beneath all slabs-on-grade.
- C. Overexcavate a minimum depth of 24 inches beneath all paving.
- D. Scarify subgrade beneath slabs-on-grade to a depth of 10 inches, moisture-condition to optimum moisture content and compact as specified.
- E. Scarify subgrade beneath paving to a depth of 10 inches, moisture-condition to optimum moisture content and compact as specified.

3.8 TRENCH EXCAVATION

- A. Excavate subsoil required to accommodate storm sewer, sanitary sewer, water, gas, electric and telephone conduits, and piping to municipal or private utilities.
- B. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 8 inch clearance on both sides of the pipe.
- C. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations.

- D. Depth of excavations on the exterior of the building shall provide for the minimum coverage above the top of the pipe, conduit, or tank measured from the lowest adjacent finish grade, as follows unless otherwise indicated on the Drawings:
- | | |
|------------------------------------|-----------|
| 1. Steel Pipe and Conduit | 24 inches |
| 2. Copper Water Tube | 18 inches |
| 3. Cast-Iron, Pressure Pipe | 36 inches |
| 4. Plastic Pipe (other than waste) | 30 inches |
| 5. Plastic Waste Pipe | 24 inches |
| 6. Soil, Sewer & Storm Drain | 18 inches |
| 7. Irrigation Pipe (pressure) | 24 inches |
| 8. Irrigation Pipe (non-pressure) | 12 inches |
- E. For pipe or conduit less than 4 inches in nominal size, do not excavate beyond indicated depths. Hand-excavate bottom to accurate elevations and support pipe or conduit on undisturbed soil.
- F. For pipe or conduit, 4 inches and larger, carry excavation 4 inches below required elevation and backfill with sand bedding to support pipe or conduit.
- G. Hand trim excavation. Remove loose material.
- H. Excavation cut not to interfere with bearing splay of foundations.
- I. At each pipe joint dig bell hole to relieve pipe bell of loads and to ensure continuous bearing of pipe on bearing surface.
- J. Remove lumped subsoil, boulders and rock up to 1/3 cu yd measured by volume. Replace with sand bedding material and compact as specified.

3.9 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials in designated on-site area.
- B. Segregate excavated materials based upon intended use.
- C. Place, grade, and shape stockpile for proper drainage.
- D. Locate stockpile away from edge of excavations.
- E. Do not stockpile materials within drip line of trees.

3.10 UNAUTHORIZED EXCAVATION

- A. Correct unauthorized excavation at no cost to Owner.
- B. Backfill excavation to correct elevation with concrete or approved fill material compacted as specified.

3.11 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Machine slope banks to angle of repose or less.
- C. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

- D. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- E. Provide shoring and bracing in good serviceable condition.
- F. Extend shoring and bracing as excavation progresses.
- G. Maintain shoring and bracing in excavations regardless of time period excavation will be open.
- H. Provide permanent steel sheet piling wherever subsequent removal of piling would permit lateral movement of soil under adjacent structures. Cut off top of piling 2'-6" below finish grade and leave permanently in place.
- I. Design and Calculations: Provide by licensed California engineer in accordance with requirements of the California Building Code and Safety Orders of the State of California, Division of Industrial Safety; Title 8, Division 1, Chapter 4, Subchapter 4, Article 6.

3.12 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- B. Grade top perimeter of excavations to prevent surface water from draining into excavations.
- C. Do not allow water to accumulate in excavations.
- D. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades.
- E. Provide and maintain pumps, well points, sumps, suction and discharge lines and other components necessary to convey water away from excavations.
- F. Establish and maintain temporary drainage ditches and other diversions to convey rain water and water removed from excavations to runoff areas.
- G. Do not use trench excavations as temporary ditches.

3.13 BEDDING OF TRENCHES

- A. Support pipe and conduit during placement and compaction of bedding fill.
- B. Place a minimum of 4 inches of sand bedding beneath all piping and conduit 4 inches in diameter and larger.
- C. Place a minimum of 12 inches of sand bedding above all piping and conduit.
- D. Compact sand bedding to density required.

3.14 BACKFILLING

- A. Backfill excavations as promptly as work permits, but not until the following has been completed:
 - 1. Acceptance of subgrade.
 - 2. Construction below grade, where applicable, for damproofing, waterproofing, perimeter insulation, and protection board.
 - 3. Inspection, testing, approval and record documentation of location of underground utilities.
 - 4. Removal of concrete formwork.
 - 5. Removal of shoring and bracing if not to be left in place.
 - 6. Backfill of voids in subgrade with satisfactory materials.
 - 7. Removal of trash and debris.
 - 8. Installation of bedding material.
 - 9. Permanent or temporary bracing of horizontally supported walls.
- B. Compact subgrade to density requirements for subsequent backfill.
- C. Backfill to contours and elevations required.
- D. Place geotextile fabric over drainage fill prior to placing backfill.
- E. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- F. Place and compact fill material in continuous layers not exceeding specified compacted depth for each layer.
- G. Employ a placement method that does not disturb or damage foundation perimeter drainage, foundation damproofing, foundation waterproofing protective cover, and utilities in trenches.
- H. Before placing successive layers, all ruts, and other hollows more than 6 inches in depth shall be regraded and compacted.
- I. Maintain optimum moisture content of backfill materials.
- J. Backfill against supported foundation walls.
- K. Backfill simultaneously on each side of unsupported foundation walls.
- L. Backfill trenches with concrete where excavation is less than 3 feet below bottom of footing. Place concrete to level of bottom of adjacent footing. Width of concrete backfill to match width of footing and be full width of trench. Maintain minimum 6 inch encasement on sides, top, and bottom.
- M. Place 4 inch thick concrete base slab then backfill trenches with concrete for piping or conduit where top of piping or conduit is less than 30 inches below finished elevation of paving or 18 inches below finished grade. Minimum 6 inches of encasement on sides and top.
- N. Remove and replace or scarify and air dry subgrade or fill material that is too wet to permit compaction to required density.

3.15 PLACING TOPSOIL

- A. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, in excess of one inch in size.
- B. Remove subsoil contaminated with petroleum products.
- C. Scarify subgrade to depth of 12 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil. Remove all rocks larger than one inch in size.
- D. Place topsoil in areas where seeding, sodding, planting is scheduled.
- E. Use topsoil in relatively dry state. Place during dry weather.
- F. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.
- G. Remove stones, roots, grass, weeds, debris, and foreign material while spreading.
- H. Manually spread topsoil around trees, plants, and building to prevent damage.
- I. Lightly compact placed topsoil.
- J. Place compacted topsoil thicknesses for the following various locations:
 - 1. Grass, Seeded: 6 inches.
 - 2. Grass, Sod: 4 inches.
 - 3. Shrub Beds: 18 inches.
 - 4. Flower Beds: 12 inches.
 - 5. Planter Boxes: To within 3 inches of box rim.

3.16 COMPACTION

- A. Control soil compaction during construction providing density specified for each area classification.
- B. Place and compact fill materials in continuous layers of not more than 8 inch thick compacted depth.
- C. Provide not less than the specified percentages of density of soil material compacted at optimum moisture content, for each layer of soil material in place.
- D. When existing ground surfaces have a density less than that specified for a particular area classification, scarify existing surface to a depth of 10 inches, moisture-condition to optimum moisture content and compact to required percentage of maximum density.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Moisture content shall be uniform throughout all layers. Add necessary moisture or aerate soil material at borrow source if it is not possible to obtain uniform moisture content at soil surface at time of placement.
- G. When moisture content and condition of each soil layer is satisfactory compact soils to specified density.
- H. Compaction of free draining material such as gravel shall be by treads of crawler type tractor, surface vibrator, smooth or pneumatic roller, hand or power tampers.
- I. Compaction of soils by use of water jetting or puddling is not an acceptable procedure.
- J. Correct improperly compacted areas or layers as directed by Architect if soil density tests indicate inadequate compaction.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIAL

- A. Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of legally off site.
- B. Remove surplus backfill materials from site and dispose of legally off site.
- C. Remove surplus topsoil materials from site and dispose of legally off site.
- D. Leave material stockpile areas completely free of excess materials.

3.18 PROTECTION OF WORK

- A. Protect finished work under provisions of Section 01 61 00.
- B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- C. Protect bottom of excavations from freezing, water saturation, and disturbance.

3.19 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Allow testing service to inspect, test, and approve each subgrade and fill layer before further backfill or construction work is performed
- C. Laboratory tests and analysis of fill material will be performed in accordance with ASTM D1557 and with Section 01 45 29.
- D. In place site tests and analysis of fill material will be performed in accordance with ASTM D1556, ASTM D2937 or ASTM D2922, and with Section 01 45 29.
- E. In place site moisture tests will be performed in accordance with ASTM D3017.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.20 GRADING TOLERANCES

- A. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevation.
- B. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
- C. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- D. Building Slab: Grade smooth and even, free of voids, to required subgrade elevation. Final grade tolerance to be within 1/2 inch when tested with a 10 foot straightedge.

3.21 MAINTENANCE

- A. Protect newly graded areas. Keep free of trash and debris.
- B. Provide erosion control methods to prevent erosion.
- C. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances and density.
- D. Where completed areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

- E. Where settling occurs, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface finish to match adjacent work and eliminate evidence of restoration.

3.22 PLACEMENT SCHEDULE

A. Interior Crawl Space:

- 1. Subsoil and or recycled fill, existing or import, to required subgrade, compacted to 95 percent.

B. Interior Slab-On-Grade:

- 1. Existing or imported subsoil and or recycled fill 8 inches thick to subgrade elevation compacted to 95 percent.
- 2. Cover with gravel fill, 8 inches thick, compact to 95 percent.

C. Exterior Side of Foundation Walls:

- 1. Existing or imported subsoil and or recycled fill, to subgrade elevation, compacted to 95 percent.

D. Fill Under Footings:

- 1. Existing or imported subsoil and or recycled fill, 8 inches thick to subgrade elevation, compacted to 95 percent.

E. Retaining Walls:

- 1. Existing or imported subsoil and or recycled fill, to subgrade elevation, compacted to 95 percent.

F. Grass Areas:

- 1. Subsoil and or recycled fill, existing or import, to subgrade elevation, compact to 90 percent.
- 2. Cover with topsoil, existing or import, to finish grade elevation, compact to 90 percent.

G. Planted Areas:

- 1. Subsoil fill, existing or import, to subgrade elevation, compact to 90 percent.
- 2. Cover with topsoil, existing or import, to finished grade elevation, lightly tamped.

H. Asphalt Paving:

- 1. Subsoil and or recycled fill, existing or import, to subgrade elevation, compact to 95 percent.
- 2. Cover with aggregate base specified under Section 32 12 16.

I. Concrete Paving:

- 1. Subsoil and or recycled fill, existing or import, to subgrade elevation, compact to 95 percent.
- 2. Cover with recycled base to subgrade elevation, compact to 95 percent.
- 3. Cover with aggregate base specified under Section 32 13 13.

J. Concrete Walks, Curbs, and Gutters:

- 1. Subsoil and or recycled fill, existing or import, to subgrade elevation, compact to 95 percent.
- 2. Cover with recycled, base to subgrade required, compact to 95 percent.

- K. Fill to Correct Overexcavation:
 - 1. Lean concrete of minimum compressive strength as specified.
 - 2. Import fill, to required elevation, compact to 95 percent.
- L. Drainage Pipe:
 - 1. Drainage fill, compact to 95 percent.
 - 2. Wrap drainage fill with geotextile fabric.
 - 3. Remaining fill of subsoil fill, existing or import, to subgrade elevation, compact to 95 percent.
- M. Utility Trenches on Interior of Building:
 - 1. Sand bedding to 12 inches above pipe, compact to 95 percent.
 - 2. Existing or imported subsoil fill, compact to 95 percent.
 - 3. Cover with gravel fill, 8 inches thick, compact to 95 percent.
- N. Utility Trenches on Exterior of Building:
 - 1. Sand bedding to 12 inches above pipe, compact to 95 percent.
 - 2. Existing or imported subsoil fill, compact to 95 percent.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Weed killer.
- B. Geotextile paving grid.
- C. Prepared base. Recycled base.
- D. Headers and stakes.
- E. Asphaltic concrete paving.
- F. Surface sealer.
- G. Pavement striping.
- H. Concrete wheel stops.

1.2 REFERENCES

- A. ASTM D979 - Standard Practice for Sampling Bituminous Paving Mixtures.
- B. ASTM D2041 - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- C. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
- D. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete In Place by Nuclear Methods.
- E. ASTM D3549 - Standard test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
- F. Southern California Chapter, American Public Works Association - Standard Specifications for Public Works Construction.
- G. Redwood Inspection Service - Standard Specifications for Grades of California Redwood Lumber.
- H. Storm Water Quality Association - Storm Water Best Management Practice Handbook (BMP Handbook) Construction Edition.
- I. TAI (The Asphalt Institute) - Manual Series No. 2 (MS-2).

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with Standard Specifications for Public Works Construction.
- B. Mixing Plant: Conform to State of California standards.
- C. Obtain materials from same source throughout.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable San Bernardino County standards for paving work on public property.

1.5 SUBMITTALS

- A. Submit proposed mix design of each class of mix for review prior to commencement of work under provisions of Section 01 33 00.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F.
- B. Perform asphalt paving waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

2. PART 2 PRODUCTS

2.1 AGGREGATES

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.
- B. Recycled Base Aggregate: Crushed bituminous asphalt and concrete paving and concrete and masonry complying with requirements of Section 200-2.4 for Crushed Miscellaneous Base of the Standard Specifications for Public Works. Free of any deleterious or detrimental material.
- C. Granular base aggregate: In accordance with Section 200-2.2 of Standard Specifications for Public Works Construction.
- D. Granular base aggregate maximum size:
 - 1. Base courses over 6 inch thick: 1-1/2 inches.
 - 2. Other base courses: 3/4 inches.
- E. Aggregates for asphaltic concrete paving: In accordance with Section 203.6.2.2. of Standard Specifications for Public Works Construction.

2.2 WEED KILLER

- A. Commercial chemical for weed control, registered by EPA. Dry, free-flowing, dust-free chemical compound, nonflammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.
- B. Weed Killer products:
 - 1. Oust: E.I. Dupont de Nemours and Co., www.dupont.com.
 - 2. Casoron 4G: Uniroyal Chemical Co., Inc., www.cromptoncorp.com.
 - 3. Substitutions: Under provisions of Section 01 25 13.

2.3 HEADERS AND STAKES

- A. Headers: Construction heart grade redwood in compliance with the Standard Specifications for Grades of California Redwood Lumber.
- B. Stakes: Redwood of grade specified for headers.
- C. Nails: Common, galvanized, 12d minimum.

2.4 CONCRETE WHEEL STOPS

- A. Prefabricated 5-1/2 inch high x 7-1/2 inch wide x 48 inch long, 3,500 psi concrete wheel stop.
- B. Chamfer corners and provide holes for anchoring to substrate.
- C. Dowels: Galvanized steel, 1/2 inch diameter, minimum 12 inch length.
- D. Substitutions: Under provisions of Section 01 25 13.

2.5 PAVEMENT STRIPING PAINT

- A. Vinyl emulsion type, white color, except at accessible parking spaces, provide blue color. Blue color to be equal to Color 15090 in accordance with Federal Standard 595C. Color of play pad markings shall be as indicated.
- B. Striping products:
 - 1. W801 Vin-L-Stripe Traffic Paint, manufactured by Dunn-Edwards, www.dunnedwards.com.
 - 2. Substitutions: Under provisions of Section 01 25 13.

2.6 ASPHALTS

- A. Comply with provisions of Standard Specifications for Public Works Construction, Section 203-1:
 - 1. Paving asphalt : PG-64-10
 - 2. Tack coat : SS-1h

2.7 ASPHALTIC PAVING MIX

- A. Provide hot plant mixed asphaltic concrete paving materials in accordance with Section 203-6 of Standard Specifications for Public Works Construction:
 - 1. Base Course Mix : B
 - 2. Parking and Drive Area Mix : C2
 - 3. Hardscape Play Area Mix : D2
- B. Asphalt concrete paving mix to have 5 to 7 percent asphalt cement content by weight in accordance with TAI Publication MS-2.

2.8 SEAL COAT

- A. Hardscape Play Areas: Guardtop high performance coolseal sealcoat, www.guardtop.com. As specified in Section 32 12 33.
- B. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Apply weed killer to entire area to be paved. Follow manufacturer's application directions.
- B. Install headers and stakes to achieve arrangement of paving shown on the Drawings.

3.3 PLACEMENT OF GRANULAR BASE COURSE

- A. Spread granular base material to compacted thickness shown on the Drawings. Compact according to Section 31 20 00 to 95 percent.
- B. Thickness tolerance: Minus 0.0 inch to plus 0.5 inch.
- C. Smoothness tolerance: 3/8 inch in 10 feet.
 - 1. Deviations: Correct by removing materials, replacing with new materials, and reworking and recompact as required.
- D. Moisture content: Only the amount needed to achieve the specified compaction.

3.4 PLACEMENT OF ASPHALTIC CONCRETE FINISHED PAVING

- A. Remove all loose materials from compacted base.
- B. Adjust frames and covers, if so required, to meet final grades.
- C. Tack Coat:
 - 1. Apply tack coat at the rate of 0.05 to 0.10 gallon per square yard to all existing pavement, curbs, gutters, manholes, and the like immediately before asphalt concrete is placed.
 - 2. Avoid smearing adjacent surfaces. Remove spillage and clean affected areas.
- D. Spreading Asphaltic Concrete Materials:
 - 1. Spread material in a manner which requires the least handling.
 - 2. Spread asphalt concrete to compacted thickness shown on drawings.
 - 3. Where thickness of asphalt concrete paving will be 3 inches or less, spread in one layer.
 - 4. Where thickness of asphalt concrete paving will be more than 3 inches, spread in two layers. Surface course shall be a minimum of 1 inch thick.
 - 5. Prime asphalt surface between layers.
 - 6. Offset layers of paving a minimum of 6 inches.
- E. Rolling:
 - 1. After material has been spread to proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown.
 - 2. Roll in at least two directions until no roller marks are visible.
- F. Compacting:
 - 1. Average density according to ASTM D2041 to be 92 percent but not less than 90 percent and not more than 96 percent.

3.5 TOLERANCES

- A. Free from birdbaths.
- B. Flatness, Parking Lot, and Drive Areas: Maximum variation of 1/8 inch in 6 feet.
- C. Flatness, Hardscape Play Areas: 1/8 inch in 10 feet.
- D. Compacted Thickness: Within 1/4 inch.
- E. Variation from True Elevation: Within 1/2 inch.

3.6 REPAVING

- A. Where existing pavement is cut, removed, or disturbed, existing pavement shall be saw cut.
- B. Where excavations are 12 inches or less in width, existing pavement to be cut 12 inches greater in length and width of excavation.
- C. Where excavations are greater than 12 inches in width, existing pavement to be cut 24 inches greater in length and width of excavation.
- D. Where existing pavement being cut is to be overlaid, pavement cutting outside limits of excavation is not required.
- E. Backfill shall conform to requirements of Section 31 20 00.
- F. Repaving shall match existing paving, but shall not be less than 3 inches of asphalt concrete placed upon 12 inches of crushed aggregate base in compliance with Section 200-2.2 of the Standard Specifications for Public Works Construction.

3.7 SEAL COAT

- A. Apply seal coat to hardscape play areas in accordance with manufacturer's instructions in two separate coats. Do not apply seal coat until 30 days after initial placement of asphaltic concrete paving.

3.8 PAVEMENT STRIPING

- A. Layout line markings and other painting in accordance with Drawings. Lines shall be 4 inches wide. Line width of play pad markings shall be as indicated.
- B. Clean surfaces to be painted. Apply paint in accordance with manufacturer's directions only when weather conditions permit proper application. Machine apply paint in as many coats as are required to provide opaque markings.

3.9 WHEEL STOPS

- A. Place wheel stops at all parking stalls as indicated.
- B. Anchor permanently in place with two steel rods.

3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing of granular base and of asphalt concrete paving mix will be performed under provisions of Section 01 45 29.
- B. Testing firm to take samples and perform tests in accordance with TAI MS-2 and as specified.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

- D. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.
- E. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979.
- G. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted as specified.
- H. In-place density of compacted pavement will be determined by testing core samples according to ASTM D2726.
 - 1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - 2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D2726.
- I. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 PROTECTION

- A. Immediately after placement, protect pavement under provisions of Section 01 61 00 from mechanical injury for 2 days.
- B. Protect all new placed pavement from landscape irrigation overspray and planter area soil erosion.

3.12 FLOOD TEST

- A. Perform flood test of finished paving by use of water tank truck.
- B. Where water ponds to a depth of more than 1/8 inch, fill or otherwise correct to provide proper drainage.
- C. Feather and smooth edge of fill so that joint between fill and original surface is invisible.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, curbs, gutters, utility slabs, parking areas, driveways, driveway aprons and approaches.
- B. Expansion, control and isolation joints.
- C. Finishing concrete pavements.
- D. Surface treatment with sealer and slip resistant coatings.
- E. Aggregate recycled base course.
- F. Concrete pavement striping.
- G. Concrete wheel stops.
- H. Steel reinforcement.
- I. Fibrous secondary reinforcement.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 117 - Standard Specification for Tolerances for Concrete Construction and Materials.
- D. ASTM A82 - Specification for Steel Wire, Plain, for Concrete Reinforcement.
- E. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- F. ASTM A184 - Specification for Fabricated Deformed Steel Bar Mats for Concrete.
- G. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- H. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready Mixed Concrete.
- K. ASTM C150 - Portland Cement.
- L. ASTM C260 - Air-Entraining Admixtures for Concrete.
- M. ASTM C289 - Potential Reactivity of Aggregates.
- N. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- O. ASTM C494 - Chemical Admixtures for Concrete.
- P. ASTM C618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture for Concrete.

- Q. ASTM C979 - Pigments for Integrally Colored Concrete.
- R. ASTM C1116 - Specification for Fiber-Reinforced Concrete and Shotcrete.
- S. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- T. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- U. DSA/AC - Division of State Architect/Access Compliance.
- V. National Ready Mix Concrete Association - Plant Certification Program.
- W. Southern California Chapter, American Public Works Association - Standard Specifications for Public Works Construction.
- X. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Obtain materials from same source throughout.

1.4 QUALIFICATIONS

- A. Manufacturer: Manufacturer of ready-mix concrete products complying with ASTM C94 requirements for production facilities and equipment. Certified according to National Ready Mix Concrete Association's Plant Certification Program.
- B. Pavement Installer: Company who has completed pavement work similar in material, design, and extent to that indicated for this project.
- C. Detectable Warning Pavement Installer: Company specializing in applying the work of this section with a minimum of 5 years experience and approved by manufacturer of the detectable warning products used.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable City of San Bernardino code for paving work on public property.
- B. Conform to (CBC) California Building Code, (CCR) Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for access requirements for individuals with disabilities.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Provide concrete curing, finishing, and waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

1.7 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Include data on joint filler, admixtures and curing compounds.
- C. Submit proposed mix design to testing laboratory and to Architect for review prior to commencement of work.
- D. Submit manufacturer's instructions under provisions of Section 01 33 00.

1.8 MOCKUP

- A. Provide mockup of pavement finish under provisions of Section 01 43 00.
- B. Construct mockup area under conditions similar to those which will exist during actual placement, with coatings applied.
- C. Locate where directed.
- D. Mockup may not remain as part of the work.

1.9 WARRANTY

- A. Provide five year warranty under the provisions of Section 01 77 00 for detectable warning pavement.
- B. Warranty: Shall indicate compliance with standards required by CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 12, Section 12-11B.209. Warranty coverage shall include durability criteria which indicates that the shape, color fastness, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for at least five years after original installation. As used in this Article, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the Division of The State Architect.

2. PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150 Normal-Type I or Type II Portland type, gray color, from single source throughout project.
- B. Fine and Coarse Aggregates: ASTM C33, non-reactive when tested in accordance with ASTM C289 and Appendix X-1 of ASTM C33.
- C. Water: ASTM C1602, clean and not detrimental to concrete.

2.2 BASE MATERIALS

- A. Aggregate Base: Crushed rock conforming to Section 200-2.2 of the Standard Specifications for Public Works Construction.
- B. Recycled Base Aggregate: Crushed bituminous asphalt and concrete paving and concrete and masonry complying with requirements of Section 200-2.4 for Crushed Miscellaneous Base of the Standard Specifications for Public Works. Free of any deleterious or detrimental material.

2.3 FORM MATERIALS

- A. Conform to ACI 301.

2.4 IMPRINTING TOOLS

- A. Patterned imprinting tool as manufactured by Bomanite Corporation, www.bomanite.com, or Symons, www.symons.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.5 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; 60 ksi yield grade; deformed billet steel bars, uncoated finish.
- B. Welded Steel Wire Fabric: Plain type, ASTM A185; in coiled rolls or flat sheets; uncoated finish.

- C. Fabricated Bar Mats: ASTM A184; welded or clip-assembled steel bar mats of ASTM A615, Grade 60 steel bars.
- D. Tie Wire: ASTM A82, annealed steel, minimum 16 gage size.
- E. Dowels: ASTM A615; 40 ksi yield grade, plain steel, uncoated finish.
- F. Supports: Chairs, spacers, dowel bar supports and other devices for spacing, supporting and fastening reinforcing bars, welded wire fabric, and dowels in place.
- G. Substitutions: Under provisions of Section 01 25 13.

2.6 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1-D, Class B.
- B. Preformed Joint Filler: ASTM D1751, 1/2 inch thick.
- C. Colored Sealer: Type recommended by manufacturer of colored concrete pigment.
- D. Clear Sealer: One component alkylalkoxy, silane penetrating sealer.
- E. Joint Sealers: As specified in Section 07 92 00.
- F. Rock Salt: Commercial standard packaged rock crystals, No. 2 size, free of fines.

2.7 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Surface Retarder: ASTM C494, Type B or D.
- C. Fly Ash: ASTM C618, Class F.
- D. Water Reducing Admixture: ASTM C494, Type A.
- E. Colored Concrete Pigment: ASTM C979 of color selected.

2.8 FINISH MATERIALS

- A. Aggregate: Natural smooth; 1/4 inch minimum size to 3/8 inch maximum size; clean washed type. No reactive or iron bearing aggregate permitted. Grey color from single source throughout.
- B. Slip Resistant Aggregate: 95 percent minimum fused homogeneous aluminum oxide.

2.9 DETECTABLE WARNING PAVEMENT

- A. Applied truncated dome warning system consisting of glass beads encapsulated in a resin binder as manufactured by TILCO Vanguard, Inc., www.vanguardonline.com.
- B. Truncated dome system shall comply with requirements of CBC, California Building Code (CCR), California Code of Regulations, Title 24, Part 2, Section 11B-705 and be approved by DSA/AC.
- C. Color of truncated domes shall be of contrasting yellow color conforming to Color 33538 in accordance with standard SAE AMS-STD-595.
- D. Substitutions: Under provisions of Section 01 25 13.

2.10 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94, Alternative No. 3.
- B. Provide concrete of the following characteristics:
 - 1. Driveways, aprons and approaches: Compressive strength of 3,500 psi at 28 days.
 - 2. Sidewalks, curbs, gutters and utility slabs: Compressive Strength of 2,500 psi at 28 days.
 - 3. Slump: 4 to 6 inches.
 - 4. Maximum aggregate size: 1 inch.
 - 5. Cement Content: Minimum 540 lbs/cu. yd.
 - 6. Fly Ash: Maximum 25 percent by weight.
 - 7. Air Entrainment: 2 to 4 percent.
 - 8. Water Cement Ratio: 0.50.
 - 9. Integral Coloring: Where integral color is designated provide 5 pounds of colored pigment per sack of cement.
- C. When automatic machine placement is used, determine mix design and obtain laboratory test results that comply with or exceed requirements.

2.11 PAVEMENT STRIPING PAINT

- A. Vinyl emulsion type, yellow color, except at accessible parking spaces, blue color. Blue color to be equal to Color 15090 in accordance with Federal Standard SAE AMS-STD-595. Color of fire lane curb marking to be red with white letters.
- B. Acceptable products:
 - 1. W801 Vin-L-Stripe Traffic Paint, manufactured by Dunn-Edwards, www.dunnedwards.com.
 - 2. 506 Traffic Line Paint-Vinyl, manufactured by Frazee, www.frazeepaint.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.12 CONCRETE WHEEL STOPS

- A. Prefabricated 5-1/2 inch high x 7-1/2 inch wide by 48 inch long 3,500 psi concrete wheel stops.
- B. Chamfer corners and provide holes for anchoring to substrate.
- C. Dowels: Galvanized steel, 1/2 inch diameter, minimum 12 inch length.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify compacted subgrade is ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Beginning of installation means acceptance of existing conditions.

3.2 BASE

- A. Prepare and compact base materials in accordance with provisions of Section 31 20 00.

3.3 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of adjacent curbs, gutters, manholes, catch basins, inlets, light pole bases and other fixed objects with form release agent to form isolation joint and prevent bond with paving.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint fillers vertical in position, in straight lines. Secure during concrete placement.

3.5 REINFORCEMENT

- A. Place reinforcement at mid-height of slabs-on-grade.
- B. Lap adjoining pieces of welded wire fabric one full mesh and lace splice with wire. Offset laps of adjoining sheets.
- C. Place fabricated bar mats in lengths as long as practical. Overlap adjacent mat 2 inches.
- D. Interrupt reinforcement at expansion joints.
- E. Place reinforcement to achieve slab and curb alignment as detailed.
- F. Provide doweled joints at interruption of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.
- G. Where joining existing concrete pavement, drill and set new dowels with epoxy grout into existing paving. Set opposite end of dowel in capped sleeve to allow for longitudinal movement.

3.6 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Hot and Cold Weather Placement: ACI 301.
- C. Place concrete formwork on public property in conformance with applicable City of San Bernardino code.
- D. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- E. Place concrete continuously between predetermined construction joints and expansion joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Place concrete to pattern indicated in strip sequence.
- H. Curb and Gutter: For automatic machine placement, produce curbs and gutters to required cross section, lines, grades, finish and jointing.

- I. Slip - Form Paving: For automatic machine placement, produce paving to required thickness, line, grade, finish and jointing.

3.7 JOINTS

- A. Review locations of joints when indicated and make recommendations for any additional joints or suggestions for new locations. Lack of joints or misplacement of joints will not constitute justification of pavement cracking.
- B. Place expansion joints at not to exceed 15 foot intervals to correct elevation and profile. Align curb, gutter, and sidewalk joints.
- C. Place joint filler at expansion joints and building or other appurtenances. Recess top of filler for sealant placement by Section 07 92 00.
- D. Provide control joints at not to exceed 5 foot intervals.
- E. Saw cut, Hand tool control joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.
- F. Provide keyed joints as indicated.
- G. Finish each edge of joint with radiused jointer tool.
- H. Use form release agent at isolation joints where paving abutts curbs, gutters, manholes, catch basins, inlets, light pole bases, and other fixed objects to prevent bonding with pavement.
- I. Where joining existing pavement, align new expansion, control and isolation joints with previously placed joints.

3.8 FINISHING

- A. Uniformly spread, screed and consolidate concrete. Do not spread concrete by vibration.
- B. Smooth Form Finish:
 - 1. Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces, with number of seams kept to a practical minimum and in a uniform, orderly pattern.
 - 2. Patch tie holes and defects.
 - 3. Trowel to smooth even finish.
 - 4. Use for curbs, gutters, and mowstrips.
- C. Medium Broom Finish:
 - 1. Float surface and trowel to smooth even finish.
 - 2. While surface is still plastic draw a soft fiber bristle broom uniformly over surface in perpendicular direction to traffic.
 - 3. Use for sidewalks, utility slabs, parking areas, driveways which have a slope of 6 percent or less and areas indicated.
- D. Slip Resistant/Heavy Broom Finish:
 - 1. Float surface and trowel to smooth even finish.
 - 2. While concrete is still plastic, uniformly broadcast aluminum oxide particles onto surface at the rate of 25 pounds per 100 sq. ft.

3. Trowel particles into surface of concrete to provide embedment. Do not force below surface.
 4. While surface is still plastic, draw a stiff fiber bristle broom uniformly over surface in perpendicular direction of traffic.
 5. Use for ramps with slope of 6 percent or greater, stair treads, and areas indicated.
- E. Exposed Aggregate Finish:
1. Top cast level 100 finish per Section 32 13 51.
 2. Provide at all locations indicated as exposed aggregate finish on site plans.
- F. Top Cast Sand Finish:
1. Top cast level 05 finish per Section 32 13 51.
 2. Provide at all colored concrete paving and at standard concrete paving within perimeter (Wireworks) fencing.
- G. Apply colored concrete sealer to sandblasted and colored concrete surfaces in accordance with manufacturer's instructions.

3.9 CHEMICALLY STAINED CONCRETE FINISH

- A. Concrete surfaces shall have cured a minimum of 28 days prior to stain application.
- B. Apply chemical stain to concrete surfaces as indicated on the drawings.
- C. Apply stain evenly over surface in quantities according to manufacturer's recommendations.
- D. Do not apply stain when temperature is above 85 degrees F.
- E. Maintain a wet edge on surfaces during application.
- F. Remoisten concrete to blend hard edges or lap marks caused by application.
- G. Flush area of stain application with mixture of water and baking soda after stain has dried.
- H. Prevent water rinse runoff to planted areas or other surfaces that may be damaged by stain residue.
- I. Apply manufacturer's recommended sealer to stained surfaces. Apply in accordance with manufacturer's recommendations.
- J. Apply a slip resistant sealer equivalent to Rafco Products Co. Masterseal or Scofield Clearcoat at all ramp and stair surfaces.

3.10 DETECTABLE WARNING PAVEMENT

- A. Install detectable warning pavement on curb ramps and other areas indicated on the drawings.
- B. Install detectable warning pavement in accordance with manufacturer's requirements and the 2010 ADA Standards for Accessible Design and CBC, Title 24, Part 2, Section 11B-705 requirements.

3.11 CURING

- A. Cure concrete surfaces in accordance with ACI 301.
- B. Apply curing compound on finished slab surfaces in accordance with manufacturer's instructions.

3.12 PAVEMENT STRIPING

- A. Lay out line markings and other painting in accordance with Drawings. Lines shall be 4 inches wide.
- B. Clean surfaces to be painted.
- C. Apply paint in accordance with manufacturer's directions.
- D. Apply only when weather conditions permit proper application.
- E. Machine apply paint in as many coats as are required to provide opaque markings.
- F. Allow for 300 linear feet of fire lane curb marking.

3.13 CONCRETE WHEEL STOPS

- A. Place wheel stops at all parking stalls as indicated.
- B. Anchor permanently in place with two steel rods.

3.14 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Owner's Inspector will take cylinders and perform slump and air entrainment tests in accordance with ACI 301 and will arrange for pick-up of cylinders by Testing Laboratory.
- C. Three concrete test cylinders will be taken for every 50 or less cu yds of each class of concrete placed each day.
- D. One slump test will be taken for each set of test cylinders taken.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.15 TOLERANCES

- A. Provide tolerances under provisions of Section 01 43 00 in accordance with ACI 117.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
- C. Maximum Variation from True Position: 1/4 inch.
- D. Variation of Pavement Thickness: Plus 3/8 inch, minus 1/4 inch.
- E. Maximum Variation of Pavement Joints: 1/8 inch vertical alignment.

3.16 PROTECTION

- A. Immediately after placement, protect concrete under provisions of Section 01 61 00 from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit traffic over pavement for 7 days after finishing.
- C. Maintain pavement free of stains, discoloration, dirt and other foreign materials. Remove surface stains and spillage of material as they occur.

3.17 REPAIR

- A. Remove and replace pavement that is broken, damaged, defective or does not comply with requirements of this Section.
- B. Refinishing pavement that is broken, damaged, or defective is not acceptable.
- C. Remove pavement in complete sections from joint to joint.
- D. Recycle pavement debris under provisions of Section 01 74 19.

END OF SECTION

SECTION 32 13 51

TOP CAST CONCRETE FINISHES

Part 1 – GENERAL

1.01 Summary

- A. Section includes: **Micro Finished and Exposed Coarse Aggregate Concrete** produced through the use of a chemical surface retarder to expose the sand and fine aggregates of a concrete mix.
- B. Related Sections: Refer to the following sections for related work
 - Section: 07 92 00: "Joint Sealants"
 - Section :32 13 13: "Concrete Paving"

1.02 References

- A. American Concrete Institute (ACI)
- B. American Society for Testing and Materials (ASTM)
 - C 31 Practices for Making and Curing Concrete Test Specimens in the Field
 - C 33 Specification for Concrete Aggregates

1.03 Submittals

- A. General: Submit the following items in accordance with the Conditions of Contract and Section 01 33 00, "Submittal Procedures".
- B. Product Data: Submit product data for the following materials and items.
- C. Chemical Surface Retarders
- D. Patching Compounds
- E. Sealants

1.04 Quality Assurance

- A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings "
 - 2. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete "
 - 3. ACI 305 "Hot Weather Concreting "
 - 4. ACI 306 "Cold Weather Concreting "
 - 5. ACI 308 "Standard Practice for Curing Concrete "
 - 6. CRSI "Manual of Standard Practice "
 - 7. SP-66 "ACI Detailing Manual "

- B. Mock-up Panels: Prepare one mock-up panel at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of sand or aggregate exposure. Mock-up panels shall be a minimum of 4' x 4'. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor. The approved mock-up panel shall serve as a standard of appearance for the final work to be produced. Manufacturer's Technical Representative, whenever possible, shall be present and or involved with the mock up to review proper preparation, application and removal processes.
- C. Quality Control Testing During Construction: Per requirements of Sections 01 43 00 & 32 13 13.

Part 2 – PRODUCTS

2.01 Acceptable Manufactures:

- A. Top Cast Surface Retarders and Top Cast SS-100 distributed by Dayton Superior Corporation. (www.daytonsuperior.com) (888-977-9600).
- B. Substitutions: Under provisions of Section 01 25 13.

2.02 Concrete Surface Retarder and Finishing Aids

- A. Spray Applied, film forming top surface retarder designed for specific sized aggregates and finish requirements. Color Coded to allow for ease of application and verification of etch level being used as well as even and complete coverage
 - 1. Acceptable Material: **Top Cast Surface Retarders by GCP Applied Technologies.**
- B. Spray Applied and film forming protective coating for adjacent masonry and concrete surfaces
 - 1. Acceptable Materials: **Top Cast SS-100 by GCP Applied Technologies.**

PART 3 EXECUTION

3.01 Placing Concrete: Coordinated with requirements of Section 32 13 13.

- A. Notify owner's representative 24 hours in advance prior to placement.
- B. Filed Inspection: Do not place concrete until forms and reinforcing steel have been inspected and approved.
 - 1. Place Ready-Mix concrete within specified time after batching.
 - a. Below 40 degrees F (4 degrees C) See Cold Weather Placing
 - b. 40 – 85 degrees F (4-29 degrees C) 90 minutes
 - c. 86 – 90 degrees F (30-32 degrees C) 75 minutes
 - d. Above 90 degrees F (32 degrees C) 60 minutes

*Concrete exceeding delivery times may be rejected by the owner's representative
 - 2. Adding Water: Do not add water after initial introduction of mixing water for batch except when slump of concrete is less than specified upon jobsite arrival and the maximum water/cement ratio has not been exceeded.
 - a. Notify owner's representative prior to adding any additional water.
 - b. Add only water enough to bring concrete slump within the specified limits. Turn drum at least 30 additional revolutions at maximum mixing speed. Do not add water to batch at any later time.

- c. Insure that concrete strength meets or exceeds specified requirements, and water does not exceed maximum amount specified in the approved CONCRETE MIX DESIGN.
- C. General: Comply with ACI 304, as specified herein.
 - 1. Place concrete continuously or in layers of such thickness that the concrete will not be placed on a preceding layer which has hardened sufficiently to cause formation of seams or planes of weakness.
 - 2. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- D. Placing Concrete in Forms:
 - 1. Consolidate placed concrete by high frequency mechanical vibrating equipment, supplemented as necessary by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations not further visible effectiveness of the machines being used. Generally, 16-20" apart.
 - c. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in continuous operation, within the limits of construction joints, until placement of panel or section is completed. Maintain reinforcing in proper position during concrete placement operations
- F. Placing Concrete Sidewalks: Place concrete in forms in one (1) layer of such thickness that when consolidated and finished, sidewalks will be of thickness indicated.
- G. Cold Weather Placing: Protect concrete work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures, comply with ACI 306.
- H. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete place concrete in accordance with ACI 305 and as herein specified.

3.02 Concrete Finishing

- A. **Exposed Coarse Aggregate finishes:** Do not use tools that may force the aggregate away from the surface creating a non-uniform surface after exposure
 - 1. Protect all areas, aluminum trim, curbs, borders and adjacent concrete and masonry surfaces, pavers, stones etc. that are not to receive retarder finish prior to concrete placement and retarder application using **GCP Applied Technologies Top Cast SS 100 Surface Protectant. Distributed by Dayton Superior.**
 - 2. Place concrete in the manner prescribed previously. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
 - 3. Allow the bleed water to evaporate the surface. It can then be floated using a wooden hand float or a bull-float preferably wooden to close the surface and surround the coarse aggregate with cement paste. Do not overwork the surface, as this tends to drive the aggregate down away from the surface to be exposed. Float to a uniform appearance.

4. To reduce the rate of evaporation of moisture from the concrete use AquaFilm® J74RTU during the finishing process, his reduction of moisture loss allows time for proper finishing.
- B. **Exposed Sand Finishes:** The use of a rolling tamper, jitterbug or rolling jitterbug shall be considered when producing micro etched concrete surfaces. This will enable the finisher to create a denser surface paste with no obstruction due to the appearance of coarse aggregate, allowing for a uniform sand texture.
1. Protect all areas, aluminum trim, curbs, borders and adjacent concrete and masonry surfaces, pavers, stones etc. that are not to receive retarder finish prior to concrete placement and retarder application using **GCP Applied Technologies Top Cast SS 100 Surface Protectant. Distributed by Dayton Superior**
 2. Place concrete in the manner prescribed previously. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
 3. Allow the bleed water to evaporate the surface. It can then be floated using a wooden hand float or a bull-float preferably wooden to close the surface and surround the coarse aggregate with cement paste. Float to a uniform appearance. Follow float operations with hand trowels or Fresno steel trowels to create tight dense smooth surface. (This may require two or three passes depending upon mix design and or desired finish to be achieved)
 4. To reduce the rate of evaporation of moisture from the concrete use AquaFilm® J74RTU during the finishing process, his reduction of moisture loss allows time for proper finishing.

NOTE: Do not burnish the surface or allow the micro etched surface to prematurely dry prior to the application of Top Cast.

C. Concrete Surface Retarders

Spray Applied, film forming top surface retarder, designed for specific sized aggregates and finish requirements. Color coded to allow for ease of application and verification of grade being used as well as even and complete coverage.

Number / Aggregate Size to Expose / Color

Sand Finish **05 / Sand Texture Finish / Lt. Blue**

Exposed Agg. Finish **100 / 3/8" to 1/2" agg. / grey**

1. Soon after the final seal finish has been completed spray **GCP Applied Technologies "Top Cast"** surface retarder using a low- pressure sprayer with a 0.5gpm tip at a rate of 200—350 sq./ft. per gallon in a full hiding coat.
 - a. Once dry **GCP Applied Technologies "Top Cast"** will yield a coating that provides intermittent rain protection. Once completely dry it can be covered to protect the surface if heavy extended rains are predicted.
2. Wash surface with water rinse using stiff brooms and water hose or by high pressure washing with power equipment as early as 4-16 depending on weather conditions. Retarder removal intervals are dependent upon strength of the concrete mix, aggregate size and desired washing techniques. Earlier washing on the light etches may be necessary. Verify in accordance with the mock-up approval detailed herein.
3. Rinse water and cement matrix removal shall be in accordance with local codes and should not be allowed to be washed or flow down to arroyos, storm sewers, ponds, streams or sanitary sewers by precipitation or other surface flows.
4. Prior to completion of the project, remove wash water residue from the site to location approved by the local district.

5. Seal concrete per Section 32 13 13.

3.07 Concrete Surface Repairs

- A. Patching Defective Areas: Immediately cut out honeycomb, rock pockets and voids over $\frac{1}{4}$ inch (6mm) in any dimension as well as holes left by tie rods, bolts etc. down to solid concrete but, in no case to a depth less than 1 inch (25mm).
 1. Cut edges perpendicular to concrete surface.
 2. Thoroughly clean, dampen with water, and brush coat area to be patched with neat cement grout or proprietary bonding agent before placing cement mortar or proprietary patching compound.
- B. Remove and replace concrete with defective surfaces if defects cannot be repaired to the satisfaction of the owner's representative.
 1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface as well as stains and other discolorations that cannot be removed by cleaning.
 - a. Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout or apply concrete bonding agent.
 - b. Mix Patching concrete of same materials to provide concrete of same type of class as original concrete.
 - c. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fence framework, fabric, and accessories.
- B. Privacy slats.
- C. Excavation for post bases.
- D. Concrete anchorage for posts and center drop for gates.
- E. Manual gates and related hardware.

1.2 REFERENCES

- A. ASTM A90 - Standards Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- B. ASTM A392 - Zinc-Coated Steel Chain Link Fence Fabric.
- C. ASTM A428 - Weight of Coating on Aluminum-coated Iron or Steel Articles.
- D. ASTM A491 - Aluminum-Coated Steel Chain Link Fence Fabric.
- E. ASTM F567 - Installation of Chain-Link Fence.
- F. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM F668 - Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.
- H. ASTM F900 - Industrial and Commercial Swing Gates.
- I. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- J. ASTM F 1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
- K. ASTM F1083 - Pipe, Steel, Hot-dipped Zinc-coated (Galvanized) Welded for Fence Structures.
- L. ASTM F1184 - Industrial and Commercial Horizontal Slide Gates.
- M. ASTM F1043 - Strength and Protective Coatings on Metal Industrial Chainlink Fence Framework.
- N. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility and Egress Standards.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in commercial quality chain link fencing with five years documented experience.
- B. Installation: ASTM F567.

1.4 REGULATORY REQUIREMENTS

- A. Conform to disabled person access and emergency egress requirements of the CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.5 SUBMITTALS

- A. Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.
- B. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit project record documents under provisions of Section 01 77 00.
- E. Accurately record actual locations of property perimeter posts relative to property lines and easements.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Framework: ASTM F1083; Schedule 40 steel pipe, standard weight, one piece without joints, finish same as fabric.
- B. Acceptable Equivalent: ASTM F1043; Group 1A pipe with minimum yield strength of 30,000 pounds per square inch; SS40 as manufactured by Allied Tube and Conduit Fence Division, www.atcfence.com.
- C. Fabric: ASTM A392, Class 1, zinc coated wire fabric.

2.2 CONCRETE MIX

- A. Concrete: As specified in Section 32 13 13.

2.3 COMPONENTS

- A. Line Posts: 2 inch NPS steel pipe.
- B. Corner and Terminal Posts: 3 inch NPS steel pipe.
- C. Gate Posts: 3 inch NPS steel pipe.
- D. Top and Brace Rail: 1-1/4 inch NPS, plain end, sleeve coupled steel pipe.
- E. Fabric: 2 inch diamond mesh steel wire, interwoven, 9 gage thick, top and bottom selvage knuckle end closed.
- F. Caps: Cast steel or malleable iron, galvanized; sized to post dimension, set screw retained.
- G. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings: Steel.
- H. Tension Wire: 7 gage thick steel, single strand.
- I. Swinging Gates: Constructed of tubular members welded at all corners in conformance with ASTM F900 and the following:
 - 1. Gate Posts: 3 inch NPS steel pipe for gates up to 6 foot for a single gate or a single leaf of a double gate. 4 inch NPS steel pipe for gates over 6 foot in width.
 - 2. Gate Frames: 1-1/4 inch NPS steel pipe, for welded fabrication with vertical intermediate brace at maximum 6 foot spacing and horizontal brace on all gates.

3. Gate Fabric: To match adjacent fencing.
 4. Gate Hardware: Fork type latch with gravity drop and provision for padlock; center gate stop and drop rod; three 180 degree gate hinges per leaf.
 5. Accessible Gate Hardware: As specified in Section 08 71 00.
- J. Sliding Gates: ASTM F1184, Type II cantilever slide, Class 1 external rollers conforming to the following:
1. Gate and Guide Posts: 3 inch NPS steel pipe for gates up to 12 feet in width. 4 inch NPS steel pipe for gates over 12 feet in width.
 2. Gate Frames: 2 inch NPS steel pipe for welded fabrication; 1-1/4 inch horizontal brace on all gates with vertical intermediate brace at maximum 6 foot spacing.
 3. Gate Fabric: To match adjacent fencing.
 4. Roller Assembly: ASTM F1184, Class 1 external roller assembly.
 5. Gate Hardware: Latches, stops and accessories of galvanized steel with provision for padlock.

2.4 PRIVACY SLATS

- A. Material: Polyethylene tubular slats, not less than 0.023 inch thick, manufactured from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with bottom lock strips.
- B. Color: As selected by Architect from manufacturer's full range.

2.5 FINISHES

- A. Galvanized: ASTM F1043; 1.8 oz/sq ft coating for schedule 40 pipe. ASTM A90; 1.0 oz/sq ft coating for Class 1A pipe.
- B. Accessories: Same finish as framing.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Provide fence of height indicated.
- C. Space line posts at intervals not exceeding 10 feet.
- D. Set terminal, gate and corner posts plumb, in 12 inch diameter concrete footings with top of footing 6 inches below finish grade. Slope top of concrete for water runoff. Footing depth below finish grade: 42 inches for gate and corner posts, 36 inches for line posts.
- E. Provide top rail through line post tops and splice with 7 inch long rail sleeves.
- F. Brace each gate and corner post back to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.
- G. Install center and bottom brace rail on corner and gate leaves.
- H. Stretch fabric between terminal posts or at intervals of 100 feet maximum whichever is less.
- I. Do not stretch fabric until concrete has cured 28 days.

- J. Position bottom of fabric 2 inches above finished grade.
- K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties maximum 15 inches on centers.
- L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- M. Install bottom tension wire stretched taut between terminal posts.
- N. Install gates with fabric to match fence. Install three hinges per leaf, latch, catches, drop bolt.
- O. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate openings.
- P. Install privacy slats in vertical direction. Securely lock bottom in place.
- Q. Ground fencing that encloses electrical power distribution equipment as required by National Electric Safety Code, Article IEEE C2.
- R. Install accessible gate hardware in accordance with Section 08 71 00 3'-4" to centerline of hand activated operable gate opening hardware.
- S. Install 10 inch high smooth metal kickplate on each side of accessible gate. Mount 2 inches above finished grade.

3.2 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch.
- B. Maximum Offset from True Position: 1 inch.
- C. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Decorative metal fencing.
- B. Gates.
- C. Hardware.

1.2 REFERENCES

- A. The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- E. ASTM D523 - Test Method for Specular Gloss.
- F. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- G. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- H. ASTM D924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dipped Process.
- I. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- J. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- K. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- L. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- M. ASTM F2408 - Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.3 SYSTEM DESCRIPTION

- A. Basis of Design: Ameristar Montage II® Welded and Rackable Ornamental Steel Genesis™ design. The system shall include all components to include panels, posts, gates and hardware required.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating fencing components, attachments and hardware installation.
- C. Submit product data under provisions of Section 01 33 00.
- D. Submit product data for each type of fencing specified.
- E. Submit samples under provisions of Section 01 33 00.
- F. Submit two samples illustrating fencing finish.
- G. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed specified requirements.
- H. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 QUALITY ASSURANCE

- A. Quality Assurance: Under provisions of Section 01 40 10.
- B. Perform work in accordance with manufacturer's printed instructions.
- C. Maintain one copy of document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum ten years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience.

1.7 REGULATORY REQUIREMENT

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Store and protect products under provisions of Section 01 61 00.
- C. Protect fencing materials from damage.

1.9 SEQUENCING AND SCHEDULING

- A. Schedule work under provisions of Section 01 32 16.
- B. Coordinate work under provisions of Section 01 31 00.

1.10 WARRANTY

- A. All rails, pickets, and posts shall be warranted by the manufacturer for a period of 20 years from date of Substantial Completion. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
- B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufacturer's warranty shall be guaranteed for 5 years from date of Substantial Completion.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Montage II® Welded and Rackable Ornamental Steel, Genesis™ design, 3-Rail style, extended picket, industrial swivel brackets, 6'-0" in height, manufactured by Ameristar Fence Products, Inc., www.ameristarfence.com.
- B. Other acceptable manufacturers:
 - 1. Beta Fence USA, www.betafenceusa.com.
 - 2. Master Halco, www.masterhalco.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Steel Material for Fence Pickets, Rails and Posts: Galvanized prior to forming. Conform to requirements of ASTM A924, with a minimum yield strength of 45,000 psi. Hot-dip galvanized to meet requirements of ASTM A653 with a minimum zinc coating weight of 0.60 oz/ft², Coating Designation G-60.
- B. Fence pickets: 1 inch square x 14 Ga. tubing.
- C. Rails Steel channel, 1.75 x 1.75 x .105 inch. Picket holes in rail shall be spaced 4.715 inch o.c.
- D. Fence Posts: 3 inch x 12 gauge.
- E. Gate posts: Minimum size requirements below for gate width listed:
 - 1. 3'-0" to 8'-0": 4 inch x 11 gauge
 - 2. 8'-1" to 14'-0": 4 inch x 11 gauge
 - 3. 14'-1" to 16'-0": 6 inch x 3/16 inch thick

2.3 FABRICATION - FENCING

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

- B. Pickets shall be inserted into pre-punched holes in rails and aligned to standard spacing using a calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by fusion welding.
- C. Fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

2.4 FABRICATION - SWINGING GATES

- A. Swinging gate system shall conform to Exodus design series as manufactured by Ameristar Fence Product, Inc. www.ameristarfence.com.
- B. Gates that exceed 6'-0" in width will have a 1.75 inch sq. x 14 ga. intermediate upright.
- C. 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.
- D. Cable kits shall be provided for additional trussing for all gates leaves over 6'-0".
- E. Gate height shall match adjacent fence height.

2.5 FABRICATION - ROLLING GATES

- A. Rolling gate system shall conform to Pass Port Commercial design series, manufactured by Ameristar Fence Products, Inc. www.ameristarfence.com.
- B. Design series to match adjacent fence design.
- C. Ornamental Pickets: 1 inch sq. x 14 ga. spaced at 4-5/8 inch on center.
- D. Top Rails, Uprights and Diagonals: 2 inch sq. x 12 ga.
- E. Bottom Rail: 2 inch x 4 inch x 11 ga.
- F. Posts: 4 inch sq. x 11 ga.
- G. Gate Accessories: Roller guides, V-grooved wheels, V-track and gate stops as required by manufactured system.
- H. Assembled gate to withstand a 200 lb. load applied at mid span of gate without permanent deformation.
- I. Gate height shall match adjacent fence height.

2.6 FACTORY FINISHING

- A. Panels and posts shall be subjected to an inline electro deposition 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. The color shall be Black.
- B. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown below:
 - 1. Adhesion - ASTM D3359- Method D: Adhesion over 90 percent of test area.

2. Corrosion Resistance - ASTM B117, D714 & D1654: Resistance of over 1,500 hours.
3. Impact Resistance - ASTM D2794: Impact resistance of over 60 inch lbs.
4. Weathering Resistance - ASTM D822, D2244, & D523 (60 degree method): Weather Resistance of over 1,000 hours with color variance of no more than 3 delta - E color units.

2.7 GATE HARDWARE

- A. Swinging Gate Hardware: Fork type latch with gravity drop and provisions for padlock; center gate stop and drop rod for vehicular gates. Three 180 degree heavy duty gate hinges per leaf.
- B. Rolling Gate Hardware: Manufacturer's standard rolling gate latch capable of padlock attachment.
- C. Accessible gate hardware: Per hardware specification.
 1. Kickplate: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to G60 coating class according to ASTM A924 with minimized spangle, 0.067 inch thick, with all edges hemmed. Finish to match fencing.
 2. Security Screen: 1 / 8 inch thick galvanized steel screen. 3 / 16 inch round holes on 1/4 inch centers, staggered. 51 percent open area. Finish to match fencing.
 3. Closer: LCN 4040XPSRI parallel arm closer.
 4. Mullion: Sargent L980A removable lockable mullion.

2.8 CONCRETE MIX DESIGN

- A. Concrete: As specified in Section 32 13 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that locations for fencing are ready to receive work.
- B. Verify field measurements are as shown on shop drawings.
- C. Verify that required utilities are available, in proper locations, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.2 FENCE INSTALLATION

- A. Erect in accordance with manufacturer's instructions.
- B. Space fence posts at a maximum spacing of 8'-0" o.c.
- C. Anchor posts and panels to walls where required using mechanical fasteners and brackets provided by manufacturer.
- D. Anchor panels to posts with brackets provided by manufacturer.

- E. Install posts in concrete footings as follows:
 - 1. Line Posts: 12 inch diameter x 3'-6" depth.
 - 2. Corner Post: 1'-6" diameter x 4'-6" depth.
 - 3. Gate Posts: 1'-6" diameter x 4'-6" depth.
 - 4. Finish top of footing smooth with adjacent grade. Slope top to drain.
- F. When installing fencing adhere to the following steps to seal cut or drilled steel surfaces:
 - 1. Remove all metal shavings from cut area.
 - 2. Apply zinc-rich primer to cut or drilled area.
 - 3. Apply 2 coats of custom finish paint matching fence color.
 - 4. Primer and touch up paint to be provided by fence manufacturer.
- G. Install V-track for rolling gate in 6 x 12 inch concrete mow strip.

3.3 TOLERANCES

- A. Maximum Post Spacing Variation: ½ inch maximum.

3.4 ADJUSTING

- A. Adjust work under provisions of Section 01 77 00.
- B. Adjust gates for smooth operation with operating force off swinging pedestrian gates not to exceed 5 lbs pressure.

3.5 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean fencing and remove any excess materials from site.

END OF SECTION

SECTION 32 84 00

IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

The work of this Section shall conform to the "GREENBOOK Standard Specifications for Public Works Construction," latest edition, Section 212, Construction Specifications Operation Guidelines except as modified herein.

1.02 SCOPE OF WORK:

Work of this Section includes the furnishing, adjusting, installing and testing of mains, laterals, risers and fittings, quick couplers, gate valves, excavation and backfill, and all other work in accordance with the plans and specifications for a complete operating system. All work shall be in accordance with applicable City and County codes, and these plans/specifications.

1.03 RELATED WORK DESCRIBED ELSEWHERE:

A. Landscape Planting: Section 32 93 00

1.04 STANDARDS:

Materials and workmanship shall conform to the requirements of all applicable regulations and codes, except that requirements specified herein shall govern where they are greater. Refer and comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:

- A. National Electrical Code.
- B. Electrical Safety Orders of the State of California, Division of Industrial Safety.
- C. American Society for Testing and Materials International (ASTM):
 - 1. ASTM A53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM D1784- Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 3. ASTM D2466- Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 4. ASTM D2467- Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- D. American Society of Mechanical Engineers International (ASME):
 - 1. B36.10M- Welded and Seamless Wrought Steel Pipe.
- E. American National Standards Institute (ANSI):
 - 1. ANSI B125.1 – Welded and Seamless Steel Pipe.
 - 2. ANSI B125.2 – Black/Hot-Dipped Zinc Coated Welded/ Seamless Pipe.
- F. Federal Specifications:
 - 1. FS WW-P-460-Pipe Fittings: Brass or Bronze.
- G. Ductile Iron Pipe (ANSI):
 - 1. ANSI/AWWA C 100
 - a. ANSI/AWWA C 105/A2.5 Polyethylene Encasement –Corrosive Protection

1.05 QUALITY ASSURANCE:

- A. The Contractor shall maintain, continuously, a competent superintendent or foreman, 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 materials manufacturer's recommended methods of installation, and who shall direct all work performed under this Section. The superintendent shall be authorized to represent the Contractor.

- B. Prior to commencement of work, contractor shall verify drawing dimensions with actual field conditions, and exact location of irrigation water meter - point of connection provided by others. Verify existing pressure at point of connection; coordinate location and installation of new main line. Immediately report to the Landscape Architect and/or Owner all conditions, which prevent proper execution of this work.
- C. All assemblies specified herein shall be installed in accordance with the respective details. In the absence of detail Drawings or specifications pertaining to the specific items required to complete the work, the Contractor shall perform such work in accordance with the best standard practice and to the satisfaction of the Landscape Architect.
- D. Irrigation Contractor is responsible for replacing or repairing any acts of theft or vandalism during construction and the maintenance period.
- E. The Contractor shall obtain and pay for all permits and inspections required by outside agencies.
- F. Due to the scale of Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. Carefully investigate the structural and finished conditions affecting all of this work and plan this 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.
- G. All materials furnished and installed shall be new and shall conform to the Standard Specifications for Public Works construction, current edition as adopted by the Owner.
- H. The Contractor shall organize and conduct a pre-construction system familiarization meeting with Calsense Product Representative, Landscape Architect, and/or Irrigation Consultant.
- I. All materials except interconnect conductors shall have a three-year limited warranty. A five-year warranty shall apply when the controller is installed in a pre-assembled stainless-steel enclosure per the Owner's specification). The Contractor shall submit proof of warranty to the Owner prior to the start of the maintenance period. It is the Contractor's responsibility to obtain the necessary warranty inspections from the equipment supplier. No installation will be accepted without proof of warranty.
- J. All existing computerized irrigation control systems and all new computerized irrigation control system components shown on the plans shall be fully operational at final acceptance.
- K. All incidental parts which are not shown on the plans or specified herein and are necessary to complete the system shall be furnished and installed as though such parts were shown on plans or specified. All systems shall be in satisfactory operation at the time of completion.
- L. Any existing control/interconnect system shall be maintained in effective operation by the Contractor for the duration of the work. The Contractor shall notify the Landscape Architect 48 hours prior to performing any work on an existing system.
- M. The Contractor shall coordinate with the School District for Ethernet connections to the Local Area Network (LAN) service and installation of conduits at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no cost to the Owner. All changes to the plans shall be first approved in writing by the Landscape Architect.
- N. Work noted as "NIC." (Not in Contract) is not part of this section.
- O. Permission to shut off any irrigation lines must be obtained from the Owner. Disruption of existing systems and services shall be kept to a minimum.

1.06 SUBMITTALS:

- A. Product Data: Within five (5) days after award of the Contract, and before any materials of this Section have been delivered to the job site, submit to the Landscape Architect:
 - 1. A complete materials list of all items proposed to be furnished and installed under this Section.

2. The manufacturer's recommended methods of installation which, when recommended for approval by the Landscape Architect, shall become the basis for review and accepting or rejecting actual installation methods used on the work when not otherwise specified or detailed.
- B. **Materials and Samples:** The Contractor shall, prior to the installation of any irrigation work, submit for recommended approval by the Landscape Architect, a list of materials and equipment he proposes to use. The material and equipment list shall include, but not be limited to, polyvinyl chloride pipe, control valves, irrigation heads, quick coupler valves, and controllers.
1. Should the Contractor propose to use materials or equipment other than those listed on the plans, he shall submit samples of the make and type proposed. Samples shall be submitted a sufficient time in advance of the start of construction to allow a period of not less than seven (7) days for testing and recommended approval. Substitution of any product, material, or equipment without prior, written, recommended approval would not be permitted.
- C. **Manufacturer's warranties:** Shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- D. The Contractor shall submit to the Landscape Architect catalog data and full descriptive literature for approval of all items specified.
- E. Submit shop drawings and specifications for controller enclosure assembly(s), including electrical wiring schematic(s). Submit shop drawings and specifications for all special assemblies, e.g. booster pump(s), controller enclosure, central control computer system, flow sensing equipment, etc., if shown on the drawings.
- F. The Contractor shall furnish the articles, equipment, materials or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Architect.
- G. The Contractor shall submit to the Landscape Architect catalog data and full descriptive literature for approval of all items specified.
- H. Submit shop drawings and specifications for controller enclosure assembly(s), including electrical wiring schematic(s). Submit shop drawings and specifications for all special assemblies, e.g. booster pump(s), controller enclosure, central control computer system, flow sensing equipment, etc., if shown on the drawings.
- I. Equipment or materials installed or furnished without the prior approval of the Landscape Architect may be rejected and the Contractor required to remove such materials from the site at his own expense
- J. Approval of any item, alternate, or substitute, indicates only that the product(s) apparently meet the requirements of the drawings and specifications based on the information or samples submitted
- K. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranty shall only supplement the guarantee.
- L. Material shall be of the best quality obtainable, of American manufacture, and shall comply strictly with the drawings and specifications. All equipment shall be new and unused prior to installation.
- M. **Project Record Drawings:** Provide separate and complete Project Record Drawings prepared in accordance with the provisions of Sub-section 3.15, following

1.07 **PRODUCT HANDLING:**

- A. **Protection:** Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- B. **Delivery:** Polyvinyl chloride pipe shall be delivered to the work site in unbroken bundles or rolls packaged in such a manner as to provide adequate protection for the pipe ends, threaded or plain.

- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the recommended approval of the Landscape Architect and at no additional cost to the Owner.
- 1.08 SMART WATER APPLICATION TECHNOLOGY (S.W.A.T.) CERTIFIED:
- A. The Controller and Internet-based system shall be qualified through S.W.A.T. protocol test at the Center for Irrigation Technology (C.I.T.) with a score exceeding 98% on adequacy and being less than -2% on efficiency.
- 1.09 EQUIPMENT TO BE FURNISHED:
- A. Supply as a part of this contract the following:
- (1) Two sets of wrenches for disassembling and adjusting of each type of head installed.
 - (2) One operating key shall be furnished for each five (or less) gate valves installed.
 - (3) Two quick coupler keys with matching swivels with globe valves.
 - (4) Manufacturer cut sheet and operation manual for controllers and booster pumps.
 - (5) Two individually bound "Operating and Maintenance Manuals" detailing operation and maintenance requirements for irrigation systems. Include descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.
- Provide the following in each manual:
- a. Index sheet, stating Irrigation Contractor's name, address, telephone number and name of person to contact.
 - b. Duration of guarantee period, including all manufacturer's guarantees or warranties.
 - c. Equipment list providing the following for each item:
 - Manufacturer's name.
 - Make and model number.
 - Name and address of local manufacturer's representative
 - Spare parts list in detail.
 - Detailed operating and maintenance instructions for major equipment.
- B. The above-mentioned items shall be turned over to the Owner at the end of the project, prior to final payment.
- C. In addition to the above-mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Landscape Architect at the conclusion of the project that this service has been provided.
- 1.09 IRRIGATION CONTROL SYSTEM:
- A. The irrigation controller shall have a programmable watering calendar for up to 16 days and shall have water budgeting feature that changes all stations within a program from 0% to 255% (with 100% as normal).
- B. The irrigation controller shall have programmable delay between stations ranging from 1 second to 4 minutes and shall have a programmable "valve test" for system test purposes.
- C. Irrigation controller shall have a non-volatile memory that will hold program throughout power failure of any duration and shall have a real time battery backup to keep accurate time during power failures up to 30 days.

- D. Irrigation controller shall have automatic, semi-automatic, single station timed manual and true manual operation.
- E. Irrigation controller shall have a remote ready port and shall have a two-stage primary and secondary surge protection standard.
- F. Irrigation controller shall be UL listed and shall have a maximum operating output to valves: 43 vac, 1.80 amps (all programs including master valve).
- G. Transformers within controller shall have an input: 120 vac 60 Hz, 1.0 amp and an output: 24 vac, 2.08 amp.
- H. Irrigation controller shall have quick disconnect cables to terminal strip board and two separate sensor hook-ups for shut down and cycle initiation.

1.10 **GUARANTEE:**

The irrigation system shall be guaranteed for a period of one (1) year following site acceptance, in accordance with Sub-section 3.20, following.

PART 2 - MATERIALS

2.01 **GENERAL:**

All materials shall conform to Section 212 of the "Standard Specifications".

2.02 **AUTOMATIC CONTROLLER:**

- A. Refer to Legend

2.03 **IRRIGATION CONTROLLER ENCLOSURE:**

- A. The enclosure shall be of a vandal and weather resistant nature manufactured entirely of 304-grade stainless steel, and the top shall be 12 gauge and the body 14 gauge. The main housing shall be louvered upper and lower body to allow for cross flow ventilation. A stainless-steel backboard shall be provided for the purpose of mounting electronic and various other types of equipment. The backboard shall be mounted on four stainless steel bolts that will allow for removal of the backboard.
- B. The 38-inch height with flip top shall provide easy access for programming from a standing position under normal installations.
- C. The pre-assembled vandal resistant enclosure by Calsense shall come complete with lightning and surge protection and all terminals shall be factory labeled. The pre-assembled enclosure shall come provided with an On/Off switch to isolate the controller along with a GFI receptacle. An optional radio antenna shall be pre-mounted and connected on SSE-R enclosure. The enclosure shall include 27/8", 1-1/2" thick, 6-pin cylinder, die-cast steel padlock with unique shackles design.
- D. Factory pre-assembled enclosure with controller shall carry a full UL listing.
- E. The enclosure and Calsense installed equipment within shall carry a ten (10) year warranty.
- F. varying in size when the controller is specified as a –F option

2.04 PIPE:

Manufacture from virgin polyvinyl chloride compound in accord with ASTM 1785, 2241, and 2672 or 3139; hydrostatic design stress rating not less than 2,000 psi.

- A. PVC in accordance with ASTM 1785, 2241, 2672, 3139 Type 1, Grade 1
 - 1. Mainline shall be determined as follows:
2" and smaller shall be Sch. 40, 1120/1220 Streamline solvent weld
3" and larger shall be CL 315 solvent weld
 - 2. All 3" and larger shall have thrust blocks. All ends, corners, etc. on mainline which is 3" and smaller which would receive thrust from the mainline shall have a Joint Restraint System.
 - 3. Lateral Lines shall be 1120/1220 PVC Pipe Sch 40 Streamline solvent weld.
 - 4. All pipe shall be continuously marked with: Manufacturers name, nominal size, PVC type, pressure rating, SDR, NSF seal, and date of extrusion.
- B. Seamless copper water tube, ACT B88, Type "K", drawn temper.
- C. Brass screwed pipe shall be red brass conforming to Federal Specification #WW-P-351.
- D. Poly Swing Pipe; linear low-density polyethylene, black in color, O.D. 0.69, I.D. 0.49, wall thickness 0.20, pressure rating 80 psi at 110 degrees F.
- E. All pressure supply lines under vehicular paving to be installed with a PVC Schedule 40 sleeve, the sleeve shall be a minimum of twice the irrigation line diameter and shall extend a minimum of twelve inches (12") beyond such pavement. All other Irrigation Lines Sleeve or Low Voltage Control Wire Sleeves shall be PVC Schedule 40 polyvinyl chloride.

2.05 FITTINGS:

- A. Mainline Schedule 80 PVC Solvent Weld ASTM D 2464.
- B. Laterals Schedule 40 PVC ASTM D 2466, solvent weld, injected molded, IPS deep socket. NSF Seal of approval. Tee's and ells are to be side gated.
- C. Reducer tees will be used in cases of pipe size reduction. Bushing will only be allowed in cases of reduction where such a reducer tee is not manufactured.
- D. Rigid PVC Nipples: ASTM D1785, Schedule 80, Type 1, molded threads.
- E. Schedule 40 PVC street ells.
- F. Brass: Red brass conforming to Federal Specification #WW-P-351. Schedule 40 threaded nipple stock, tees, ells, and unions.
- G. Copper - Wrought solder-joints.
- H. Leemco, Inc Joint Restraint System "L" Series Ductile Iron ASTM A-536 with Low Alloy Steel (TinCor) standard, 304 Stainless Steel.

2.06 FITTING CONNECTION:

- A. Solvent Cement: ASTM D2564 for PVC Pipe and fittings.
- B. Use heavy body cement for Sch 80 fittings. Follow ASTM procedures for all pipe welding and installation. Use Teflon Tape at all fittings.

- C. PVC Primer: Use in all cases as recommended by pipe and fittings manufacturer.
 - 1. IPS Weld -On P - 70 primer
 - 2. IPS Weld -On 2711 (gray) cement
 - D. PVC to metal joints shall be made with PVC Schedule 80 threaded fittings into galvanize with female adapter to PVC pipe. The PVC fitting shall be hand tightened, plus one turn with strap wrench. Joint compound shall be IPS weld on Teflon pipe joint compound or equal.
 - E. Metal to Metal joints: graphite and oil lubricant or Teflon paste on male threads only.
- 2.07 SLEEVES AND CONDUIT: For use under paving and hardscape as sleeves for irrigation pipe and conduit for control wire shall be PVC;
- 2 ½" and Smaller shall be Sch. 40
 - 3" and Larger shall be Class 315
- A. Only standard lengths of pipe shall be used. Couple and weld only when length required is longer than a standard manufactured length.
 - B. See details for specifications of installation.
- 2.08 PIPE QUALITY AND PROTECTION:
- A. Pipe manufactured more than two years before installation not permitted. All pipes shall have been protected for sun exposure during storage and installation.
 - B. Pipe which show any sign that it has not been protected from exposure to sun at any time shall is not permitted.
 - C. Wrap all ferrous metals where come in contact with soil with Polyethylene encasement -corrosive protection
- 2.09 GALVANIZED PIPE AND FITTINGS:
- A. All galvanized steel pipe shall be Schedule 40, threaded, coupled and hot dip galvanized, and shall comply with ASTM A120 and A53.
 - B. All fittings for galvanized steel pipe shall be 150 psi rated galvanized malleable iron, banded pattern.
 - C. Pipe sizes indicated on the Drawings are nominal inside diameter unless otherwise noted.
- 2.11 COPPER PIPE AND FITTINGS:
- A. Pipe: Type K, hard tempered.
 - B. Fittings: Wrought copper, solder joint type.
 - C. Joints shall be soldered with silver solder, 45% silver, 15% copper, 16% zinc, 24% cadmium, solidus at 1125 Degrees F. and liquidus at 1145 Degrees F.
- 2.12 BRASS PIPE AND FITTINGS:
- A. Brass pipe shall be 85% red brass, American National Standard Institute (ANSI), Schedule 40 screwed pipe.
 - B. Fitting shall be medium brass, screwed 125-pound class.

2.13 Shut-Off Valves (Gate Valves):

- A. Gate valves shall be NIBCO T-113-irr, all brass, sized as required, with brass or galvanized nipples.

2.14 CONTROL WIRE:

- A. All control wire shall be of the Underwriter's Laboratory type UF (underground feeder), single conductor, solid copper, plastic insulated, 600 volts rated, for direct burial applications; maximum conductor operating temperature, 60 degrees C. for both wet and dry locations. Wire composition is as follows:
1. Conductor - The conductors shall be solid annealed uncoated copper meeting the applicable requirements of the latest revisions of ASTM B-3.
 2. Insulation - The insulation shall be colored plastic which meets the test requirements of I.P.C.E.A. (The Insulated Power Cable Engineer's Association) Pub. No. S-61-402, dated July 1961, Section 3.7 for 60 degrees C. polyvinyl chloride insulation. The insulation shall be flame retardant, resistant to fungus, resistant to corrosive fumes, suitable for wet locations and furnish some degree of inherent protections against mechanical abuse. Insulation thickness shall be 47 mils for AWG #14, #12 & #10, and 62 mils for AWG #8.
 3. Color Coding - The conductor insulation shall be color coded as follows:
 - a. All pilot (valve control) wires shall be uniquely colored for each controller on the site.
 - b. All common ground wire shall be white with a colored stripe to match the control wire color associated with that controller (i.e. if controller 'A' has red control wires, the common wire for controller 'A' shall be white with a red stripe).
 4. Wire Connections for direct burial shall be "one step" waterproof wire connectors.
 5. All wire for control for valves and pump start relays shall be insulated solid copper conductor of type approved for direct burial. Use color-coded wire for pilot wires, a different color for all valves of each controller, and install per valve manufacturer's specifications and wire chart. Common wire for each controller shall be white with stripe of same color as pilot wires. Spare wires shall be black. A color different from all pilot and extra wires shall be used for master valve and flow sensor wires.
- B. Sizing of wire shall be in accordance to manufacturer's recommendations, in no case less than #14 in size.
- C. Connections on 24-volt wire shall be made by Scotchloc. Connector Seating Pack #3577 as manufactured by the 3M Company, Dri-Splice DS-400 as manufactured by Spears or approved equal.
- D. Higher voltage line connections or 110 volts shall be made by clamp and waterproofed with 3M Company Scotch cast splicing kits or approved equal.

2.15 WIRE SPLICES:

- A. Conductors shall be installed with no underground splices, unless necessary and unavoidable. Any and all underground splices that are required to be made, must be approved by the Architect, and shall be placed in a suitable type valve box for easy access.
- B. Wire splices on the two conductor cable communication wires shall be made with 3M DBY splice kit or approved equal.
- C. Wire splices on the multi-conductor cable communication wires shall be made with Preformed Super Serviseal with Polybee sealant (product #8006039).

2.16 AUTOMATIC CONTROL VALVES (ELECTRIC):

- A. All automatic control valves (electric) shall be globe or angle pattern, electrically controlled, hydraulically operated, single seat, normally closed.
- B. The valves shall be actuated by a normally closed solenoid valve operator, using a 24-volt, 60-cycle alternating current. The wires in the coil of the solenoid shall be embedded in an epoxy resin. The entire solenoid shall be enclosed in a watertight housing. Valves shall automatically close in event of electrical power failure.

- C. All automatic control valves shall have a flow control device for manually adjusting the amount of flow of water through the valve. The flow control device shall be adjusted so that the pressure at the nozzle of the sprinkler head farthest from the automatic control valve shall be that as specified in the irrigation legend per plan. The pressure at the sprinkler head shall be measured by means of a pilot tube and pressure gauge while the sprinkler head is operating.
- D. Automatic control valves shall be as specified on the plans. Reference the irrigation plans, details, and legends for size and appropriate model number.
- E. Tags: Christy's Standard Irrigation ID Tags.

2.17 VALVE BOXES:

- A. Required for each remote-control valve and stubbed ends of control wires. The valve box shall be durable plastic: CARSON OR BROOKS or an approved equal and identified with letters "RCV" stenciled two inches (2") high on the outside of the cover with purple lid cover.
 - 1. Carson 1419 - 12 Series - Standard rectangular. Use 1419 T-cover with captive pentahead "L" Bolt.
- B. Quick coupling valve boxes shall be round durable plastic: CARSON OR BROOKS or an approved equal with purple lid cover. The cover shall be branded with the letters "QCV," two inches (2") high
- C. Gate valve and ball valve boxes shall be durable plastic: CARSON OR BROOKS or an approved equal with purple lid cover. The cover shall be identified with the letters "GV" or "BV", two inches (2") high stenciled on the outside of the cover.

2.18 SPRINKLER HEADS:

- A. As per drawings.

2.19 Bubblers/ Drip Assemblies:

- A. Low Volume Emitters -Salco Pro-Spec Emitter/ RainBird Drip Assembly or approved equal.
 - 1. ½" FIPT (PST) or ¼" barbed base (PS)
 - 2. PC Flow: .05, 1, 2, or 4 gph.
 - 3. Pressure range: 5-65 psi
 - 4. Zone Filtration: 100 – 150 mesh
 - 5. Internal Check Valve feature, model (PST-CV) include positive spring to holdback 9.25' of elevated water.
- B. IH Series Riser:
 - 1. Pre-assembled with two ½" MIPT UVR male adapters
 - 2. Maximum Flow: 7 gpm
 - 3. Maximum Pressure: 60 psi.

Refer to Irrigation Legend for model numbers and irrigation detail sheet.

2.20 SWING JOINTS:

- A. Swing joints shall consist of schedule 40 PVC Street ells and schedule 80 nipples of proper length per sprinkler head for rotor heads and marlex for street ells and swing pipe for spray heads.

2.21 PULL BOX:

- A. All pull boxes shall be Carson (concrete), or equal, for connection of conduit and route of communication and sensor cable. The pull box will have a cast iron lockable traffic lid.

2.22 BACKFLOW UNIT: (As REQUIRED)

- A. Reduced Pressure Backflow Prevention. Size and type per Irrigation Plans.

PART 3 - EXECUTION

3.01 GENERAL:

All work shall conform to Section 308 of the "GREEN BOOK Standard Specifications FOR Public Works Construction" except as modified herein. No work of this Section other than sleeving under pavement shall commence prior to the completion and acceptance of all grading work specified in Earthwork Section

- A. Prior to all work of this Section, carefully inspect existing site conditions and equipment. Verify available pressure at point of connection and location of "service line provided by Plumbing Engineer.
- B. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the reference standards and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Landscape Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- D. Trenches and other excavations for irrigation pipe and appurtenances shall be excavated true to alignment and grade and shall be of ample size for the proper performance of installation work, review, testing and backfill.
- E. Protect all existing utilities and repair any damage to existing utilities with matching new materials, at no increase in contract price.
- F. Generally, piping under concrete shall be installed by jacking, boring or hydraulic driving. Where any cutting or breaking of pavement, track sections and/or concrete work is necessary, it shall be removed and replaced by the Contractor. Permission to cut or break pavement, track sections and/or concrete shall be obtained from the Owner. No hydraulic driving will be permitted under asphalt concrete paving or track sections.
- G. Coordinate with planting operations, as ten inch (10") deep cross-ripping is required prior to irrigation systems installation. (Cross-ripping is part of the planting work).

3.02 UTILITY SERVICES:

- A. Contractor shall provide for connections to electrical services at locations indicated on the drawing.
- B. Contractor shall connect new mainline to water services at locations indicated on the drawings. Refer to Civil Engineers Utility Plans.

3.03 LAYOUT:

- A. All piping or equipment show diagrammatically on drawing outside of planting areas shall be installed inside planting areas whenever possible.
- B. Layout each sprinkler head and make any minor adjustments required due to differences between actual site conditions and the Drawings. Minor adjustments shall be maintained within the original design intent. Protect in place all existing trees and shrubs.

3.04 TRENCHING AND BACKFILL:

- A. Trenching:
 - (1) Minimum trench width shall be six inches (6").
 - (2) Minimum trench depth below bottom of pipe shall be two inches (2").

- (3) Minimum cover shall be based on finished grades, unless otherwise noted on Drawings.
 - a. Lateral Line cover shall be no more than twelve inches (18").
 - b. Main Line minimum cover shall be twenty-four inches (24") for lines two and one-half inches (2-1/2") and less; twenty-four inches (24") for lines two and one-half inches (2-1/2") and larger.
 - c. Pipe and Wire Sleeves minimum cover shall be twenty-four inches (24").

B. Backfill:

- (1) All plastic pipe shall be bedded and encased with approved backfill material free of rocks and clods as indicated in the following table and/or shown on the plans.

Thickness under Pipe Minimum	Thickness above Pipe Minimum	Thickness at Side of Pipe Minimum
Two inches (2")	Four inches (4")	Two inches (2")

- (2) Provide not less than four inches (4") clearance between each line and not less than six inches (6") clearance between lines of other trades, unless otherwise noted.
- (3) Do not install parallel lines directly over any other line.
- (4) The balance of backfill material shall be approved soil. Unsuitable material, including clods and rocks over three fourths inch (3/4") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.
- (5) Backfill material shall be sufficiently compacted under and on each side of the pipe to provide support free of voids. Pipe joints shall remain exposed until the completion of pressure and leakage test, unless authorized by the Architect. The top six inches (6") of backfill shall be free of rocks over one inch (1"), subsoil, rubbish and debris.
- (6) The remainder of the backfill material shall contain no lumps or rocks larger than two and three fourths inches (2-3/4"), nor contain rubbish and debris.
- (7) Backfill shall be tamped or puddled to the dry density of adjacent soil. Backfill within areas of structurally compacted soils shall be returned to the original relative density as before trenching.

3.05 INSTALLATION OF PIPE:

- A. Unless otherwise specified, the construction of lateral lines and main lines shall include excavation and backfill, the furnishing, installing and testing of pipe, tube and fittings, the furnishing and installing of anchors, Joint Restraint System and location wire, the improvements, line flushing and testing, and all other work in accordance with the plans and specifications.
- B. Polyvinyl chloride pipe shall be installed in such a manner to provide for expansion and contraction as recommended by the manufacturer.
- C. All polyvinyl chloride pipe shall lay free in the trench with no induced strain. Where there is evidence of induced pipe strain, the Contractor shall be required to make pipe cuts and install angle fittings as necessary to eliminate the strain.
- D. When a connection is plastic to metal, a female adapter shall be used. The metal nipple shall be hand-tightened, plus one turn with a strap wrench. Joint compound shall be IPS weld-on Teflon pipe joint compound or equal. (Plastic to galvanize coupling to galvanize nipple. Do not connect galvanize into plastic).

- E. The Contractor will be required to remove and replace any fitting, which induces a torque strain to the pipe.
- F. Polyvinyl chloride pipe shall be cut with a PVC pipe cutter, hand saw, or hack saw with the assistance of a square and sawing vise or in a manner to ensure square ends. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.
- G. All plastic-to-plastic joints shall be solvent-weld joints. Only the solvent recommended by the pipe manufacturer shall be used.
- H. The solvent-weld joints shall be made in the following manner:
 - 1. Thoroughly clean the mating pipe and fitting with a clean dry cloth.
 - 2. Try the parts for fit. The parts should "dry-mate" between one-third (1/3) and two-thirds (2/3) the depth of the socket. If adequate insertion is not obtained, or bottoming occurs, try another part until a satisfactory "dry-fit" is obtained.
 - 3. Apply a uniform coat of solvent to the outside of the pipe with a non-synthetic bristle brush.
 - 4. Apply a uniform coat of solvent-weld to the fitting socket.
 - 5. Reapply a light coat of solvent-weld to the pipe and quickly insert it into the fitting.
 - 6. Give the pipe or fitting a quarter turn to ensure even distribution of the solvents and make sure that the pipe is inserted to the full depth of the fitting socket.
 - 7. Hold in position for at least fifteen (15) seconds.
 - 8. Wipe off excess solvent that appears at the outer shoulder of the fitting.

NOTE: For PVC Type I, 1120-1220, pipe mating surface shall first be cleaned with the application of Methyl Isobutyl Ketone (MIBK) solvent. This cleaning shall be accomplished by applying MIBK solvent to the full mating surface area and wiping off with a clean cloth, repeating the process, if necessary, until no trace of shine remains (neither streaks nor spots). The use of commercial PVC solvent-cement thinners as a substitute of MIBK is not allowed.
- I. Pressure supply steel pipe and fittings: Assemble using red lead and boiled linseed oil paste or an approved equivalent. Brass and Galvanized threaded fittings shall be assembled with both Teflon tape and oil base compound to male threads only.
- J. Provide concrete thrust blocks at each change of direction and at all terminal points of all rubber gasket piping. Block in accord with pipe manufacturer's instructions.

3.06 INSTALLATION OF PIPE UNDER EXISTING PAVING:

- A. Piping under existing pavements may be installed by jacking, boring or by hydraulic driving, except as otherwise specified or directed.
- B. All pipes under pavement surface to be installed a minimum of 24 inches below A.C. paving with a 6-inch bedding and a 6-inch cover of sand backfill.
- C. Secure Owner's permission prior to cutting or breaking existing pavements.
- D. Make completely clean cuts using power saws at approved locations only.
- E. Replace and restore all surfaces to original condition, including grade, landscaping and paving
 - 1. Restoration work shall match the original work in every respect, including type, strength, texture and finish.

2. Consult with Owner for approved methods of patching and/or replacing any damaged paving sections as a result from boring, saw cutting or removal.

3.07 INSTALLATION OF PIPE UNDER NEW PAVED AREAS:

- A. Coordinate installation of piping and wires under paved areas with other trades.
- B. All pipes under pavement surface to be installed a minimum of 24 inches below A.C. paving with a 6-inch bedding and a 6-inch cover of sand backfill.
- C. If the only piping installed is over 20 feet long, pressure testing is required for that section at the time of installation. Upon completion of piping installation, the entire system must be tested.
- D. If wire under paved areas cannot be continuous, all splices shall be enclosed in an approved pull box.

3.08 INSTALLATION OF CONTROL WIRE:

- A. Unless otherwise specified, the installation of control wire shall include excavation and backfill, the furnishing, installing and testing of the wires, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.
- B. Unless otherwise specified all neutral (common ground) wire shall be AWG #12 and all pilot (valve control) wire shall be AWG #14.
- C. At least one spare wire shall be installed from the controller clock to the most distant valve. When wire runs go in different directions from the controller clock, a separate spare wire shall be installed from the controller clock to the most distant valve in each different wire run direction.
- D. Tape and bundle all control wires at ten feet (10') o.c. maximum; place wiring with eighteen inch (18") minimum cover. When wiring is placed in common trenches with piping, set wiring two inches (2") from any piping. Place control wire along right side of pipe. Do not place over the pipe.
- F. All wire splicing shall take place in the valve boxes and/or pull boxes. All splices shall be made with a mechanical connector encased in a self-curing epoxy resin which provides a permanent watertight connection. No underground splices will be allowed.
- G. All direct burial control wires shall be identified as to their respective valve number and controller clock letter in all pull boxes and at all wire termination. Spare wires and "future valve" wires, if any, shall also be identified. Labels and tags shall be used for identification which are not affected by moisture or temperatures between minus 30 degrees F. and plus 200 degrees F. The labels and tags shall be resistant to abrasion, dirt, grease, and chemicals used in lawn fertilizers and conditioners. The labels and tags shall be firmly attached to the wire in every case. The Contractor shall submit samples of the labels or tags to be used, to the Architect for recommended approval, prior to the installation of the control wire. Examples of nomenclature of tags or labels are as follows:

Neutral (common ground) wire	= "Neutral" Clock "A"
Pilot (valve control) wire	= "A.V. #1." Clock "A"
Spare Wire	= "Spare" Clock "A"
- H. The final operating sequence of the remote-control valves, within each individual controller clock, shall be as called out on drawings.

I. Testing:

- (1) All direct burial control wire installed shall be tested in the following manner.
 - a. Before any backfill material is placed over the control wires in the trench, the wires shall be tested with a meter for insulation resistance. Minimum insulation resistance to ground shall be fifty - (50) megohms. Any conductor not meeting this requirement shall be replaced.
 - b. After backfill encasement, the wires shall again be tested with a meter. The minimum acceptable insulation resistance to ground on this test shall be one (1) megohm. Any conductor not meeting this requirement shall be replaced.

3.09 INSTALLATION OF AUTOMATIC CONTROLLERS:

- A. Unless otherwise specified, the installation of automatic controllers shall include the test of controllers and connection.

3.10 INSTALLATION OF VALVES:

- A. General: Unless otherwise specified, the installation of the valves shall include excavation and backfill, the furnishing, installing and testing of fittings and valves, the furnishing and installing of valve boxes and appurtenances, accessories, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.
 - (1) Fill area under valve box with a minimum of three (3) cubic feet of pea gravel before box is installed.
- B. Shut-off Valves: Shut-off valves installed underground shall be housed in a suitable valve box. The gate valve hand wheel shall be removed from the stem of all valves installed underground. The wheel shall be replaced with an operating nut.
- C. Quick Coupling Valves: Unless otherwise indicated, locate valves within twelve inches (12") of hardscape. Install in designated valve box.
- D. Automatic Control Valves: Automatic control valves shall be set upright and housed in designated valve box, with a hinged, lockable top. The Contractor shall place Christy's Standard Valve Identification tags on each valve corresponding to its appropriate valve station number.

3.11 INSTALLATION OF SPRINKLER HEADS:

- A. Unless otherwise specified, the installation of sprinkler heads shall include excavation and backfill, the furnishing, installing and testing of risers, fittings and heads, the furnishing and installing of cone shaped screens at base of each head, the removal and/or restoration of existing improvements and all other work shall be in accordance with the plans and specifications.
- B. Flushing: All water lines shall be thoroughly out before heads are installed.
- C. Location and arc of heads shall be adjusted, if required to eliminate any dry spots, over water or spillage on adjacent areas.
- D. All lawn sprinkler heads to be installed adjacent to existing walks, curbs, or other paved areas, shall be set to the grade of the existing improvements. Sprinkler heads which are to be installed in areas where the turf has not yet been established shall be set two inches (2") above the proposed finished grade. The Contractor prior to final acceptance shall lower heads installed in this manner. In established lawn areas the sprinkler heads shall be set to existing grade.

3.12 SWING JOINTS:

- A. Double Swing-joints will consist of three street elbows plus one Schedule 80 riser of proper length.
- B. Marlex may be used with Teflon Tape at all turf / shrub body assemblies. The double swing joint shall be constructed with a marlex elbow closet to the lateral and a PVC elbow closet to the connection of the sprinkler head.

3.13 THRUST BLOCKS:

- A. Thrust blocks shall be concrete 2000 psi at 28 days. They shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set.

3.14 INSTALLATION OF WARNING TAPE:

- A. Warning tapes shall be installed directly on top of the pipe longitudinally and shall be centered. The warning tape shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic tape banded around the pipe with fasteners no more than 5 feet apart. Taping attached to the sections of pipe before lying in the trench shall have flaps sufficient for continuous coverage. All risers between the mainline and control valves shall be installed with warning tape.

3.15 ELECTRICAL:

- A. Contractor shall verify power sources shall be as indicated on the drawings.
- B. The Contractor shall be responsible for making 110-volt electrical connections to the automatic controller and wire circuits from remote control valves to controllers. All electrical work shall be in accordance with all local and /or county ordinances. Wire sizes to be as per manufacturer's specifications.

3.16 RECORD DRAWINGS:

- A. The Contractor shall provide and keep up to date, a complete record set of bond prints which shall be corrected daily and show every change from the original Drawings and Specifications and the exact locations, sizes and kinds of equipment. Prints for this purpose may be obtained from the Owner. This set of Drawings shall be kept on the site and shall be used only as a record set. Architect shall review drawings prior to any planting.
- B. In order to complete the record Drawings in a neat, legible manner, the contractor shall indicate the necessary changes on bond tracings procured from the Owner/Landscape Architect.
- C. The contractor shall dimension from two (2) permanent points of reference, building corners, sidewalks, etc., the location of the following items:
 - 1. Point of connection (referenced from known existing elements to remain).
 - 2. Connection to electrical power.
 - 3. The routing of the sprinkler main lines. (Dimension every one hundred feet [100'] maximum and at change in direction).
 - 4. Routing of control wiring by valve number and location of existing controller
 - 5. Shut-off valves.
 - 6. Control valves.
 - 7. Quick coupling valves.
 - 8. Show where sleeves are installed under paving and concrete.
 - 9. Pull boxes / wire splice boxes.
 - 10. Spare wire locations.
 - 11. Any other pertinent underground item, if so deemed by the Landscape Architect.
- D. On or before the date of the final inspection, deliver the completed record drawings to the Architect. Delivery of the record drawings will not relieve the Contractor of the responsibility of furnishing additional information that may have been omitted from the original record drawings.

3.17 EQUIPMENT TO BE FURNISHED:

- A. Six (6) operator and service manuals and information pages for all equipment used shall be furnished to the Owner. Manuals may be loose leaf and should show drawings or exploded views of equipment and catalog number. Operating instructions for all equipment shall be furnished.

3.18 GUARANTEE:

- A. The entire irrigation control system shall be guaranteed by the Contractor as to material and workmanship, for a period of one year following the date of final acceptance of the work
- B. Should any operational difficulties in connection with the irrigation control system develop within the specified guarantee period, which in the opinion of the Owner may be due to inferior material and/or workmanship, said difficulties shall be immediately corrected by the Contractor to the satisfaction of the Owner, at no additional cost.
- C. Notes and any other manufacturer-guarantees required in other articles of this specification. Provide Owner with original copy of all guarantees required.

3.19 CONTROLLER CHARTS:

- A. Prior to the date of the final acceptance of the project, at the end of the Landscape Maintenance period, the Contractor shall acquire from the architect a CAD file and or print(s) at the Contractor's expense and record from the jobsite record set all changes made during construction and label as "Record Drawings" Do not prepare charts until record Drawings have been approved by the Owner's representative.
- B. Provide in controller chart for each automatic controller installed.
 - 1. Chart may be a reproduction of the record drawing if the scale permits fitting the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - 2. Chart shall be black-line print of the actual system, showing the area covered by that controller.
- C. Identify the area of coverage of each remote-control valve, using a distinctly different pastel color, drawn over the entire area of coverage.
- D. Following approval of charts by Owner's representative, they shall be hermetically sealed between two layers of 20-mil thick plastic sheet.
- E. Charts must be completed and approved prior to final review of irrigation system.

3.20 TESTS:

- A. Pressure Tests:
 - 1. All pressure lines shall be tested under hydrostatic pressure of 150 pounds per square inch, and all non-pressure lines shall be tested under the existing static pressure and both are proved watertight. Contractor shall provide all equipment for hydrostatic tests at no cost to the Owner.
 - 2. Pressure shall be sustained in the lines for not less than two (2) hours. If leaks develop, the joints shall be replaced, and the test repeated until the entire system is proved watertight.
 - 3. Tests shall be observed and recommended for approval by the I.O.R (Inspector of Record/and or owners field superintendent prior to backfill.
- B. Coverage Test:
 - 1. When the irrigation system is completed, the Contractor, in the presence of the Landscape Architect, shall perform test coverage of water afforded the planting areas, complete and adequate. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage disclosed arising from his work.
 - 2. Contractor shall inform the Owner's representative of any deviation from the plan required due to wind, planting, soil or site conditions that bear on proper coverage; and upon approval, perform changes to provide for proper coverage at no additional cost to Owner.

- C. The Contractor shall cause the following tests to be performed by equipment supplier on all electrical circuits and system components and shall submit a written approval from the equipment supplier to the Architect prior to the start of the establishment period.
1. Each circuit shall be labeled and tested for continuity.
 2. Each circuit shall be tested for leaks to ground with an ohm meter after each inter-connects circuit have been installed and connections have been made. No circuit checking lower than 1 mega-ohm will be acceptable
 3. The grounding system shall be tested with a meter and shall not measure more than 15 ohms.
 4. A functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended. The test may commence only with the approval of the Architect.
 5. The functional test for each new or modified electrical system shall consist of not less than five days of continuous, satisfactory operation. If unsatisfactory performance of the system develops, the condition shall be corrected, and the test shall be repeated until the five days of continuous satisfactory operation are obtained.
 6. Starting of functional tests and turn-on shall not be made on a Thursday or on the day preceding a legal holiday. Shutdown caused by factors beyond the Contractor's control shall not constitute discontinuity of the functional test.
 7. Any material revealed by these tests to be faulty in part of the installation shall be replaced or corrected by the Contractor at his/her expense in a manner permitted by the Architect. The same test(s) shall be repeated until no fault is evident.
 8. Results of circuitry tests shall be recorded and submitted to the Architect prior to acceptance of work.

3.21 REVIEWS:

- A. Normal Progress Reviews: Normal progress reviews shall be requested from the Architect at least forty-eight (48) hours in advance of any anticipated review. The Landscape Architect on each of the steps listed below will make a review. The Contractor will not be permitted to initiate the succeeding steps of work until he has received written approval to proceed by the inspector.
1. Immediately prior to the commencement of the work of the Section.
 2. Pressure supply line installation, trenching and testing.
 3. System layout.
 4. After placement of all heads, valves and controllers for coverage test.
 5. Final review and receipt of "Record Drawings" and "Controller Charts."
 6. Final acceptance of project by Owner.
- B. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval. The Contractor, at his expense, shall open any work covered prior to review to view.
- C. Unprepared Review Requests: In the event the Contractor requests review of work and said work is incomplete, the Contractor shall be responsible for review cost.
- D. Completion: The work will be accepted, in writing, when the whole system shall have been completed satisfactorily to the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved by the Owner, in writing, at the proper times.
1. Leave the entire installation in complete operating order, free from any and all defects in material, workmanship or finish, regardless of any discrepancies and/or omissions in plans or specifications.
 2. Remove from the site all debris and rubbish resulting from the work and leave the installation in clean condition.

3.22 MAINTENANCE:

- A. Maintenance of irrigation system prior to job completion, and during the Landscape Maintenance period, shall be the responsibility of the Contractor including, but not limited to, the following:
1. Cleaning of plugged irrigation heads.
 2. Irrigation heads adjustments. The Contractor shall check all systems for proper operation a minimum of once a month. Lateral lines shall be flushed out after removing the last sprinkler head or at two at each end of the lateral as deemed necessary. All heads are to be adjusted as necessary for optimum head to head coverage.
 3. Volume of water being applied. (Coordinate with landscape maintenance).
 4. Programming of the controller. (Coordinate with landscape maintenance). Set program automatic controllers for seasonal water requirements. The Contractor shall adjust his watering schedule equal to the application rate each area can receive based upon topography, soil type, plant material, season, available E.T data and weather. The Contractor shall provide the owner with a key to controllers and instructions on how to turn off the system in case of emergency.
 5. Repairing leaking valves, etc.
 6. Any other problem areas, which occur after installation, attributed to the irrigation system.
 7. Repair or replace equipment due to acts of vandalism, theft or pest damage. Repairs shall be made within one watering cycle. All replaced equipment shall match equipment specified on the plans and within these specifications.
 8. Lower all turf heads to final grades prior to final acceptance by Owner.

END OF SECTION

LANDSCAPE PLANTING

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Bare-Root Stock (Applies to Palms only): Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- D. Finish Grade: Elevation of finished surface of planting soil (not top of mulch or thatch layer).

- E. **Manufactured Topsoil:** Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- F. **Pesticide:** A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- G. **Pests:** Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- H. **Planting Area:** Areas to be planted.
- I. **Planting Soil:** Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- J. **Plant; Plants; Plant Material:** These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- K. **Root Flare:** Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- L. **Stem Girdling Roots:** Roots that encircle the stems (trunks) of trees below the soil surface.
- M. **Subgrade:** Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- N. **Subsoil:** All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- O. **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

1.05 **QUALITY ASSURANCE:**

- A. The Contractor shall provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with the type of materials being installed and the proper materials and methods for their installation, and who shall direct all work performed under this Section.
- B. All plants and planting material shall meet or exceed the specifications of Federal, State and County laws requiring inspection for plant disease and insect control.
- C. **Nursery Qualifications:** Company specializing in growing and cultivating the plants with three years documented experience and which is regularly inspected by the State Department of Agriculture.
- D. **Installer's Qualifications:** Landscaping Work shall be performed by a single firm specializing in commercial landscaping.
- E. **Source Quality Control:**
 - 1. **General:** Ship landscape materials with certificates on inspection required by governing authorities. Comply with regulations applicable to landscape materials.
 - 2. Do not make substitutions. If specified landscape materials are not obtainable, submit proof of non-availability to Landscape Architect or Owner together with propose plant substitution. For equivalent use of material as specified.

3. Analysis and Standards: A Package standard product with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Agriculture Chemists wherever applicable.
 4. Topsoil: Before delivery of topsoil, submit independent laboratory analysis of topsoil fill. Analysis shall indicate percentage of nitrogen, phosphorus, potash; soluble salts content, organic matter content, and pH value. Submit data to independent testing and inspection agency for Project as specified in Sub-section 1.04E.
 5. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscaping and complying with recommendations and requirements of ANSI Z60.1 – American Standard for Nursery Stock. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sunscald, injuries, abrasions or disfigurement
 6. Label at least one tree and one shrub of each variety with a securely attached waterproofed tag bearing legible designation of botanical and common name.
 - a. Dimensions: The height and spread of all plant material shall be measured with branches in their normal positions. The caliper of other dimensions of any plant materials shall be of standard quality and size for type listed. When the same species of tree is shown in a group planting on the plan, all trees in the group shall match in height, spread and appearance. The height of balled and burlapped Palm trees shall be measure from the base of the palm above the finish grade to the bottom of the first green frond projecting upward from the palm pineapple. Refer to the Palm tree planting detail on the detail sheet.
 7. Inspection: The Landscape Architect reserves the right to inspect box size trees at place of growth or upon delivery to the site prior to planting for compliance with requirements for genus, species, variety, size and quality. Owner retains the right to further inspect trees and shrubs for size and condition of root-balls, root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.
- F. The Applicator of all weed control materials shall be licensed by the State of California as a Pest Control Operator and a Pest Control Advisor in addition to any subcontractor licenses that are required.
1. Provide certificate of compliance from governing authority having jurisdiction indicating approval of herbicide mixture.
- G. All materials and methods used for Weed Abatement must conform to Federal, State, and Local Regulations.
- H. Industry Standards: The following standards shall be referenced from a part of this Section.
1. Standardized Plant Names latest edition issued by the American Joint Committee on Horticulture Nomenclature.
 2. American Standard for Nursery Stock for Stock, latest edition issued by American Association of Nurserymen, Inc.
- I. The Contractor shall obtain soil samples from the following areas after rough grading but prior to soil preparation and fine grading: Submit Samples to Wallace Laboratories: 365 Coral Circle. El Segundo, Ca. 90245. Tel: (310) 615-0116 or an approved Soils Lab. Samples shall be taken at a minimum depth of 12 inches below the rough finish grade.

1.06 SUBMITTALS:

A. Materials lists: Within five (5) days after award of the Contract, submit a complete list of all materials proposed to be furnished and installed under this Section, demonstrating complete conformance with the requirements specified.

1 Materials list shall include the weed control materials and quantities per acre intended for use in controlling the weed types prevalent and expected on the site, as supplied by the Landscape Contractor. Landscape Contractor shall furnish the general contractor and landscape Architect data to demonstrate the compatibility of the weed control materials and methods with the intended plant and seed varieties.

2 Samples: Topsoil. Submit three 10-lb samples of topsoil fill to testing laboratory, in air-tight containers and submit to an approved Soils Laboratory for agronomic soil testing.

3. Planting Schedule: Proposed Schedule: proposed planting schedule, indicating dates for each type of landscaping work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of Substantial Completion review. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

4. Selection, Tagging and Ordering Plant Material:

a. Submit request for inspection and documentation to the Landscape Architect and Owner at least one month prior to start of landscape planting work, certifying that all plant materials have been ordered.

b. Plants shall be subject to inspection and rejection by the Landscape Architect and Owner at place of growth and after delivery, for conformance to specifications.

5. Present shipping tickets of Hyro-Stolens; Hydro-Mulch and or Hydro-Seeding Mixes upon delivery of material onsite.

B. Certificates: Deliver all certificates to the Landscape Architect upon delivery to job site. Include:

1 Quantity of commercial fertilizers

2 Quantity of soil amendments.

3 Quantity and quality of plant material

4 Quality and purity of seed germination

1.07 PRODUCT HANDLING:

A. Delivery and Storage:

1. Deliver all items to the job site in their original containers with all labels intact and legible at time of Landscape Architect's review.

2 Plants damaged during transit or delivery, or exhibiting broken limbs, defoliation or damaged from heat, frost or wind shall be rejected at the project site and replaced with new stock at no charge in Contract Time or Sum to the Owner.

3 Handle plant in a manner to avoid any damage to the plant. always Protect plants from sun or drying winds. Plants that cannot be planted immediately upon delivery shall be kept in the shade, well protected and adequately watered. Do not store plants on asphalt paving for a period no longer than a full workday.

4. Trees and Shrubs: Deliver trees and shrubs after preparations for planting have been completed and plant immediately. Keep Plants moist
 - a. Do not prune prior to delivery unless otherwise approved by the Landscape Architect.
 - b. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark break branches or destroy natural shape.
 - c. Provide protective covering during delivery.
 - d. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.
5. Groundcovers: Deliver plant materials immediately prior to placement. Keep plants moist. Do not remove container-grown stock from containers until planting time.

1.08 RESPONSIBILITY AND COORDINATION DURING WEED ABATEMENT:

- A. During Weed Abatement procedures, the landscape contractor is responsible for the erection of all signs and barriers required to prevent intrusion into the treated areas and to notify the public.
- B. No material or methods used for Weed Abatement shall affect the landscape planting or turf establishment. No material or method shall render the job site unusable for more than ten (10) days from date of application.
- C. Weeds: Include Dandelion; Jimsonweed; Quackgrass; Horsetail; Morning Glory; Rush Grass; Mustard, Lambsquarter; Chickweed Cress; Crabgrass, Canadian Thistle, Nutgrass, Posion Oak, Blackberry, Tansy Ragwort, Bermuda Grass ,Johnson Grass. Poison Ivy, Nut- Sedge, Nimble Will, Bent weed, Wild Garlic, Perennial Sorrel and Brome Grass

1.09 PROJECT CONDITIONS:

- A. Utilities- Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- B. Excavation – When conditions detrimental to plant growth are encountered, such as rubble fills, adverse drainage conditions, or obstructions, notify Architect/Engineer before planting.

1.10 SEQUENCING AND SCHEDULING:

- A. Planting Time - Proceed with and complete landscaping work as rapidly as portions of site become available.
 1. Correlate planting with specified maintenance periods to provide maintenance from date of Substantial Completion review.
 2. All irrigation work shall be inspected and approved before start of any work of this section.
- B. Coordination with lawns/turf areas – Plant trees and shrubs after grades are established and prior to planting lawns –hydro seeded or sodden- unless otherwise acceptable to Architect/Engineer. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- C. Observations:
 - 3 All field observations herein specified shall be made by the Landscape Architect/District. The Contractor shall request at least 48 hours in advance of the time observations are required.
 - 4 Field Observations will be required for the following parts of the work:
 - a. After rough grading is complete and the landscape contractor has crossed rip and tilled the planting areas and removed rocks more than one (1) inch.

- b. When fine grading is complete per Civil Engineers precise grading plans and all rocks more than one (1) inches are removed and completion of soil amendments.
- c. Boulder placement. When material is delivered onsite and is ready to be placed in landscape areas.
- d. Plant material selection prior to site delivery –as time permits for review by Landscape architect. The contractor shall submit plant photographs of each material specified from the nursery of procurement. The contractor shall also submit the name of the nursery, the location and the name of the contact person along with a phone number of the nursery contact person.
- e. When plant material is spotted for installation but before planting holes is excavated and when specimen tree locations are staked.
- f. Specimen trees at source before delivery. All tree shown in tree masses or in row formation shall be matched in height and form, general appearance and shall be approved at the nursery before delivery.
- g. When finished grading is complete in groundcover and other planting areas prior to conducting an irrigation coverage test.
- h. Thirty-day establishment period after initial Hydroseed and issuance of landscape maintenance period.
- i. Final acceptance and project turn over.

PART 2 - MATERIALS

All materials shall conform to the requirements of Section 212 of the Standard Specifications, except as modified herein.

- 2.01 GENERAL: All materials shall be standard, first grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis.
- 2.02 SOIL CONDITIONERS AND FERTILIZERS: Soil conditioners may include any or all of the specified conditioners herein specified and shall be applied at rates indicated in the soils report or special conditions.
- 2.03 TOPSOIL: Import Class 'A' Soil. Tested for agronomic and germination recommendations. Free from infestation with nematodes or other undesirable insects, plant diseased organisms and petroleum bi products.
- 2.04 NON-SELECTIVE HERBICIDES: Non-selective contact herbicide and/or non-selective systemic herbicides (as recommended by the Pest Control Advisor or Landscape Contractor).
- 2.05 SELECTIVE HERBICIDES: Selective pre-emergent herbicides (as recommended by the Pest Control Advisor or Landscape Contractor).
- 2.06 ORGANIC SOIL AMENDMENTS:
 - A. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. Organic matter shall be at least 50% on a dry weight basis.
 - B. The pH of the material shall be between 6 and 7.5.
 - C. The salt content shall be less than 10 milliohm/cm @ 25° C. on a saturated paste extract.
 - D. Boron content of the saturated extract shall be less than 1.0 part per million.
 - E. Silicon content (acid-insoluble ash) shall be less than 50%.
 - F. Calcium carbonate shall not be present if to be applied on alkaline soils.

- G. Types of acceptable products are composts, manures, mushroom composts, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
- H. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.
- I. Sludge-based materials are not acceptable.
- J. Carbon: nitrogen ratio is less than 25:1.
- K. The compost shall be aerobic without malodorous presence of decomposition products.
- L. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending.
Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

Arsenic	20	copper	150	selenium	50
Cadmium	15	lead	200	silver	10
Chromium	300	mercury	10	vanadium	500
Cobalt	50	molybdenum	20	zinc	300
		Nickel	100		
- M. Gypsum: To be agricultural grade gypsum and shall conform to section 212-1.2 of the standard specifications for Public Works Construction, latest edition.
- N. Non-Staining Iron Sulfate: Pelletized or granular form containing not less than 18.5% expressed metallic iron and shall be registered as an agricultural mineral, with the State Department of Agriculture in compliance with Article 2 - "Fertilizer Materials", Section 1030 of the Agricultural Code as "Green Iron" manufactured by Gro-Power.
- O. Ammonium Sulfate: Granular form containing not less than 21% nitrogen and 24% sulfur and shall be registered as an agricultural mineral, with the State Department of Agriculture in compliance with Article 2 - "Fertilizer Materials", Section 1030 of the Agricultural Code.

2.07 **FERTILIZERS:** Commercial fertilizers with an analysis of 5-3-1 Gro-Power Plus, Gro-Power Controlled Release Nitrogen, 16-20-0, 12-8-8 Urea formaldehyde as designated herein, or approved substitute as required by the Agronomic soils report.

- 1. Fertilizer shall be delivered to the site in the original unopened container, bearing the manufacturer's guaranteed analysis. Any fertilizer that becomes caked or damaged, making it unsuitable for use, will not be accepted and shall be removed from site.

2.08 **TREE STAKES:** Tree stakes shall be two to three-inch diameter, lodge pole stakes copper naphthenate treated, driven a minimum of two feet (2') into firm soil, long enough to firmly support tree head. (Refer to typical tree installation details.)

2.09 **TREE TIES:** Tree ties shall be as specified on tree planting detail and shall be uniform throughout the project.

2.10 **DEEP ROOT BARRIERS:** Deep Root barriers shall linear style as manufactured by Deep Root Products and install per manufacturer recommendations. Contact Deep Root Products at 1 (800) 458-7668 or 1 (800) 766-8835 for technical support.

2.11 **PLANTING TABLETS:** Fertilizer planting tablets shall be tightly compressed commercial grade planting tablets having a 12-8-8 formula, weighing 7 grams each. The planting tablets shall be delivered to the site in the original, unopened containers, bearing the manufacturer's guaranteed analysis.

2.12 PLANT MATERIAL: The scientific and common names of plants herein specified conform to nursery standard for plant identification; in the event of a discrepancy, the landscape architect shall decide all questions as to interpretation. (Refer to plant legend on drawings). Each group of plant materials delivered to the site shall be clearly labeled as to species and variety and nursery source. All plants shall have normally well-developed branch structure, with vigorous and fibrous root systems which are not pot bound and surface exposed. The size of the plants shall correspond with that normally expected for species and variety of available nursery stock, or as specified on the drawings. Plants larger in size than specified may be used with the approval of the landscape architect, but the use of larger plants will make no change in contract price.

- A. Rejection: All plants not conforming to the requirements herein specified shall be considered defective, and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site and replaced with new plant(s) at the contractor's expense. The plants shall be of the species, variety, and size as specified on the drawings or pre-selected at the nursery. Under no condition will there be any substitution of plants or sizes for those listed on the drawing.
- B. Pruning: At no time shall a tree or shrub be pruned, trimmed or topped prior to delivery, and any alteration of their shape shall be conducted only with the approval and when in the presence of the landscape architect.
- C. Protection: All plants shall be handled and stored so that they are adequately protected from drying out, from windburn, or from any other injury.
- D. Right of Inspection: The landscape architect reserves the right to approve or reject at any time upon delivery or during installation any or all plant material not conforming to plan specification, size, variety or condition.

2.13 WEED-CONTROL BARRIERS:

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz. /sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids. Mirafi 140N.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz. /sq. yd. Mirafi 700X.

PART 3 - EXECUTION

Installation shall conform to the requirements of Section 308 of the "Standard Specifications," except as modified herein.

3.01 GENERAL:
Prior to the start of work of this Section, all trash and deleterious materials on the surface of the ground shall be removed and legally disposed of.

3.02 WEED ABATEMENT:

- A. Prior to the installation of the irrigation system, all weed growth shall be removed within the areas designated to be cleared and grubbed. Refer to plans for limit of work.
 - 1. Perennial grasses and weeds existing in the planting areas require control prior to removal, spray these areas per Pest Control Adviser's or landscape contractor's recommendations (Round-up or another approved herbicide.) Physically remove all weeds and undesirable material from the site.
 - 2. Remove all dead weeds by rake or hoe to a depth of one to two inches (1" to 2") below the surface of the soil. Remove all weed and/or undesirable grass residue and top growth and dispose of in a legal manner.

3.03 SOIL PREPARATION AND FINE GRADING:

A. Soil Preparation: Prior to amending the surface, soil should be cross-ripped or otherwise tilled to a depth of ten inches (10"). All planting areas to receive soil preparation. All rock two inches (2") and larger shall be removed to a depth of four inches (4"). Dispose of all debris off-site in a legal manner.

B. Planting Areas: To all planting areas (turf), uniformly broadcast soil amendments and thoroughly incorporate to a minimum six-inch (6") depth by means of a rototiller or equal.

Soil Amendments are to be thoroughly incorporated at the following rates per one thousand square feet (1,000 sf.) by rototilling or other approved method:

4 cu. yds.	Organic amendment
200 lbs.	5-3-1 Commercial fertilizers
10 lbs.	Iron Sulfate
50 lbs.	Agricultural Gypsum

Any sledge base amendments high in nitrogen will be prohibited from use.

C. Finish Grade:

1. Rough grade shall be within one tenth (1/10) of one foot (1') of finish grade.
2. Work such as fine grading and light cultivation are required of all planting areas indicated on plan to prepare grades prior to seed planting.
3. After approximate finished grades have been established, all soil areas shall be compacted and settled by application of heavy irrigation to a minimum depth of twelve inches (12").

3.04 PLACEMENT OF TOPSOIL:

A. Place topsoil in planter areas as shown on the Civil Engineers plans and or Architect's wall construction detail

B. Fine grade area(s) to desired elevations and contours as referenced on the plans.

C. Compact area to desired compaction.

3.05 FINAL GRADES:

A. After the foregoing specified deep watering, minor modifications to grade may be required to establish the final grade. These areas shall not be worked until the moisture content has been reduced to a point where working it will not destroy soil structure.

B. Finish grading shall ensure proper drainage of the site. Refer to the Civil Engineers Precise Grading Plans for Final Grade and Drainage.

C. Eliminate all erosion scars.

3.06 TREE AND SHRUB INSTALLATION:

A. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally acceptable horticultural practices.

B. All irrigation work shall have been reviewed by the Landscape Architect prior to beginning any planting.

C. Installation of all plant material shall be in accordance with the planting details.

D. Locations for plants and outlines of areas to be planted shall be marked on the ground by the Landscape Contractor before any plant pits are dug. The landscape architect shall review all locations. If any underground utilities are encountered in the excavation of the planting areas, notify the Landscape Architect immediately so that other locations for planting may be selected.

E. Excavation for Planting:

1. Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.
2. Protect all areas from excessive compaction when trucking plants or other material to the site.
3. All excavated holes shall have vertical sides with rough surfaces and shall be of a size is at least twice the width and depth of the original plant container. The holes shall be, in all cases, large enough to permit planting without damage to the root ball. Compact soil so depth of root ball is three (3") higher than existing grade.

F. Planting:

1. No planting shall be done in any area that is under construction, where the grades have not been established or fine graded until the area concerned has been satisfactorily prepared in accordance with these specifications.
2. No more plants shall be distributed in the planting area on any day than can be planted and watered on that day.
3. Containers shall be cut and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken, and they shall be planted and watered as herein specified immediately after the removal from the containers. Containers shall not be cut or broken prior to placing the plant in the planting areas.

4. The amended surface shall be used for backfill around trees and shrubs; use the following formula (thoroughly blended):

Native on-site soil (Refer to soils report. Import soil may be used)	6 parts
Organic Amendments	4 parts
Commercial Fertilizer 5-3-1	15 lbs/cy
Iron Sulfate	2 lbs/cy.

Note: Mix proportions are for bid purposes only. If mix proportions differ from agronomic soils test results notify the architect and or general contractor immediately.

5. Three inches of amend backfill shall be thoroughly mixed with three inches of native or import soil at the bottom of each hole to provide a transitional soil mix of at least six inches between the native soil and backfill.
6. Backfill shall be placed at the bottom of each hole, and thoroughly compacted to a height that when a plant is placed in the hole, its root crown is three inches (3") above the established final grade. Any plants, which settle deeper than specified above, shall be raised back to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately one-half the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil.
7. After the water has completely drained, fertilizer tablets shall be place as indicated:

3 tablets per one-gallon container
6 tablets per five-gallon container
12 tablets per fifteen-gallon container
14 tablets per 24" box
18 tablets per 36" box

The remainder of the hole shall then be backfilled.

3.07 GROUND COVERS:

- A. Groundcover will be hand planted in the areas indicated on the plans.
- B. After preparation of the soil in accordance to section 3.04 the areas to be planted with hand planted Ground covers only shall be given additional pre-fertilizer of six pounds (lbs.) per thousand square feet (1,000 sq. ft.) of commercial fertilizer, 16-20-0 as specified in Section 2.07 evenly broadcast over the area.
- C. Ground cover plants shall be grown in flats or peat pots as indicated on plant legend. Flat grown plants (rooted cuttings) shall remain in those flats until transplanting. The flats' soil shall contain sufficient moisture so that it will not fall apart when lifting the plants. If plants from peat pots are used, the pots shall be protected at all times prior to planting to prevent unnecessary drying of the root ball.
- D. Each plant shall be planted with its proportionate amount of flat soil or in a peat pot, in a manner that will ensure minimum disturbance of the root system, but in no case shall this depth be less than finished grade. To avoid drying out, planting shall be immediately sprinkled after planting until the entire area is soaked to the full depth of each hole, unless otherwise noted on the drawings.

3.08 WATERING:

- A. Apply water to all planted areas during operations and thereafter, until acceptance of the work.
- B. Apply water in sufficient quantities and as often as seasonal conditions require to keep the planted areas sufficiently moist at all times, well below the root system of grass and plants.
- C. All turf areas shall be kept damp at all times and irrigation should be adjusted accordingly. This normally would involve four (4) to six (6) watering periods daily, each watering period (ON) regulated to just dampen the mulch without creating run off.
- D. Intervals between irrigation (OFF) sequences should be judged by the length of the time mulch remain damp. Once the mulch begins to dry out, the water (ON) sequence should be repeated.

3.09 ESTABLISHMENT AND MAINTENANCE PERIOD:

The Contractor shall continuously maintain all areas involved in this contract during the progress of the work and during the 30-day establishment period for all turf and Ground cover areas and 90-day maintenance period until final acceptance of the work by the Owner.

- A. Plant establishment period: The contractual establishment period shall be for no less than thirty- (30) continuous calendar days. The contractual establishment period begins on the first day after all planting in this project is completed and accepted and the planted areas are brought to a neat, clean and weed free condition. (All turf areas and Ground cover areas installed by flats shall be reviewed under the establishment period).
- B. Landscape maintenance period: Upon successful completion and approval of the establishment period the landscape maintenance period may begin. The contractor will be notified in writing the acceptance of the establishment period and commencement of the maintenance period.
 - 1. Any day when the Contractor fails to adequately maintain plants, replace unsuitable plants or do weed control or other work, as determined necessary by the Landscape Architect and/or owner's field representative will not be credited as one of the landscape maintenances working days.
 - 2. In order to carry out the landscape maintenance work, the Contractor shall furnish sufficient men and adequate equipment to perform the work during the maintenance period.
 - 3. Improper maintenance or possible poor condition of any planting at the termination of the scheduled establishment period may cause postponement of the final acceptance of Plant Establishment and delay the start of maintenance period. Contractor shall bear all costs for extension of the Plant Establishment period.

C. Plant Maintenance:

1. All areas shall be kept free of debris, and all planted areas shall be weeded at intervals of not more than ten (10) days. Watering, mowing, fertilization, spraying and pest control, as may be required, shall be included in the maintenance period. Maintenance shall include gopher control.
2. Post fertilize all turf areas at the end of every 45-60 days (of maintenance) at the rate of five pounds (5 lbs.) per one thousand square feet (1,000 sf.) using ammonium sulfate, 21-0-0, evenly applied and thoroughly watered in. The first application should occur 30 days after sodding. In early fall and spring, substitute a complete fertilizer such as 16-6-8 or equal for the ammonium sulfate at a rate of 6 lbs. per 1000 sf.
3. Mowing of turf will commence when turf grass has reached a height of one inch (1"). The height of cut will be 1/2" to 3/4" as directed by the landscape architect. Mowing will be at least weekly after the first cut. Turf must be well established and free of bare spots and weeds to the satisfaction of the Landscape Architect prior to final acceptance by the Owner.
4. The Contractor shall maintain the irrigation systems in a like new operating condition; adjusting head heights and spray arcs as necessary. The Contractor is responsible for proper watering of all planting areas, for providing any necessary supplemental water as may be required and shall replace any material damaged due to improper moisture.
5. During the maintenance period, the Contractor shall be responsible for maintaining adequate protection for all planting areas. Any damaged areas shall be repaired, and any plant materials replaced at the Contractor's expense.
6. The Contractor's maintenance period will be extended past (360) days if these provisions are not filled.

3.10 GUARANTEE AND REPLACEMENT:

- A. Any turf area found to be dead or in poor condition due to such improper weed abatement practices and/or methods, as determined by the Landscape Architect and/or Owner, shall be replaced by the Contractor at his expense.
- B. Material and Labor involved in the replacing of material shall be supplied by the Landscape Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 32 94 00

TREE PROTECTION AND TRIMMING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.
- B. Related Sections:
 - 1. Section 311000 – Site Clearing.
 - 2. Section 312000 – Earthwork
 - 3. Section 328400 – Irrigation Systems.
 - 4. Section 329300 – Planting.

1.2 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located and employed by the Contractor.
- B. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless requirements that are more stringent are indicated.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes. Topsoil shall be tested for agronomic purposes by a certified and approved testing lab.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Chain Link Fence: Metallic-coated steel chain link fence fabric, 60 inches high, minimum; line posts, 1.9 inches in diameter; terminal and corner posts, 2-3/8 inches in diameter; and other accessories for a complete fence system.
- E. Orange vinyl construction fencing, snow fencing or other similar fencing should be at least 4 feet high and supported by 6' steel T-posts with compliant safety caps.

PART 3 EXECUTION

3.1 PREPARATION

- A. Contractor is responsible for the protection of all trees that will remain within the limits of work.
- B. Contractor arborist shall identify the trees that must be protected.
- C. Contractor arborist shall supervise protection, pruning and repairing of existing trees.
- D. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage.

- E. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.
- F. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- G. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
- D. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.
- E. 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.
- F. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
- G. Where excavation or construction within the critical root zone of a tree is necessary and less than 50% of the root system will be affected, root pruning can occur. Cut roots cleanly prior to mechanical excavation near tree to minimize damage to remaining roots and reduce the risk of causing disease, decay and instability. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop. No roots over 1" in size shall be cut unless under the direct supervision of a certified Arborist.
- H. As a temporary measure, place burlap material and/or spread mulch over exposed roots after cuts are made and before soil is replaced. Keep this material damp until backfilled to prevent the fine roots from drying and dying.

3.3 RE-GRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.
- B. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- C. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- D. Moderate Fill: Where existing grade is more than 6 inches, but less than 12 inches, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
- E. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fills up to 6 inches below elevation of grade.
- F. Place filter fabric with edges overlapping 6 inches minimum.
- G. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

- A. Prune remaining trees affected by temporary and new construction.
- B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- C. Pruning Standards: Follow current ANSI A300 Standards for Tree Care Operations – Tree, Shrub, and Other Woody Plant Management – Standard Practices (Pruning). Never remove more than 25% of a tree's crown at one time:
 - 1. Type of Pruning: Crown cleaning.
 - 2. Type of Pruning: Crown thinning.
 - 3. Type of Pruning: Crown raising.
 - 4. Type of Pruning: Crown reduction.
 - 5. Type of Pruning: Vista pruning.
 - 6. Type of Pruning: Crown restoration.
 - 7. Cut branches with sharp pruning instruments; do not break or chop.
 - 8. Chip branches removed from trees. Spread chips where indicated or as directed by Architect.
 - 9. Use the three cut method to remove large or heavy limbs. If the whole limb must be removed, properly prune to the trunk without cutting into the branch bark ridge. Do not leave a stub or flush cut into the trunk.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
- C. Contractor shall replace all trees which Contractor has damaged. Contractor shall replace these trees with trees of the same size and species. When damaged trees are more than 10 inches in caliper size (measured 12 inches above grade) these trees may be replaced with trees with a caliper size of 8 inches minimum.
- D. Contractor shall compensate the District for all damaged trees that are more than 10 inches in caliper size and replaced with trees of smaller caliper. The district will request a Tree Appraisal from an appropriate Consultant. Any fees associated with this appraisal will be at Contractor's expense. The value/replacement cost will be determined by adjusting a tree's basic value by its condition, location, and species using the most recent edition of the Guide for Plant Appraisal, published by the Council of Tree and Landscape Appraisers.
- E. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches on center. Backfill holes with an equal mix of augured soil and approved compost humus material.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Dispose of materials in a legal and safe manner as established by local governing body. Recycling is encouraged whenever possible. Burning is not permitted.

END OF SECTION

SECTION 33 10 00

WATER UTILITIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water mains, valves, fittings, and accessories.
- B. Fire hydrants and assemblies.
- C. Backflow preventer.
- D. Thrust blocks.

1.2 REFERENCES

- A. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers.
- B. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assembly.
- C. AWWA C104 - Standard for Cement-Mortar Lining for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
- D. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and other Liquids.
- E. AWWA C110 - Standard for Gray-Iron and Ductile-Iron Fittings, 3 inch through 48 inch for Water and Other Liquids.
- F. AWWA C111 - Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- G. AWWA C151 - Standard for Ductile-Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
- H. AWWA C300 - Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
- I. AWWA C502 - Standard for Dry-Barrel Fire Hydrants.
- J. AWWA C600 - Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
- K. AWWA C651 - Standard for Disinfecting Water Mains.
- L. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water.
- M. AWWA C901 - Standard for Polyethylene Pressure. Pipe and Tubing 1/2 inch through 3 inch, for Water Service.
- N. AWWA M17 - Manual for Installation, Field Testing, and Maintenance of Fire Hydrants.
- O. AWWA M23 - Manual for PVC Pipe-Design and Installation.
- P. ASTM B88 - Seamless Copper Water Tube.
- Q. ACPA - American Concrete Pipe Association, Concrete Pipe Handbook.
- R. CDA - Copper Development Association, Copper Tube Handbook.
- S. NFPA 1963 - Standard for Screw Threads and Gaskets for Fire Hose Connections.

- T. UL 246 - Standard for Hydrants for Fire Protection Service.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this Section.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit product data for pipe and pipe accessories.
- C. Submit reports on piping disinfecting.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of pipe runs, connections, and depths.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

2. PART 2 PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated.
- B. Piping: Provide pipes of the following materials, of weight/ class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes , with joining method as indicated.
- C. Copper Tube: ASTM B88; Type K hard drawn.
- D. Polyvinyl Chloride (PVC) Pipe: AWWA C900, Class 150.
 - 1. Fittings: Integral wall (thickened bell end), integral sleeve reinforced bell end or elastomeric gasket couplings meeting the requirements of AWWA C900.
- E. Polyethylene (PE) Pipe: AWWA C901, Class 160.
 - 1. Fittings: Copper alloy or nylon barbed insert type with 2 strap-type stainless steel clamps over pipe at each insert.

2.2 BACKFLOW PREVENTORS

- A. ASSE standard backflow preventer of size indicated for maximum flow rate and maximum pressure loss indicated.
- B. ASSE 1013 reduced-pressure-principle backflow preventer with OS and Y gate valves on inlet and outlet. Include test cocks and pressure-differential relief valve having ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves for continuous-pressure application.

2.3 PIPE IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

- B. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."
- C. Nonmetallic Piping Label: Engraved plastic-laminate label, for installation on main electrical meter panel; not less than 1 inch by 3 inches, with captions "CAUTION - THIS STRUCTURE HAS A NONMETALLIC WATER SERVICE."

2.4 PIPE ACCESSORIES

- A. Valves and Fittings: Conform to AWWA Specifications. All valves and fittings shall be designed for an operating pressure larger than the design pressure of lines on which they are installed.
- B. Gate Valves: Double disk parallel seat type, iron body, bronze mounted inside screw, non-rising stem, flanged or screw filling standard hub nut.
- C. Thrust Blocking: Provide on water lines at bends, tees and fire hydrants. Use 2,500 psi concrete as specified in Section 03 30 00. Locate and place in accordance with standard practice.
- D. Access Boxes: Unless otherwise specified in accordance with [Section 22 30 00].

2.5 FILL MATERIAL

- A. Sand: Type specified in Section 31 20 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material of sand.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION - PIPE AND FITTINGS

- A. Maintain separation of water main from sewer piping in accordance with code.
- B. Install pipe to indicated elevation to within 5/8 inches.
- C. Route pipe in straight line.
- D. Install pipe to allow for expansion and contraction without stressing pipe of joints.
- E. Slope water pipe and position drains at low points.
- F. Form and place concrete for thrust restraints at each elbow or change of direction of pipe.
- G. Copper Tube: Install in accordance with CDA "Copper Tube Handbook"
- H. Polyvinyl Chloride (PVC) Pipe: Install in accordance with AWWA M23.
- I. Polyethylene (PE) Pipe: Install in accordance with manufacturer's installation instructions.
- J. Form and place concrete for thrust blocks.

- K. Install warning tape during back-filling of trench for underground water service piping. Locate 8 inches below finished grade directly over piping. [Attach non-metallic piping label permanently to main electrical meter panel.]
- L. Water Main Connection: Arrange and pay for tap in water main, of size and in location as indicated, from water Purveyor.
- M. Water Service Termination: Terminate water service piping 5'-0" from building foundation in location and invert as indicated. Provide temporary pipe plug for piping extension into building.

3.4 INSTALLATION - HYDRANT

- A. Comply with AWWA M17. Install with gate valve and provision for drainage as indicated.
- B. Set hydrants plumb and locate nozzles perpendicular to roadway.
- C. Set hydrants to grade with nozzles at least 20 inches above ground.
- D. Locate control valve 4 inches away from hydrant.
- E. Provide drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- F. Paint hydrants in accordance with Section 09 90 00.

3.5 INSTALLATION - BACKFLOW PREVENTOR

- A. Install backflow preventer of type, size and capacity indicated. Include valves and test cocks.
- B. Install according to authority having jurisdiction.
- C. Support backflow preventers, valves, and piping on 2,500-psi; concrete piers as indicated.

3.6 INSTALLATION OF VALVES

- A. General: Install valves as indicated with stems pointing up. Provide valve box over underground valves.

3.7 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Test: Test at not less than 1-1/2 times working pressure for two hours.

3.8 ADJUSTING AND CLEANING

- A. Use disinfecting procedure prescribed by authority having jurisdiction.
- B. In case a method is not prescribed by that authority, use procedure described in AWWA C651, or as described below:
 - 1. Fill system or part thereof with water/chlorine solution containing at least 50 ppm of chlorine. Valve off system or part thereof and allow to stand for 24 hours.
 - 2. Drain system or part thereof of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine. Valve off system or part thereof and allow to stand for three hours.
 - 3. Flush system with clean potable water until chlorine does not remain in water coming from system.

- C. Prepare reports for all disinfecting activities and submit to Architect.

END OF SECTION

SECTION 33 30 00

SANITARY UTILITIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sanitary drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to municipal sewers.
- C. Cleanout access.

1.2 REFERENCES

- A. ACPA - American Concrete Pipe Association.
- B. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- C. ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
- D. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- E. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
- F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- H. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- I. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- J. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- K. ASTM D2855 - Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- L. ASTM D3212 - Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- M. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and other Liquids.
- O. CISPI - Cast Iron Soil Pipe Institute.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this Section.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit product data for pipe and pipe accessories.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of pipe runs, connections, manholes, cleanouts and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

2. PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Pipe: ASTM D3034, Type PSM, SDR35 wall thickness, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.

2.2 PIPE ACCESSORIES

- A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.

2.3 PIPE IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - SANITARY SEWER LINE BURIED BELOW."
- B. Metallic-Lined Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - SANITARY SEWER LINE BURIED BELOW."

2.4 CLEANOUTS

- A. Cleanouts: Cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty secured, scoriated cast-iron cover.

2.5 FILL MATERIAL

- A. Sand: Type specified in Section 31 20 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material of sand.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION - PIPE

- A. Extend sanitary sewerage system to connect to building sanitary drain, of sizes and in locations indicated.
- B. Solvent cement PVC pipe and fittings in accordance with ASTM D2855 and install piping in accordance with ASTM D2321.

- C. Place pipe on minimum four inch deep bed of sand.
- D. Lay pipe to slope gradient noted on Drawings with maximum variation from true slope of 1/8 inch in 10 feet.
- E. Install warning tape during back-filling of trench for underground sanitary sewer piping. Locate 8 inches below finished grade directly over piping.
- F. Install sand at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.
- G. Place sand in maximum 6 inch lifts, consolidating each lift.
- H. Increase compaction of each successive lift. Refer to Section 31 20 00 for compaction requirements. Do not displace or damage pipe when compacting.
- I. Connect to municipal sewer system.

3.4 INSTALLATION - CLEANOUTS

- A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated.
- B. Set cleanout frame and cover in concrete block 18 x 18 x 12 inches deep.
- C. Set top of cleanouts flush with paved surfaces. Elsewhere, set top 1 inch above surrounding earth grade.
- D. Install accessories as indicated.
- E. Set top of frame and covers flush with paved surfaces. Elsewhere, set top 3 inches above grade.

3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 45 29.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Protect pipe from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Connection of building and site storm drainage system to point of disposal.
- C. Catch basins, drywells, cleanouts.
- D. Paved area drainage, site surface drainage.

1.2 REFERENCES

- A. ACPA - American Concrete Pipe Association.
- B. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- C. ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
- D. ASTM C33 - Specification for Cement Aggregates.
- E. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- G. ASTM C858 - Specifications for Underground Precast Concrete Utility Structures.
- H. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- I. ASTM D2855 - Practice for making Solvent - Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- J. ASTM D2321 - Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
- K. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- L. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
- M. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and other Liquids.
- N. CISPI - Cast Iron Soil Pipe Institute.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this Section.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit product data indicating pipe, pipe accessories and drainage structure.
- C. Submit manufacturer's installation instructions.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of pipe runs, connections, catch basins, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

2. PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPE MATERIALS

- A. Polyvinyl Chloride Pipe (PVC): ASTM D3034; SDR 35 minimum wall thickness; bell and spigot style; solvent cement joints conforming to ASTM D2564.
- B. Perforated Polyvinyl Chloride Pipe (PVC): ASTM D3034; SDR 35 minimum wall thickness; bell and spigot style; solvent cement joints conforming to ASTM D2564; perforations to be symmetrically located in an arc of 160 degrees. Perforations shall have a total open area of at least 0.3 square inches per lineal foot of pipe. Perforations shall be either holes or slots. Diameter of holes may vary from 1/4 inch minimum to 3/8 inch maximum; the width of the slots may vary from 3/16 inch minimum to 5/16 inch maximum; the length of the slot shall not exceed 4 inches.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 PIPE ACCESSORIES

- A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.
- B. Geotextile Fabric: As specified in Section 31 20 00.

2.3 PIPE IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - STORM SEWER SERVICE BURIED BELOW."
- B. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - STORM SEWER SERVICE BURIED BELOW."

2.4 CATCH BASINS

- A. Basin Lid and Frame: Galvanized cast iron construction, hinged lid, linear grill lid design; nominal lid and frame size as indicated. Grate bars to be less than 1/2 inch apart.
- B. Base Pad: Cast-in-place concrete of type specified in Section 32 13 13; levelled top surface sleeved to receive storm sewer pipe sections.

2.5 CLEANOUTS

- A. Cleanouts: Cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

2.6 DRY WELLS

- A. ASTM C858, precast reinforced perforated concrete rings with cast-in-place concrete floor and lift-off-type concrete cover with lift rings.

- B. Wall thickness of 4 inches with 1 inch diameter or 1 x 3 inch slotted perforations totally free area of 15 percent of ring surface.
- C. Aggregate fill for drywell; ASTM C33 gravel, crushed gravel or crushed stone.

2.7 FILL MATERIAL

- A. Sand: Type specified in Section 31 20 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material of sand.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION - PIPE

- A. Extend storm sewerage piping to connect to building storm drain, of sizes and in locations indicated.
- B. Include storm sewerage system piping and appurtenances from a point 5'-0" outside building foundation to point of disposal.
- C. Solvent cement PVC pipe and fittings in accordance with ASTM D2855 and install piping in accordance with ASTM D2321.
- D. Place pipe on minimum 4 inch deep bed of sand.
- E. Install perforated PVC pipe at a minimum slope of 0.05 percent. Coordinate with installation of drainage fill and filter fabric specified in Section 31 20 00.
- F. Install warning tape during back-filling of trench for underground storm drain piping. Locate 8 inches below finished grade directly over piping.
- G. Lay pipe to slope gradients noted with maximum variation from true slope of 1/8 inch in 10 feet.
- H. Install coarse sand at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.
- I. Place sand in maximum 6 inch lifts, consolidating each lift.
- J. Increase compaction of each successive lift. Refer to Section 31 20 00 for compaction requirements. Do not displace or damage pipe when compacting.
- K. Connect to point of disposal.

3.4 INSTALLATION - CATCH BASINS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for storm drainage pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.

- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.
- E. Install accessories as indicated.
- F. Set top of frame and covers flush with paved surfaces. Elsewhere, set tops 3 inches above grade.

3.5 INSTALLATION - CLEANOUTS

- A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated.
- B. Set cleanout frame and cover in concrete block 18 x 18 x 12 inches deep.
- C. Set top of cleanout flush with paved surfaces. Elsewhere, set top 1 inch above surrounding earth grade.

3.6 INSTALLATION - DRYWELL

- A. Install as indicated on undisturbed native soil.
- B. Fill around drywell with 1 to 2 inch crushed rock on gravel to a minimum of 12 inches beyond drywell perimeter. Fill drywell full depth with crushed rock or gravel.
- C. Set top of drywell a minimum of 12 inches below finish grade.

3.7 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 45 29.
- B. Clear interior of piping and structures of dirt and other debris as work progresses.

3.8 PIPELINE FLUSHING

- A. Flush newly constructed storm drain piping with water.
- B. Collect and remove any rock, debris and silt using a metal screen during flushing procedure.

3.9 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Protect pipe from damage or displacement until backfilling operation is in progress.

END OF SECTION