



WALNUT CREEK SCHOOL DISTRICT

WALNUT CREEK INTERMEDIATE

DSA SUBMITTAL
MODERNIZATION AND
RECONFIGURATION PROJECT
INCREMENT 2

TECHNICAL SPECIFICATIONS

CONSTRUCTION PHASE 2 BID SPECS
CONSTRUCTABILITY COMMENTS INCORPORATED
11/3/2020

BIDDING ONLY - NOT FOR CONSTRUCTION

DIVISION OF THE STATE ARCHITECT
SPECIFICATIONS SUBMITTAL
DSA APP. NO. 01-118676

July 22, 2020

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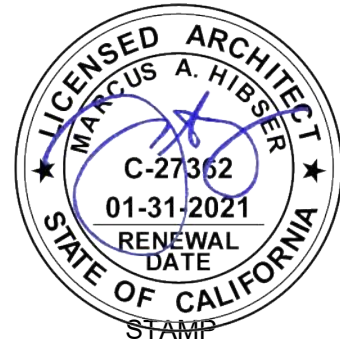
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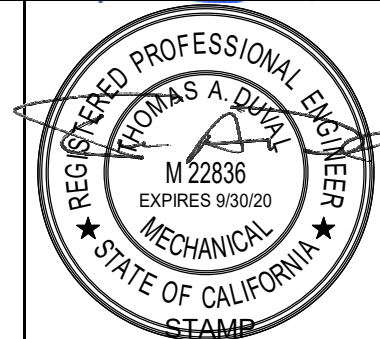
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Updated per Constructability Comments

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Updated per
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SECTION 01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work shown on Drawings.
- B. Work by District.
- C. Owner-furnished products.
- D. Contractor's use of site and premises.
- E. Work sequence.
- F. District occupancy.

1.2 WORK INCLUDED

- A. Work of this Contract comprises general construction including remodeling and modernization of Walnut Creek Intermediate School located at 2425 Walnut Blvd, Walnut Creek, CA 94597.

Increment 1:

Site Work: entry canopy and walkway structure; reconfiguration of parking; plaza at east campus; plaza at west campus; associated accessibility site work

Building 300 (classrooms): general alterations

Building 350 (modular classrooms): general alterations

Building 400 (classrooms and administration): rehabilitation

Building 500 (modular classrooms): general alterations

Building 700 (gymnasium and classrooms): minor HVAC and/or fire alarm alterations

Building 800 (locker rooms): minor HVAC and/or fire alarm alterations

Building L (library): general alterations

Increment 2:

Building 100 (classrooms and administration): rehabilitation

Building 150 (classrooms): rehabilitation

Building 200 (classrooms): rehabilitation

Increment 3:

Building 600 (multipurpose room, food service and classrooms): rehabilitation and addition

- B. Construct the Work under a Guaranteed Maximum Price Contract.

1.3 WORK BY DISTRICT

- A. Items noted "NIC" (Not In Contract) will be furnished and installed by District.
- B. District may remove and retain possession of the following items prior to start of Work:
 - 1. verify
 - 2. verify
- C. Contractor will remove and District may elect to take possession of the following items prior to start of Work:
 - 1. Door hardware.
 - 2. Projection screens and monitor/camera brackets.
 - 3. Low voltage components.
 - 4. Data and Technology components.
- D. Items noted "Owner-Furnished, Contractor-Installed" shall be incorporated into the Work by Contractor under the Contract.
- E. The District reserves the right to purchase, at its own expense, any of the following items:
 - 1. verify
 - 2. verify
- F. In the event the District exercises this option, Contractor shall receive, store and install these items under the same conditions as if the Contractor had purchased them.

1.4 OWNER-FURNISHED PRODUCTS

- A. Items noted "OFCl" (Owner-Furnished, Contractor-Installed) will be furnished by District and installed by Contractor.
- B. Items noted "OFOl" (Owner-Furnished, Owner-Installed) will be furnished by District and installed by District.
- C. District's Responsibilities:
 - 1. Coordinate scheduling and delivery with Contractor.
 - 2. Arrange for and deliver District reviewed Shop Drawings, Product Data, and Samples to Contractor.

3. Arrange and pay for product delivery to site.
 4. On delivery, inspect products jointly with Contractor.
 5. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 6. Arrange for manufacturer's warranties, inspections, and service.
- D. District's Right to Purchase: The District reserves the right to purchase at its own expenses any of the following items. In the event the District exercises this option, Contractor shall receive, store, and install these items under the same conditions as if the Contractor had purchased them.

1. verify

2. verify

- E. Contractor's Responsibilities:
1. Review District reviewed Shop Drawings, Product Data, and Samples.
 2. Receive and unload products at site; inspect for completeness or damage, jointly with District.
 3. Handle, store, install and finish products.
 4. Repair or replace items damaged after receipt.

- F. Product furnished and installed by District (OFOI):

1. [REDACTED].

2. [REDACTED].

- G. Items furnished by District for installation by Contractor [(OFCl)]:

1. [REDACTED].

2. [REDACTED].

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Limited use of site and premises to allow for:
1. District occupancy.

1.6 WORK SEQUENCE

- A. Construct Work in phases to accommodate District's occupancy requirements during the construction period; coordinate construction schedule and operations with Construction Manager:

- 1. Phase 1: Verify

- 2. Phase 2: Verify

- 3. Phase 3: Verify

1.7 DISTRICT OCCUPANCY

- A. The District will occupy the site during entire period of construction, for the conduct of its normal operations.
- B. Cooperate with District to minimize conflict, and to facilitate District's operations.
- C. Schedule Work to accommodate District occupancy.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01 21 00 ALLOWANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Administrative and procedural requirements governing handling and processing allowances.
- B. Selected materials and equipment, and in some cases, their installation are shown and specified in the Contract Documents by Allowances.
- C. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation.
- D. Include in the Contract Sum all Allowances stated in the Contract Documents.
- E. Actual requirements for Allowances will be issued by Change Order.
- F. Designate in the Construction Schedule the delivery dates for products, materials, and equipment specified under each Allowance.

1.2 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in Allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each Allowance.

1.3 ALLOWANCES FOR PRODUCTS

- A. The amount of each Allowance includes:
 - 1. The cost of the product to the Contractor or subcontractor, less any applicable trade discounts.
 - 2. Delivery to the site.
 - 3. Applicable taxes.
- B. Excluded in the amount of each Allowance, but included in the Contract Sum are the Contractor's costs for:
 - 1. Handling at the site, including unloading, uncrating and storage.
 - 2. Protection from the elements and from damage.

3. Labor for installation and finishing, except where labor is specified to be a part of the Allowance.
4. Other expenses required to complete the installation.
5. Contractor's and subcontractor's overhead and profit.

1.4 SELECTION OF PRODUCTS

A. Architect's Duties:

1. Consult with the District and Contractor in consideration of products and suppliers or installers.
2. Make selection in consultation with the District. Obtain District's written decision designating:
 - a. Product, model and finish.
 - b. Accessories and attachments.
 - c. Supplier and installer, as applicable.
 - d. Cost to Contractor, delivered to the site or installed, as applicable.
3. Transmit District's decision to the Contractor.
4. Prepare Change Orders.

B. Contractor's Duties:

1. Assist Architect and District in determining qualified suppliers or installers.
2. Obtain proposals from suppliers and installers when requested by Architect.
3. Make appropriate recommendations for consideration of the Architect.
4. Notify Architect promptly of:
 - a. Any reasonable objections Contractor may have against any supplier or party under consideration for installation.
 - b. Any effect on the construction schedule anticipated by selections under consideration.

1.5 CONTRACTOR RESPONSIBILITY FOR PURCHASES, DELIVERY AND INSTALLATION

- A. On notification of selection, execute purchase agreement with designated supplier.
- B. Arrange for and process Shop Drawings, Product Data and Samples, as required.
- C. Make all arrangements for delivery.
- D. Upon delivery, promptly inspect products for damage or defects.
- E. Submit claims for transportation damage.
- F. Install and finish products in compliance with requirements of referenced Specification Sections.

1.6 ADJUSTMENT OF COSTS

- A. Should the net cost be more or less than the specified amount of the Allowance, the Contract Sum will be adjusted accordingly in a Change Order.
- B. The amount of the Change Order shall recognize any changes in handling costs at the site, labor, installation costs, overhead, profit, and other expenses caused by the selection under the Allowance.
- C. For products specified under a unit cost Allowance, the unit cost shall apply to the quantities actually used with a nominal cost for waste as determined by receipted invoices or by field measurement.
- D. Submit claims for anticipated additional costs at the site, or other expenses caused by the selection under the Allowance, prior to execution of the Work.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect products covered by an Allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

- A. Coordinate materials and their installation for each Allowance with related materials and installations to ensure that each Allowance item is completely integrated and interfaced with related construction activities.

END OF SECTION

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

- A. General requirements applicable to substitutions of materials, products, equipment and systems.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by Contractor after award of Contract are considered to be requests for substitutions. Following are not considered to be requests for substitutions:
 - 1. Substitutions requested during bidding period, and accepted by Addendum prior to award of Contract, are included in Contract Documents and are not subject to requirements specified in this Section for Substitutions.
 - 2. Revisions to Contract Documents requested by District Representative or Architect.
 - 3. Specified options of products and construction methods included in Contract Documents.
 - 4. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. Substitutions, General: Catalog numbers and specific brands or trade names are used in materials, products, equipment and systems required by the Specifications to establish the standards of quality, utility and appearance required. Alternative products which are of equal quality and of required characteristics for the purpose intended may be proposed for use provided the Contractor complies with provisions of Supplementary General Conditions and Contract General Conditions, subject to the following provisions.
 - 1. See Section 01 60 00 - Basic Product Requirements for requirements regarding product options.

2. Substitutions will only be authorized by properly executed Change Order or Field Instruction.
3. Product and Material Substitution period ended 10 days prior to bid. The District has no obligation to entertain substitutions.

1.5 SUBMITTALS

- A. Requests for substitutions will not be considered before selection of Contractor. Substitutions will not be considered when:
 1. Indicated on shop drawings or product data submittals without separate formal "Substitution Request" by the Contractor.
 2. Requested directly by subcontractor or supplier.
 3. Acceptance will require revision of Contract Documents.
 4. Proposed changes are not in compliance with general intent of Contract Documents.
- B. Requests for substitutions will be considered only as allowed in the Supplementary General Conditions and Contract General Conditions. Other requests will be considered after Notice to Proceed only when:
 1. Specified product or method of construction cannot be provided within Contract Time. Architect or District Representative will not consider request if product or method cannot be provided as result of failure to pursue Work promptly or coordinate activities properly.
 2. Subsequent information or changes indicate specified product will not perform as intended.
 3. Requested substitution offers District substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities District must assume. District's additional responsibilities include compensation to Architect for redesign and evaluation services, compensation to District Representative for additional processing and evaluation services, increased cost of other construction by District, and similar considerations.
 - a. District Representative and Architect's time shall be compensated as specified for compensation of time in paragraph 01 25 00-H-3-a.
 4. Specified product or method of construction cannot receive necessary approval by governing authority, and requested substitution can be approved.
 5. Specified product or method of construction cannot be provided in manner that is compatible with other materials and where Contractor certifies that substitution will overcome incompatibility.
 6. Specified product or method of construction cannot be coordinated with other materials and where Contractor certifies that proposed substitution can be coordinated.
 7. Specified product or method of construction cannot provide warranty required by Contract Documents and where Contractor certifies that proposed substitution provides required warranty.
- C. Do not order or install substitute products without written acceptance from the District.
- D. Only one request for substitution for each product will be considered. When substitution is not accepted, provide specified product.

- E. Architect will determine acceptability of substitutions.
- F. Submit two copies of each request to Architect through District Representative on Substitution Request Form at end of Section. Submit separate form for each substitution.
1. Identify products by Specification Section and Article numbers.
 2. Provide manufacturer's name and address, trade name of products, and model or catalog number.
 3. List fabricators and suppliers as appropriate.
 4. Document each request with complete data substantiating compliance of proposed substitution with requirements of Contract Documents including independent laboratory testing reports, approval numbers, listings, and approved assembly descriptions as requested by Campus Construction Manager or Architect, or as required by agencies having jurisdiction.
 5. Attach product data as specified in Section 01 33 00.
 6. Give itemized comparison of proposed substitution with specified product, listing variation, and reference to Specification Section and Article numbers.
 7. Give quality and performance comparison between proposed substitution and specified product.
 8. Submit written certification from manufacturer that proposed substitution is appropriate for this application.
 9. List availability of maintenance services and replacement materials.
 10. State effect of substitution on construction schedule, and changes required in other Work or products.
- G. By making requests for substitutions, Contractor:
1. Represents that Contractor has personally investigated proposed substitute product and determined that it is equal to or superior in all respects to that specified.
 2. Represents that Contractor will provide same warranty for substitution that Contractor would for the specified product.
 3. Will coordinate installation of accepted substitute, making such changes as may be required for Work to be compatible with substrates and adjacent materials, and complete in all respects.
 4. Waives claims for additional time related to substitution that may later become apparent.
 5. Certifies that cost data presented is complete and includes related costs under this Contract, including redesign costs, and waives claims for additional costs related to substitution which may later become apparent.
- H. Modification of Documents: Where substitution requires changes to design of Work as indicated on accepted Shop Drawings for proper installation; furnish drawings and specifications prepared by and bearing seal of licensed Architect and Architects as appropriate, revising Shop Drawings.
1. Submit revised Documents for acceptance in accordance with Section 01 33 00.
 2. Revised Drawings shall be sufficiently complete for proper installation of substitution and related Work.
 - a. Include details of connection to and relationship with adjacent materials.

3. If, in Architect's sole judgment, proposed substitution is of such significance or deals with product or system affecting basic design or aesthetics, pay Architect for changes required to Contract Documents as follows:
 - a. Reimburse Owner for Architect's account for time spent in changing Contract Documents at rate of 3.2 times rate of Direct Personnel Expense (DPE). Direct Personnel Expense is defined as direct salaries of Architect's personnel engaged on Project and portion of costs of mandatory, and customary contributions and benefits related thereto, including employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions, and similar contributions and benefits.
4. Contractor is responsible for cost of revised Documents, obtaining and paying for review and plan check by authorities having jurisdiction, and cost of revised construction.
5. Submit revised drawings with Record Documents in accordance with Section 01 78 39.

1.6 SUBMITTAL PROCEDURES

- A. Architect's and District Representative's Action: If necessary, Architect through District Representative will request additional information or documentation for evaluation within one week of receipt of request for substitution. Architect will notify Contractor of acceptance or rejection of substitution within two weeks of receipt of request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in form of Change Order, should a change in Contract cost or time be associated with the substitution.
 1. Architect or District Representative will not make exhaustive attempt to determine products proposed for substitution are equivalent to, or can be modified in order to be equivalent to specified products.
 - a. Where extensive investigation is required by District Representative or Architect, as determined by District Representative or Architect, Contractor shall reimburse District for District Representative's or Architect's account for time spent in processing additional resubmittals at rate of 3.2 times rate of Direct Personnel Expense (DPE). Direct Personnel Expense is defined as direct salaries of Architect's or District Representative's personnel engaged on Project and portion of costs of mandatory, and customary contributions and benefits related thereto, including employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions, and similar contributions and benefits.
 2. Use product specified if Architect and District Representative couldn't make decision on use of proposed substitute within time allocated.
 3. If accepted by Architect and District Representative, products proposed for substitution are accepted subject to modifications by manufacturer, if necessary, to meet detailed requirements of Drawings and Specifications.
- B. For Accepted Products: Submit shop drawings, product data, and samples in accordance with Section 01 33 00.

- C. Contractor's submittal, and Architect's and District Representative's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with Contract Documents do not constitute acceptable or valid request for substitution, nor do they constitute approval.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures / Schedule of Submittals
- B. Proposed Products List.
- C. Shop Drawings.
- D. Product Data.
- E. Samples.
- F. Manufacturer's instructions.
- G. Manufacturer's certificates.
- H. Deferred approval requirements.

1.2 SUBMITTAL PROCEDURES / SCHEDULE OF SUBMITTALS

- A. Transmit each submittal in conformance with requirements of this Section.
- B. Prior to transmittal of first submittal, prepare and obtain approval for a detailed Schedule of Submittals. Schedule shall show every submittal required by these project documents, date to be submitted to Architect, required return date, and note where shop drawings or physical samples will be furnished.
- C. Sequentially number the transmittal forms. Resubmittals to have original number with a numeric suffix. Architect will not review more than one resubmittal for a specified product, without additional charge.
- D. Identify Project title, address and Architect's project number; Contractor, subcontractor or supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
- E. 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. Incomplete submittals will be returned without review.
- F. Schedule submittals to expedite the Project, and deliver to Architect electronically except for physical samples. Coordinate submittals so that related items requiring color selection may be reviewed simultaneously.

- G. Make submittals in groups containing associated and related items to ensure that information is available for checking each item when it is received. Submittals for all items requiring color selection must be received before any will be approved.
- 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 far enough in advance of scheduled dates for installation to provide time for review and possible revisions and resubmission prior to approval 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 processing.
- K. Contractor's review shall 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/or 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. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.

1.3 PROPOSED PRODUCTS LIST

- A. Within 10 calendar days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.4 SHOP DRAWINGS

- A. Submit one electronic copy of each Shop Drawing in accordance with the submittal list. Upon request, submit hard-copy transparency or blue-line prints. Review comments will be shown on the transparency and Contractor may make and distribute such copies as are required for his purposes. Provisions may be made for electronic transmittal at the District's option.
- B. After review, distribute in accordance with procedures specified above and for Record Documents described in Section 01 78 39, Project Record Documents.

- C. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information furnished without specific reference to the Project and to existing conditions is not a Shop Drawing.
- D. Do not use or allow others to use Shop Drawings which have been submitted and have been rejected.

1.5 PRODUCT DATA

- A. When specified in individual Specification Sections, submit copies of data for each product which Contractor requires. If hard-copy is required, provide four copies to be retained by Architect.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data as required to provide information unique to this Project.
- C. After review, distribute in accordance with procedures specified above and provide copies for Record Documents described in Section 01 78 39, Project Record Documents.

1.6 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. Where specific colors or patterns are not indicated, provide materials and products specified in the full range of color, texture and pattern for selection by Architect. Range shall include standard stocked color/texture/pattern, 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 range at no additional cost to District.
- C. Include identification on each Sample, with full Project information.
- D. Submit the number of Samples which Contractor requires, plus one which will be retained by Architect and one by the District.
- E. Reviewed Samples which may be used in the Work are indicated in individual Specification Sections.

1.7 MANUFACTURER'S INSTRUCTIONS

- A. Where required by 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.

1.8 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.

1.9 MOCK-UP

- A. Where indicated, provide mock-ups as required. Mock-ups shall be prepared per the Specifications and shall accurately and reasonably represent the quality of construction the Contractor will provide. If the mock-up or portions thereof do not adequately represent the quality of the Work specified, the Contractor shall modify the mock-up as needed.
- B. Once completed to the Architect's satisfaction, the mock-up shall serve as the standard of quality for the Work.
- C. All mock-ups, at the District's option, shall remain the property of the District. If not required by the District, Contractor shall remove and dispose of the mock-up.
- D. Where indicated, on-site mock-ups, if accepted, may be integrated into the Work.

1.10 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. Increment 1: no deferred approval requirements
- B. Deferred approval drawings and specifications become part of the approved Contract Documents for the Project when they are submitted to and approved by the Division of the State Architect.
- C. Submit one electronic copy (or one transparency and three blue-line or full-size copies, upon request) of each drawing, or number of copies noted in the schedule below.
- D. Submit 6 copies of calculations, Product Data and test reports or number of copies noted in the schedule below.

- E. Identify and specify all supports, fasteners, spacing, penetrations, etc., for each of the deferred approval items, including calculations for each and all fasteners.
- F. Submit documents to Architect for review prior to forwarding to the Division of the State Architect.
- G. 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.
- H. Architect will forward submittal to Project Structural, Mechanical, and Electrical Engineers.
- I. Review of Architect, and Structural, Mechanical, and Electrical Engineers is only for conformance with design concept shown on the documents.
- J. After review by Architect/Engineers forward submittal to the Division of the State Architect for approval.
- K. Respond to review comments made by the Division of the State Architect and revise and resubmit submittal to the Division of the State Architect for final approval.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.1 SUBMITTAL LIST

01 33 00 – 3.1 – SUBMITTAL LIST					
SPEC. SECTION	TITLE	MOCK-UP	**SAMPLE	CATALOG SHEET	*REPORT, SCHEDULE, OR SHOP DRAWING
01 21 00	Allowances				
01 25 00	Substitution Procedures				
01 29 73	Schedule of Values				X
01 32 16	Construction Schedule				X
01 33 00	Schedule of Submittals				X
01 33 00	Proposed Products List				X
01 78 23	Operation & Maintenance Data				X
01 78 36	Warranties				X
01 78 39	Project Record Documents				
02 41 19	Selective Demolition				X
03 10 00	Concrete Formwork				X
03 20 00	Concrete Reinforcing				X
03 30 00	Cast-in-Place Concrete				X
03 54 13	Gypsum Cement Underlayment			X	X
05 05 13	Shop-Applied Coatings for Metal		X		X
05 12 00	Structural Steel				X
05 12 10	Structural Steel-Additional Seismic Requirements				X
05 50 00	Metal Fabrications				X
05 52 00	Metal Railings		X	X	X
06 10 00	Rough Carpentry			X	X
06 17 00	Shop-Fabricated Structural Wood			X	X
06 20 00	Finish Carpentry		X	X	X
07 01 52	Roofing Repair			X	X
07 13 00	Sheet Waterproofing		X	X	X
07 19 00	Water Repellents			X	
07 21 13	Board Insulation			X	
07 21 16	Blanket Insulation			X	X

01 33 00 – 3.1 – SUBMITTAL LIST					
SPEC. SECTION	TITLE	MOCK-UP	**SAMPLE	CATALOG SHEET	*REPORT, SCHEDULE, OR SHOP DRAWING
07 22 16	Roof Board Insulation			X	
07 26 00	Vapor Retarders		X	X	
07 27 26	Fluid-Applied Membrane Air Barriers		X	X	
07 31 13	Asphalt Shingles		X	X	
07 42 13	Metal Wall Panels		X	X	X
07 42 33	Phenolic Wall Panels		X	X	X
07 52 00	Modified Bituminous Membrane Roofing			X	X
07 56 00	Fluid-Applied Roofing			X	
07 61 00	Sheet Metal Roofing		X	X	X
07 62 00	Sheet Metal Flashing and Trim		X	X	X
07 71 23	Gutters and Downspouts			X	X
07 81 00	Applied Fireproofing			X	
07 84 00	Firestopping			X	
07 92 00	Joint Sealants		X	X	
08 11 13	Hollow Metal Doors and Frames		X	X	X
08 14 16	Flush Wood Doors		X	X	X
08 31 00	Access Doors and Panels			X	
08 36 13	Sectional Doors			X	X
08 41 13	Aluminum Entrances and Storefronts		X	X	X
08 51 13	Aluminum Windows		X	X	X
08 62 23	Tubular Skylights			X	X
08 71 00	Door Hardware			X	X
08 80 00	Glazing		X	X	
08 88 13	Fire-Rated Glazing		X	X	
08 91 00	Louvers			X	X
09 24 00	Cement Plastering		X	X	

01 33 00 – 3.1 – SUBMITTAL LIST					
SPEC. SECTION	TITLE	MOCK-UP	**SAMPLE	CATALOG SHEET	*REPORT, SCHEDULE, OR SHOP DRAWING
09 26 13	Gypsum Veneer Plastering		X	X	
09 28 13	Cementitious Backing Boards			X	
09 29 00	Gypsum Board			X	
09 30 13	Ceramic Tile		X	X	
09 51 00	Acoustical Ceilings		X	X	
09 65 16	Resilient Flooring		X	X	
09 67 13	Resinous Flooring			X	
09 68 00	Carpeting		X	X	
09 72 16	Vinyl-Coated Fabric Wall Coverings		X	X	
09 77 23	Fabric-Wrapped Panels		X	X	X
09 84 00	Surface-Applied Acoustical Panels		X	X	
09 91 00	Painting		X	X	
10 11 00	Visual Display Units		X	X	
10 14 00	Signage			X	X
10 21 13	Phenolic Toilet Compartments		X	X	
10 28 13	Toilet Accessories			X	X
10 44 00	Fire Protection Specialties			X	X
11 30 13	Appliances			X	
11 61 43	Stage Curtains		X	X	
12 24 13	Roller Window Shades			X	X
12 35 50	Educational Casework			X	X
12 36 00	Countertops			X	X
12 48 13	Entrance Floor Mats and Frames			X	
12 93 00	Site Furnishings			X	
14 42 00	Wheelchair Lifts		X	X	X
21 00 50	Basic Fire Sprinkler Materials and Methods			X	
21 10 00	Fire Sprinkler Systems			X	X

01 33 00 – 3.1 – SUBMITTAL LIST					
SPEC. SECTION	TITLE	MOCK-UP	**SAMPLE	CATALOG SHEET	*REPORT, SCHEDULE, OR SHOP DRAWING
22 00 50	Basic Plumbing Materials and Methods			X	
22 10 00	Plumbing Pipe Systems			X	
22 40 00	Plumbing Fixtures			X	X
22 50 00	Plumbing Equipment			X	
23 00 50	Basic HVAC Materials and Methods			X	
23 05 93	Testing, Adjust and Balancing for HVAC				X
23 09 23	Energy Management Systems for HVAC			X	X
23 80 00	Heating, Ventilating and Air Conditioning		X	X	X
26 05 00	Electrical Materials and Methods			X	
26 13 00	Raceways and Boxes			X	
26 22 00	Fuses			X	
26 24 20	Panelboards			X	
26 27 26	Wiring Devices			X	
26 28 16	Enclosed Switches and Circuit Breakers			X	
26 51 00	Interior Lighting			X	X
26 51 01	Lighting Control System			X	X
26 56 00	Exterior Lighting			X	X
27 05 00	Data Networking			X	X
27 51 00	Assistive Listening System			X	X
27 76 00	Public Address and Clock System			X	X
27 80 00	Smart Classroom Audio Visual System			X	X
28 16 00	Intrusion Alarm System			X	X
28 31 00	Networked Fire Alarm System			X	X

01 33 00 – 3.1 – SUBMITTAL LIST					
SPEC. SECTION	TITLE	MOCK-UP	**SAMPLE	CATALOG SHEET	*REPORT, SCHEDULE, OR SHOP DRAWING
31 20 00	Earthwork				
32 10 00	Asphalt Concrete Paving				
32 13 00	Site Concrete				
32 14 13	Permeable Interlocking Precast Concrete Unit Paving			X	
32 31 19	Decorative Metal Fences & Gates			X	X
33 00 00	Site Utilities				

* Indicates four (4) prints and one (1) transparency to be submitted.

** Samples are generally required for Architect's "color and material board" or for testing lab. To expedite approval, Contractor shall expedite the submittal of these items. Color board items will not be approved until all such items are received. Refer to Division 1 and other Sections for further requirements.

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

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.

1.2 REFERENCES

- A. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- C. CBC - California Building Code.
- D. Title 24, Part 2, of the California Code of Regulations.
- E. DSA – Division of the State Architect, Department of General Services

1.3 OBSERVATIONS AND SUPERVISION

- A. The Owner and Architect or their appointed representatives will review the Work and the Contractor shall provide facilities and access to the Work at all times as required to facilitate this review. Administration by the Architect and any consulting structural engineer will be in accordance with applicable regulations, including, without limitation, CCR, Part 1, Title 24, Section 7-141.
- B. One or more Project Inspector(s) approved by DSA and employed by or in contract with the Owner, referred to hereinafter as the "Project Inspector", will observe the work in accordance with CCR, Part 1, Title 24, Sections 7-144(a)(b)(c), 7-145(a):
 - 1. The Project Inspector shall have access to the tests wherever it is in preparation or progress for ascertaining that the tests is in accordance with the Contract Documents and all applicable code sections. The Contractor shall provide

facilities and access as required and shall provide assistance for sampling or measuring materials.

2. The Project Inspector will notify the Owner and Architect and call the attention of the Contractor to any observed failure of tests or material to conform to Contract Documents.
 3. The Project Inspector shall observe and monitor all testing and inspection activities required.
- C. The Contractor shall conform with all applicable laws as indicated in the Contract Documents, including, without limitation, to CCR, Part 1, Title 24, Section 4-343. The Contractor shall supervise and direct the Work and maintain a competent superintendent on the job who is authorized to act in all matters pertaining to the Work. The Contractor's superintendent shall also inspect all materials, as they arrive, for compliance with the Contract Documents. Contractor shall reject defective Work or materials immediately upon delivery or failure of the Work or material to comply with the Contract Documents. The Contractor shall submit verified reports as indicated in the Contract Documents, including, without limitation, the Specifications and as required by Part 1, Title 24, Section 7-151.

1.4 TESTS AND INSPECTIONS

- A. The Contractor shall be responsible for notifying the Owner and Project Inspector of all required tests and inspections. Contractor shall notify the Owner and Project Inspector forty-eight (48) hours in advance of performing any Work requiring testing or inspection.
- B. The Contractor shall provide access to Work to be tested and furnish incidental labor, equipment, and facilities to facilitate all inspections and tests.
- C. The Owner will pay for first inspections and tests required by the "CCRs", and other inspections or tests that the Owner and/or the Architect may direct to have made, including, but not limited to, the following principal items:
 1. Tests and observations for earthwork and paving.
 2. Tests for concrete mix designs, including tests of trial batches.
 3. Tests and inspections for structural steel capitalize Work.
 4. Field tests for framing lumber moisture content.
 5. Additional tests directed by the Owner that establish that materials and installation comply with the Contract Documents.
 6. Test and observation of welding and expansion anchors.
 7. Factory observation of components and assembly of modular prefabrication structures and buildings.

- D. The Owner may, at its discretion, pay and back charge the Contractor for:
 - 1. Retests or reinspections, if required, and tests or inspection required due to test failures Contractor error or lack of required identifications of material.
 - 2. Uncovering of Work in accordance with Contract Documents.
 - 3. Testing done on weekends, holidays, and overtime will be chargeable to the Contractor for the overtime portion.
 - 4. Testing done off site.
- E. Testing and inspection reports and certifications:
 - 1. If initially received by Contractor, Contractor shall provide to each of the following a copy of the agency or laboratory report of each test or inspection or certification.
 - a. The Owner.
 - b. The Construction Manager, if any.
 - c. The Architect.
 - d. The Consulting Engineer, if any.
 - e. Other Engineers on the Project, as appropriate.
 - f. The Project Inspector.
 - g. The Contractor.
 - 2. When the test or inspection is one required by the CCR, a copy of the report shall also be provided to DSA.

1.5 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing as specified by Owner's testing laboratory.
- B. Owner's employment of testing laboratory shall in no way relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.6 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.

1.7 LABORATORY REPORTS

- A. After each inspection and test, Owner shall then submit one copy of laboratory report to Contractor. Laboratory shall submit copies of the report per the requirements of Section 01 30 00, Submittals. 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.
- B. Verification of Test Reports: Each testing agency shall submit in accordance with Section 01 30 00 Submittals, a verified report 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.

1.8 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.

1.9 CONTRACTOR RESPONSIBILITIES

- A. Submit proposed items for testing as required herein and/or as defined in Section 01 45 00 Quality Control to Architect for review in accordance with applicable Specifications.
- B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.
- C. Notify Architect, Owner's Representative, 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 Contractor's Work and/or materials does not comply with Contract Documents.

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

- A. The testing agency shall perform tests and inspections per DSA approved "Tests and Inspections" list as well as for the following in conformance with the (CBC) California Building Code (International Building Code with State of California Amendments), Title 24, Part 2, of the California Code of Regulations. [Furnish copies of Product Data and Test Reports as required. Furnish facilities for storage and curing of test samples.].
1. General Requirements (Chapter 17A):
 - a. Special Inspections - 1701A.
 - b. Nondestructive Testing - 1704A.
 - c. Prefabricated Construction -1704A.
 2. Foundations (Chapter 18A and 33):
 - a. Earth fill compaction - 3304.1.
 3. Concrete (Chapter 19A):
 - a. Materials:
 - (1) Portland Cement Tests - 1903A.2.
 - (2) Concrete Aggregates - 1903A.5.
 - (3) Reinforcing Bars - 1903A.8, 1929A.2.
 - (4) Prestressing Steel & Anchorage – 1910A.5, 1910A.3.
 - (5) Waiver of Batch Plant Inspection and Tests – 1929A.5.
 - b. Concrete Quality:

- (1) Proportions of Concrete - 1904A.1, 1904A.2, 1904A.3, 1904A.4, 1905A.1, 1905A.2, 1905A.3, 1905A.4, 1905A.5.
 - (2) Strength Tests of Concrete - 1905A.6.
 - (3) Splitting Tensile Tests - 1905A.1.4.
 - (4) Composition Construction Cores - 1929A.8.
- c. Concrete Inspection:
 - (1) Job Site Inspection - 1905A.6, 1905A.7.
 - (2) Batch Plant or Weighmaster Inspection - 1929A.4.
 - (3) Reinforcing Bar Welding Inspection - 1929A.12.
- d. Anchors in Concrete:
 - (1) Drilled-In-Expansion Bolts or Epoxy-Type Anchors in Concrete - 1923A.3.5.
- 4. Masonry (Chapter 21A):
 - a. Materials:
 - (1) Masonry Units - 2102A.2, 4., 5., 6.
 - (2) Portland Cement - 2102A.2,2.
 - (3) Mortar & Grout Aggregates - 2102A.2, 1, 2103A.3, 2103A.4.
 - (4) Reinforcing Bars - 2102A.2, 10. 1903A.5, 1929A.2.
 - b. Masonry Quality:
 - (1) Portland Cement Tests - 1903A.2, 1929A.1.
 - (2) Mortar & Grout Tests - 2105A.3.4, 2.
 - (3) Masonry Prism Tests - 2105A.3.2, 2105A.3.3, 2105A.3.4, 2105A.3.5.
 - (4) Masonry Core Tests -2105A.3.1.
 - (5) Masonry Unit Tests - 2105A.3.4,1.
 - (6) Reinforcing Bar Tests - 1929A.2.
 - c. Masonry Inspection:

- (1) Reinforced Masonry - 2115A, 2105A.7.
- (2) Reinforcing Bar Welding Inspection - 1929A.12.

5. Structural Steel (Chapter 22A):

a. Materials:

- (1) Structural Steel - 2203A.2, 2231A.1.
- (2) Material Identification - 2203A.

b. Inspection and Tests of Structural Steel:

- (1) Tests of Structural & Cold Formed Steel - 2231A.1.
- (2) Tests of H.S. Bolts, Nuts, Washers - 2231A.2.
- (3) Tests of End Welded Studs - 2231A.3.
- (4) Shop Fabrication Inspection - 2231A.4.
- (5) High Strength Bolt Inspection - 2231A.6.
- (6) Welding Inspection - 2231A.5.
- (7) Nelson Stud Welding - 2231A.3.
- (8) Non-destructive Weld Testing - 1703A.

6. Wood (Chapter 23):

a. Materials:

- (1) Lumber and Plywood Grading - 2304.

7. Roof Covering (Chapter 15A):

a. Materials:

- (1) Roof Tile Tests – 1507A.7.1.

8. Aluminum (Chapter 20):

a. Materials:

- (1) Alloys - 2001.2.

(2) Identification - 2001.4.

b. Inspection.

(1) Welding - 2004.8.

- B. Plumbing: Testing as specified in plumbing specifications including, but not limited to: sterilization, soil waste and vent, water piping, source of water, pressure, gas piping, downspouts and storm drains.
- C. Automatic Fire Sprinklers (where applicable): Testing as specified in plumbing specifications shall include, but not be limited to, hydrostatic pressure.
- D. Heating, Ventilating and Air Conditioning: Testing as specified in HVAC specifications 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.
- E. Electrical: Testing as specified in Electrical Specifications, including, but not limited to, equipment testing, all electrical system operations, grounding system and checking insulation after cable is pulled.

1.11 PROJECT INSPECTOR'S ACCESS TO SITE

- A. A Project Inspector employed by the Owner in accordance with the requirement of State of 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, and as indicated in the General Conditions.
- B. The Owner and the Construction Manager 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 Project Inspector. He shall have free access to any or all parts of the Work at any time. The Contractor shall furnish the Project 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 a Project Inspector shall in no way change, mitigate or alleviate the responsibility of the Contractor.
- D. The Project 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.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

- A. Requirements for Project Record Documents to be submitted for Contract closeout.

1.3 PROJECT RECORD DOCUMENTS

- A. General:

- 1. Contractor shall not use Record Documents for construction purposes.
 - 2. Contractor shall protect from deterioration and loss in a secure, fire-resistive location; provide access to Record Documents for the District's and the Architect's reference during normal working hours.
 - 3. Contractor shall keep Project Record Documents current, as they will be reviewed for completeness by Architect, Inspector, and District's Representative as condition for certification of each Progress Payment Application.

- B. Record Drawings: Contractor shall record information continuously as Work progresses. Contractor shall not conceal Work permanently until all required information is recorded. Contractor shall:

- 1. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately.
 - 2. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 3. Legibly and to scale, mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the work.
 - 4. Mark new information that is important to the University, but was not shown on Contract Drawings or Shop Drawings. Record actual construction, including:
 - a. GPS X, Y and Z coordinate of manholes interior corner and each utilidor where it leaves the steam manhole.
 - b. The following for underground utilities and valves installed and encountered:

- 1) Shoot horizontal centerline, width and vertical top of pipe/utility locations and valves, referenced to permanent ground improvements along with GPS X, Y and Z coordinates.
 - 2) Service type.
 - 3) Pipe/utility size.
 - 4) Pipe/utility material.
 - c. Field changes of dimension and detail.
 - d. Details not on original Contract Drawings. Application of copies of details produced and provided by Architect during construction will be accepted.
 5. Note related Change Order numbers where applicable.
 6. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
 7. Store Record Documents separate from documents used for construction.
- C. Record Specifications: Contractor shall record changes made by Addenda and Change Orders. Contractor shall legibly mark and record in red ink actual Products installed or used, including:
1. Manufacturer's name and product model or catalog number.
 2. Product substitutions or alternates utilized.
- D. Record Photos: Contractor shall photograph all work before covering up, including:
1. All open trenches and manholes shall be photographed.
 2. All exposed utilities should be identified in the photos.
 3. Show photographs locations on Record Drawings.
- E. Initial Submission:
1. Prior to the date of the Notice of Completion, Contractor shall submit color PDF scanned record prints and one paper-copy set of marked Record Documents to Architect for review, approval and further processing.
 2. Prior to the date of the Notice of Completion, Contractor shall submit annotated PDF electronic file and one paper-copy set of marked Record Specifications to Architect for review, approval and further processing.
 3. Architect will indicate whether general scope of changes, additional information recorded, and quality of mark-ups are acceptable.
- F. Final Submission:
1. Submit color PDF scanned record prints and two paper-copy sets of marked Record Documents.
 2. Print each drawing, whether or not changes and additional information were recorded.
 3. Submit annotated PDF electronic file and one paper-copy set of marked Record Specifications.
 4. Submit annotated PDF electronic file and one paper-copy set of Record Photographs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Demolition of designated structures and removal of materials from site.
- B. Demolition and removal of foundations and slabs-on-grade where indicated.
- C. Disconnecting and capping removal of identified utilities where indicated.
- D. Removal of underground piping where indicated.
- E. Salvage, storage, and turnover of items to be retained by District.
- F. Temporary fire protection.
- G. Coordination with hazardous waste removal.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control and disposal of materials.
- B. Comply with 2019 California Fire Code (CFC), California Code of Regulations, (CCR) Title 24, Part 9, Chapter 33 - Fire Safety During Construction and Demolition.
- C. Obtain required permits from authorities having jurisdiction.
- D. Notify affected utility companies before starting Work and comply with their requirements.
- E. Do not close or obstruct roadways, sidewalks, and hydrants without permits.
- F. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.3 SUBMITTALS

- A. Pre-demolition Photographs: Show conditions of existing 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 78 39. Accurately record locations of utilities and subsurface obstructions on Record Drawings.

- C. Landfill Records: Receipt and acceptance of hazardous waste by a landfill licensed to accept hazardous waste.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for removing refrigerant, stating that refrigerant recovery was performed according to EPA regulations. Include name and address of technician and date of recovery.

1.4 QUALITY ASSURANCE

- A. Demolition Firm: Experienced firm that specializes in demolition similar to extent indicated for this Project.
- B. Refrigerant Recovery Technician: Certified by EPA – approved certification program.

1.5 PROJECT CONDITIONS

- A. Buildings to be demolished will be evacuated and their use discontinued before start of Work.
- B. District will occupy building(s) adjacent to demolition area. Conduct demolition so District's operation will not be disrupted.
- C. Provide at least 72-hour notice to District of activities that will affect District's operation.
- D. Maintain access to existing walkways, exits, and other adjacent occupied facilities.
- E. District assumes no responsibility for buildings and structures 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 Section 02 80 00, Hazardous Material Remediation.
 - 2. Do not disturb hazardous materials except as specified.

1.6 SCHEDULING

- A. Schedule Work under the provisions of Section 01 32 16.
- B. Schedule Work to coincide with new construction and phasing documents.
- C. Perform Work during normal hours of operation.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Fill Material: Type of fill as specified in Section 31 20 00.

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 pre-demolition photographs.
- D. Verify that hazardous waste remediation is complete.

3.2 PREPARATION

- A. Provide, erect, and maintain temporary barriers and security devices.
- B. Protect existing landscaping materials, appurtenances, and structures which are not to be demolished.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
- D. Mark location of utilities.

3.3 DEMOLITION REQUIREMENTS

- A. Conduct demolition to minimize interference with adjacent structures and occupancies.
- B. Cease operations immediately if adjacent structures appear to be in danger. Notify Architect. Do not resume operations until directed.
- C. Conduct operations with minimum interference to public accesses. Maintain egress and access at all times.
- D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property.
- E. Sprinkle Work with water to minimize dust. Provide hoses and water connections for this purpose.
- F. Maintain fire safety during demolition in accordance with CFC, Chapter 33 Fire Safety During Construction and Demolition.

3.4 DEMOLITION

- A. Disconnect, cap, and identify designated utilities within demolition areas.
- B. Remove foundation walls and footings.
- C. Remove concrete slabs and asphalt paving.
- D. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 02 42 21.
- E. Backfill open pits and holes caused as a result of demolition, in accordance with Section 02 40 00.
- F. Rough grade and compact areas affected by demolition to maintain site grades and contours.
- G. Remove demolished materials from site and dispose of legally.
- H. Do not burn or bury materials on site. Leave site in clean condition.
- I. Remove temporary Work.

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. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- D. Do not store materials within drip line of trees.
- E. Transport recyclable materials that are not indicated to be reused off District's property to recycling receiver or processor.
- F. Recycled incentives received for building demolition materials shall be equally shared between Contractor and District.
- G. Concrete: Break up and transport to concrete-recycling facility.
- H. Concrete Reinforcement: Remove reinforcement from concrete and sort with other metals.
- I. Masonry: Crush masonry and screen to comply with requirements for use as satisfactory fill or subbase.
- J. Masonry Reinforcement: Remove reinforcement from masonry and sort with other metals.

- K. Wood Materials: Sort and stack members according to size, type, and length. Separate dimensional and engineered lumber, panel products, and treated wood materials.
- L. Metals: Separate by metal type, Remove nuts, bolts, and rough hardware. Sort structural steel by type and size.
- M. Roofing: Separate organic and fiberglass shingles and felts. Remove nails, staples, and accessories.
- N. Doors and Hardware: Brace open end of door frames. Leave hardware attached to doors.
- O. Carpet and Pad: Store clean dry carpet and pad in closed container or trailer.
- P. Gypsum Board: Stack large clean pieces on pallets. Remove edge trim and sort with metals. Remove and dispose of fasteners.
- Q. Acoustical Ceiling Materials: Stack panels and tiles on pallets. Separate suspension system and sort with metals.
- R. Equipment: Drain tanks, piping and fixtures. Seal openings with caps or plugs.
- S. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, and other components.
- T. Lighting Fixtures: Remove lamps and separate by type.
- U. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type and size.
- V. Conduit: Reduce conduit to straight lengths and store by type and size.

3.6 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 District.
- D. Protect items from damage.
- E. Install salvaged items to comply with requirements for new materials and equipment.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items to be recycled, salvaged 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.

3.8 CLEANING

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

END OF SECTION

SECTION 03 10 00 CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in-place concrete.
- B. Form openings for mechanical and electrical work.
- C. Coordinate installation of items supplies under other specification sections.

1.2 RELATED SECTIONS

- A. Section 03 30 00: Cast-in-Place Concrete
- B. Section 03 20 00: Concrete Reinforcing
- C. Mechanical and electrical items to be embedded in concrete.

1.3 QUALITY ASSURANCE

- A. Design Requirements:
 - 1. All work shall California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC) and DSA Amendments.
 - 2. Responsibility: Design of formwork is the Subcontractor's responsibility. Comply with the following, except as modified by the Building Code or these specifications.
 - a. ACI 301 - "Specifications for Structural Concrete for Buildings."
 - b. ACI 347 - "Recommended Practice for Concrete Formwork."
 - c. ACI 303R - "Guide to Cast-in-Place Architectural Concrete Practice."
 - 3. Allowable Tolerances:
 - a. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
 - b. Note special tolerance requirements for locations of drains where indicated on drawings.

1.4 SUBMITTALS

- A. Product Data: Submit Manufacturer's data and installation instructions for proprietary materials such as form coatings, manufactured form systems, ties and accessories.
- B. Submit manufacturer's certification that form release agent will provide clean, stainfree surfaces of concrete and not interfere with bond of applied finishes.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver form release agents in manufacturer's sealed and trademarked containers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. General: Form material shall be as required to produce continuous, straight, smooth exposed surfaces. Materials selected shall be satisfactory to Architect for effect on finished appearance of concrete. Architectural concrete formwork shall be of one material throughout the work, for all similar types of concrete surfaces.
- B. Exposed Non-Architectural Concrete:
 - 1. Metal or APA graded Plyform, Grade BB, Class I or II, or HDO plywood exterior type, each piece graded, no mill oiling. Use one form face material throughout the project for similar types of concrete surfaces.
 - 2. Provide material and bracing with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- C. Concealed Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side. "Concealed" means not visible in the completed structure. (Painted concrete is not to be considered "concealed".)
- D. Form Ties:
 - 1. Provide snap ties with plastic cones of same size and shape and of same manufacturer as cement cone hole plugs provided under Concrete Section.
 - 2. Wire ties and site fabricated ties and wood separators are not acceptable.
- E. Form Coatings: Commercial formulation resin-based form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond, or adhesion,

nor impede the wetting of surfaces to be cured with water or curing compounds. Oils and petroleum distillates are not acceptable. Verify compatibility of form coating with proposed surface finish.

- F. Metal Inserts: Provide metal inserts for anchorage of materials or equipment to concrete construction, where not supplied by other trades and required for the work.
- G. Earth forms permitted for footings.

2.2 FORMWORK SYSTEMS

- A. Design, erect, support, brace and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design forms to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structuring during construction.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Provide formwork sufficiently tight to prevent leakage of cement past during concrete placement. Solidly butt and gasket joints and provide backup material at joints to prevent leakage and fins.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.2 FORM CONSTRUCTION

- A. General: Construct forms complying with ACI 347 and ACI 303R, as applicable to the sizes, shapes, lines and dimensions shown, and to accurate alignment, location, grades, levels, and plumbness. Provide for openings, sleeves, offsets, recesses, reglets, chamfers, inserts, and other features required. Use selected materials to obtain required finishes. Before placing concrete, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming system.
- B. Ties:
 - 1. Spacing: Space ties in a uniform pattern satisfactory to the Architect.

Rest cones firmly against forms and seal to prevent leakage.

C. Corner Treatment:

1. Make all corners chamfered.
2. Form chamfers with 3/4" x 3/4" strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Concealed corners may be formed either square or chamfered.

D. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. Accurately place and securely support items built into forms. Openings for doors and windows shall be formed with a tolerance of minus 0" and plus 1/2" from indicated dimensions.

E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

F. Earth Forms:

1. Construct wood edge strips at top sides of excavations.
2. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
3. Remove loose dirt and debris prior to concrete pours.
4. Foundation concrete may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Architect subject to the approval of DSA.
 - a. The horizontal dimensions of unformed concrete footings shall be increased 1 inch at every surface at which concrete is placed directly against the soil.
 - b. The minimum formwork shown on the drawings is mandatory to ensure clean excavations immediately prior to and during the placing of concrete.

G. Footings and Grade Beams:

1. Provide forms for footings and grade beams if soil or other conditions are such that earth trench forms are unsuitable.

- H. For slabs-on-grade, secure edge forms in such a manner as to not move under weight of construction loads, construction and finishing equipment, or workers

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, concrete. Use top and bottom templates, setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
- B. Coordinate and schedule the work of this Section with the work of other Sections required to be set in, on, or contiguous with forms.
- C. Anchor bolts out of position or plumb by more than 1/4" shall be reinstalled in correct position and plumb at no increase in Contract Price.

3.5 REMOVAL OF FORMS

- A. Remove forms completely. Exposed surfaces of concrete shall be clean, smooth and free of irregularities.
- B. Form Ties:
 - 1. Do not remove ties until concrete has hardened sufficiently to permit removal without damaging concrete. Do not spall concrete on exposed surfaces. Pull ties of type that are wholly withdrawn from the wall toward the inside face. Cutting ties back from face of wall will not be permitted. Plug tie rod holes as specified in Concrete Section.
- C. Do not pry against face of concrete. Use wooden wedges only.
- D. Forms:
 - 1. Remove forms in manner to ensure safety of members. Do not disturb supporting forms until concrete has hardened sufficiently to permit removal with safety and without damage to concrete surface. Construct forms to permit their removal without disturbing the original shoring.
 - 2. Time of Removal: Time of removal will depend on weather conditions, the results of cylinder tests and effectiveness of curing. The following periods between depositing of concrete and removal of forms shall be considered a minimum, which may be extended if deemed necessary by the Architect. Subject to the requirements of paragraph A above, forms for walls may be removed after 8 hours of completing concrete placement.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars for cast-in-place concrete, complete with tie wire.
- B. Support chairs, bolsters, bars supports, spacers, and other accessories for reinforcing.

1.2 RELATED SECTIONS

- A. Section 03 10 00: Concrete Formwork.
- B. Section 03 30 00: Cast-in-Place Concrete.

1.3 QUALITY ASSURANCE

- A. Perform concrete reinforcing work in accordance with CRSI 63 and 65 and ACI 301, 315 and 318, unless specified otherwise in this Section.
- B. The Owner's Testing Agency will:
 - 1. Provide tests in accordance with the California Building Code (CBC) Section 1910A.2.
 - 2. Collect mill test reports for reinforcement.
 - 3. Take samples from bundles at fabricators:
 - a. When bundles are identified by the heat number and accompanied by mill analysis, two specimens shall be taken from each ten (10) tons, or fraction thereof, of each size and grade.
 - b. When reinforcement is not positively identified by the heat numbers or when random sampling is intended, two specimens shall be taken from each 2-1/2 tons, or thereof, of each size and grade.
 - c. All costs associated with the test of reinforcing that not have mill test reports will be at the contractor's expense.
 - 4. Test for tensile and bending strengths.

1.4 REFERENCES

- A. California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC) with DSA Amendments.

- B. ACI 301 - American Concrete Institute - Specification for Structural Concrete for Buildings.
- C. ACI 315 - American Concrete Institute - Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements for Reinforced Concrete.
- E. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
- F. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.5 SUBMITTALS

- A. Submit shop drawings including appropriate plans and details. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing device.

PART 2 - PRODUCTS

2.1 REINFORCING

- A. Reinforcing Steel: 60 ksi yield grade; deformed type as indicated on drawings.
 - 1. Bars: Billet steel, ASTM 615; as indicated.
 - 2. Finish: Plain unless indicated galvanized on drawings or so specified.
 - 3. Welded Bars: ASTM A706
- B. Welded Wire Reinforcing: ASTM A185

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16-gage annealed type, or patented system accepted by Architect.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcing during construction conditions.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI 315.
- B. Locate reinforcing splices, not indicated on drawings, at points of minimum stress. Location of splices shall be reviewed by Architect.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.
- B. Place reinforcing to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcing in position during concrete placement operations.
- C. Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings, which would reduce bond to concrete.

3.2 FIELD QUALITY CONTROL

- A. General: The Owner's Testing Laboratory shall test and inspect concrete reinforcement and embedded assemblies as Work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Design Professionals for final acceptance.
- B. Owner's Testing Laboratory shall provide qualified personnel at site to inspect reinforcement and embeds using the latest Drawings and reviewed shop drawings, as follows:
 - 1. Prior to placement, inspect reinforcement and embeds for grade, quality of material, absence of foreign matter, and for suitable storage.
 - 2. Provide continuous inspection of reinforcement and embedded assemblies during placement and immediately prior to concreting operations for: size, quantity, vertical and horizontal spacing and location, correctness of bends and splices, mechanical splices, clearances, compliance with specified tolerances, security of supports and ties, concrete cover, and absence of foreign matter.
- C. Owner's Testing Laboratory shall submit inspection, observation, and/or test reports to the Design Professionals as required herein and shall provide an evaluation statement in each report stating whether or not concrete reinforcement and embedded assemblies conforms to requirements of Specifications and Drawings and shall specifically note deviations there from.
- D. Immediately report deficiencies to the Contractor. Contractor shall prepare proposed remedy for deficiency. Contractor shall present proposal to the Design Professionals for approval. After an approved proposal is accepted by the Design Professionals, the Contractor shall correct the deficiency at no cost to the Owner.

END OF SECTION

SECTION 03 30 00 CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete footings, foundations and grade beams.
- C. Floors and slabs on grade.
- D. Cast-in-place equipment pads.
- E. Surface finish of floors and walls.
- F. Preparation of concrete base slabs to receive toppings.

1.2 RELATED WORK

- A. Section 03 10 00: Concrete Formwork.
- B. Section 03 20 00: Concrete Reinforcement.
- C. Divisions 15 and 16: Mechanical and electrical items to be cast in concrete.

1.3 QUALITY ASSURANCE

- A. Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise in this Section.
- B. Inspection and testing will be performed by owner's testing laboratory.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00: Submittal Procedures.
- B. Submit proposed mix design of each class of concrete to inspection and testing firm and Architect and Engineer for review prior to commencement of work.
- C. Three concrete test cylinders will be taken not less than once for every 50 cubic yards of concrete placed or not less than once a day for each class of concrete placed by special inspector.
- D. The cement supplier shall submit certification of compliance in accordance with CBC Section 1910A.1.
- E. One additional test cylinder will be taken during cold weather concreting and be cured on job site under same conditions as concrete it represents.
- F. One slump test will be taken for each set of test cylinders taken.

- G. The manufacturer of transit-mix concrete shall deliver to job inspector a certificate with each mixer truck. Certificate shall bear signature of representative of Testing Laboratory, stating quantity of cement, water, fine aggregate, coarse aggregate, and admixtures contained in load. Certificates shall indicate time, to the nearest minute, that batch was mixed.

1.5 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing concrete.
3. ACI 301 - Specifications for Structural Concrete for Buildings.
4. ACI 305 - Hot Weather Concreting.
5. ACI 306 - Cold Weather Concreting.

- B. All work shall be done in accordance with California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC) and DSA Amendments.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: Portland, Type II; ASTM C150. Gray, except where noted, supplement with the following:
 1. Fly Ash: 25 percent maximum; Fly Ash shall conform to ASTM C618 Class N or F.
 2. Combined Fly Ash and Pozzolan: 25 percent maximum
 3. Ground Granulated Blast Furnace Slag: 50 percent maximum
 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent maximum with combined Fly Ash and Pozzolans not exceeding 25 percent
- B. Fine and Coarse Aggregates: ASTM C33 for normal weight concrete. ASTM C330 for light weight concrete. Aggregate shall be from established sources with proven history of successful use in producing concrete with minimum shrinkage. The average drying shrinkage after 28 days shall not exceed 0.045 percent for hardrock concrete.
- C. Water: Clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

- D. Source of aggregate shall remain constant for the duration of the work, as practical.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.1 percent chloride ions.
- C. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and containing not more than 0.1 percent chloride ions.
- D. Pozzolan: ASTM A618, containing not more than 0.1 percent chloride ions.
- E. Calcium Chloride: Not permitted.
- F. ASTM C 494, Type C, 30% + 2% solution of Calcium Nitrite
- G. Xypex: As manufactured by Xypex Chemical Corporation

2.3 ACCESSORIES

- A. Bonding Agent: "Anvil Bond" as manufactured by Master Builders or approved equal.
- B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in two days and 6000 psi in 28 days.
- C. Absorptive Mats: Cotton fabric or burlap-polyethylene, minimum 8oz./sq. yd; bonded to prevent separation during handling, placement and curing.
- D. Liquid Membrane-Forming curing Compound: Conforming to ASTM C309, Type I, and which will not discolor concrete or affect bonding or other finish applied thereover, and which restricts loss of water to not more than 0.500 grams per sq. cm. of surface when tested per ASTM C156.
- E. Provide Fly Ash or other reclaimed cementitious materials as indicated in Section 2.1.A.
- F. Slab-Leveling Compound. Provide leveling compound where required to meet floor flatness and levelness requirements. Acceptable products include Ardex SD-L, Burke 300 Durock or approved equal.

2.4 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer and Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

- B. Except as otherwise specified, submit written reports to Architect and Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect and Engineer.
- C. Provide concrete of following strength:
 - 1. Compressive strength (28 day) shall be as follows:
 - a. Slab on grade = 4000 psi
 - b. Footings = 4000 psi
 - 2. Select proportions for normal weight concrete in accordance with ACI 301 by Method 1, 2 or 3 as applicable. Add air-entraining agent to concrete to entrain air as indicated in ACI 301.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, water, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by architect before using in work.
- E. Admixtures:
 - 1. Use water-reducing admixture or high-range, water-reducing admixture (super plasticizer), may be used in concrete subject to approval by Architect.
 - 2. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 4 percent to 6 percent.

2.5 CONCRETE MIXES

- A. Ready-Mix Concrete: All concrete shall be ready-mix concrete unless otherwise approved by the Engineer and Architect.

PART 3 - EXECUTION

3.1 PLACING CONCRETE

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Place concrete in accordance with ACI 304, and as herein specified.
- C. Notify Structural Engineer minimum 48 hours prior to placing of concrete.

- D. Ensure anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause problems in placing concrete. Rectify misplacements and proceed with work.
- E. Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- F. Ensure reinforcement, embedded parts, formed expansion and contraction joints, and other inserts are not disturbed during concrete placement.
- G. Prepare previously placed concrete by blowing joints and provide keyway.
- H. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified only with prior approval of the Architect. Deposit concrete as nearly as practicable to this final location to avoid aggregation.
- I. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- J. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- K. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- L. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- M. Bring slab surfaces to correct level with straight-edge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- N. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer and Architect immediately on discovery.
- O. Conform to ACI 305 when concreting during hot weather.
- P. Conform to ACI 306 when concreting during cold weather.
- Q. Unless otherwise permitted, time for completion of discharge shall comply with ASTM C94/C94M. When discharge is permitted after more than 90 minutes have elapsed

since batching or after the drum has revolved 300 revolutions, verify that air content of air-entrained concrete, slump, and temperature of concrete are as specified. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, no water may be added.

3.2 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For all formed concrete surfaces except as noted below. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projects exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaced exposed-to-view or to be covered with a material such as waterproofing that requires a smooth surface. This is as cast arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projects completely removed and smoothed.

3.1 MONOLITHIC SLAB FINISHES

- A. General: finish slab surfaces in accordance with one of the finishes noted below, as designated in the Contract Documents. Finish all joints and edges with proper tools as approved.
- B. Placement: Place concrete at rate that allows spreading, straight-edging, and darbying or bull floating before bleed water appears. Screed all slabs, topping fills to true levels and slopes. Work surfaces as required to produce specified finish. Do no finishing in areas where water has accumulated; drain and re-screed. In no case use a sprinkling of cement and sand to absorb moisture.
- C. Tolerances: Measure slabs-on-grade to verify compliance with the tolerance requirements of ASTM E 1155 and ACI 117. Measure floor finish tolerances within 72 hours after slab finishing and before removed of supporting formwork or shoring.
 - 1. Concrete slab flatness and levelness tolerances to meet ACI 117, Section 4.5.6.
 - a. Minimum requirements at slab-on-ground: Flatness overall min Ff = 20 and levelness overall min FI = 17.
- D. Scratch Finish:
 - 1. Apply scratch finish to monolithic slab surfaces that are to receive mortar setting beds for tile, where mortar set tile is indicated on drawings.
 - 2. After placing slabs, plane surface to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with staff brushes, brooms, or rakes.
- E. Float Finish:
 - 1. Apply float finish to monolithic slab surfaces scheduled to receive trowel finish and other finishes as hereinafter specified.

2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surfaces to a uniform, smooth, granular texture.

F. Trowel Finish:

1. Unless otherwise noted, apply trowel finish to monolithic slab surfaces to be left exposed-to-view, or scheduled to receive floor finishes other than setting bed types.
2. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding those called out above in section C. Grind smooth surface defects, which would telegraph through applied floor covering system.

G. Non-Slip Broom Finish:

1. Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
2. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.4 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start curing procedures as soon as free water has disappeared from concrete surface after placing and finishing.
2. Continue curing as directed by Architect and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by either moist curing, by moisture retaining cover curing, membrane curing, or by combinations thereof, as herein specified.

1. Provide moisture curing by following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive

cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed at widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide liquid membrane curing as follows:
 - a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as possible after final finishing operations are complete, but not later than 2 hours. Apply uniformly in a continuous operation by power spray equipment or roller equipment in accordance with the manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.
 - b. Verify compatibility of membrane curing compounds on surfaces that are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Architect.
 - c. Do not use curing compounds that will diminish bond of subsequent materials.
4. Curing Formed surfaces: Cure formed concrete surfaces, including walls with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
5. Curing Unformed surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by any of the methods specified herein, as applicable.

3.5 PATCHING

- A. Allow Architect/Structural Engineer to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed.

3.6 FIELD QUALITY CONTROL

- A. Contractors Testing Laboratory: As specified in Section 1.3 above.

3.7 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details, and elevations.
- B. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Patch, fill, touch up, repair, or replace exposed architectural concrete for each individual area in accordance with Architect's particular directions.

END OF SECTION

SECTION 03 54 13

GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Liquid-applied, gypsum-based self-leveling floor underlayment.

1.2 REFERENCES

- A. ASTM C472 - Method for Physical Testing of Gypsum Plasters and Gypsum Concrete.
- B. ASTM E286 - Test Method for Surface Flammability of Building Materials Using an 8 Foot Tunnel Furnace.
- C. ASTM C144 - Aggregate for Masonry Mortar.
- D. CCR - California Code of Regulations.
- E. UBC - Uniform Building Code.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide physical characteristics and product limitations.
- C. Manufacturer's Instructions: Indicate mix instructions.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in performing the Work of this Section with minimum 3 years documented experience approved by manufacturer.

1.5 REGULATORY REQUIREMENTS

- A. Conform to UBC and CCR, Title 24, Part 2 for combustibility and flame spread requirements.
- B. Conform to UL Assembly Design No. UL ER 8477-01.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underlayment until floor penetrations and peripheral Work are complete.

- B. Maintain minimum ambient temperatures of 50 degrees Fahrenheit 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

1.1 MANUFACTURERS

- A. Maxxon Corp., "Gyp-Crete 2000."
- B. Rapid Floor Systems, "Rapid Floor Plus."
- C. Substitutions: Under provisions of Section 01 25 00.

1.2 MATERIALS

- A. Underlayment: Gypsum-based mix.
- B. Water: Potable and not detrimental to underlayment mix materials.
- C. Sand: ASTM C144.
- D. Primer: Manufacturer's recommended type.
- E. Joint and Crack Filler: Latex-based.

1.3 MIXING

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Mix to achieve following characteristics:
 - 1. Density: 100 pounds per cubic foot minimum dry density.
 - 2. Compressive Strength: 2,500 pounds per square inch minimum in accordance with ASTM C472.
 - 3. Fire Hazard Classification: Flame/Smoke rating of 0/0 in accordance with ASTM E286.
- C. Mix to self-leveling consistency.

2.1 EXAMINATION

- A. Verification of existing conditions prior to beginning Work.

- B. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

2.2 PREPARATION

- A. Remove substrate surface irregularities. Fill voids and deck joints and filler. Finish smooth.
- B. Vacuum clean surfaces.
- C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- D. Close floor openings.

2.3 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions.
- B. Place to minimum 3/4 inch thickness.
- C. Place after partition installation.

2.4 CURING

- A. Air cure in accordance with manufacturer's instructions.

2.5 APPLICATION TOLERANCE

- A. Top Surface: Level to 1/8 inch in 10 feet.

2.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section [01 44 00.] [01 45 29.]
- B. Placed Material: Inspecting and testing for conformance to Specification requirements.

2.7 PROTECTION OF FINISHED WORK

- A. Protect installed Work under provisions of Section 01 70 00.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Structural steel as indicated on Structural Drawings.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Comply with applicable provisions of the following; latest editions unless other specified.
 - 1. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings, of the American Institute of Steel Construction (AISC).
 - 2. Code of Standard Practice for Steel Buildings and Bridges, of AISC.
 - 3. Structural Welding Code - Steel, D1.1 of the American Welding Society (AWS).
 - 4. California Building Code, 2019 Edition, including DSA amendments.
 - 5. Safety regulations prescribed by OSHA.

1.3 TESTS AND INSPECTIONS

- A. Testing Agency: An inspection and testing agency shall be retained by the Owner for testing and inspection, as required by drawings and specifications. Selected agency will follow requirements of ASTM E329, "Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction."
 - 1. Materials and work shall be subject to inspection at fabricating plant, and building site. Material or workmanship not complying fully with drawings and specifications will not be accepted. Give Architect reasonable notice when ready for inspection. No additional compensation will be paid for any work required to prepare for testing and inspection.
 - 2. Testing Agency shall inspect all shop and field welding. Welding and high strength bolting shall be performed under full-time inspection. Agency will furnish inspectors, and comply with regulations of the California Building Code and certify in writing, upon completion of the work, that welding and high strength bolting has been performed in accordance with drawings and specifications.
 - 3. Testing Agency shall inspect all 100 percent full and partial penetration butt welds, which include, but are not limited to, column to column, column to plate, column to girder, and girder to girder connections by ultrasonic or

other approved non-destructive tests.

4. Multi-pass shop and field welds shall be continuously inspected.

B. Duties of the Owner's Testing Agencies:

1. Reports: The Testing Agency shall prepare daily reports of the structural steel work including progress and description/area of work, tests made and results. Reports of inspection of welding shall include deficiencies noted and corrections made, and other items pertinent to acceptance or rejection of the work. The reports shall state whether specimens comply with or deviate from contract requirements. The daily reports shall be collected and delivered to the Design Professionals, Contractor, DSA, and Owner weekly.
2. Rejection: The Owner's Testing Agency has the right to reject any material, at any time, when it is determined that the material or workmanship does not conform to the Contract Documents. The Testing Agency shall report deficiencies to Owner, Design Professionals, and Contractor immediately.

C. Materials Testing:

1. Steel shall be identified by heat or melt numbers and accompanied by mill analysis test reports.
2. Steel ordered from the mill shall be used without further local tests, provided an affidavit is given that materials conform to specifications requirements. In case of controversy, tensions and bend tests will be required, performed either locally or at the mill and in accordance with requirements for testing local stock.
3. Local stock structural steel may be used, provided one tension and one bend test is made for each 50 tons, or fractional part thereof, of such stock used in the work. Complete 4-sided surface inspection may be required. Each piece of high-strength local stock steel shall be tested and stamped.
4. Make arrangements to machine test required specimens under direction of Testing Agency; provide specimens of dimensions required by applicable ASTM Standard Specifications.

D. Test and Inspection Costs:

Cost of testing identified structural steel, except as specified hereunder, shall be paid by Owner.

- a. In the event that steel will be fabricated outside the State in which the project is being constructed, pay all transportation costs per diem living costs for inspection at fabricators' plants outside of the State.

- b. In the event that fabrication will take place in more than one shop location, pay all additional inspection costs resulting from fabrication.
 - 2. The owner shall pay cost of testing and inspection of unidentified steel but may back charge the contractor; cost of tests and inspections for all work and materials proved faulty; and all required retesting and inspection, and repairs.
- E. Ultrasonic Weld Testing: Ultrasonic testing shall be performed by a specifically trained, qualified technician, who shall operate equipment, examine welds and maintain a record of all welds examined, defects found and disposition of each defect. All defective welds shall be repaired and re-tested with ultrasonic equipment.
- 1. Initially, welds requiring ultrasonic testing shall be tested at rate of 100 percent in order to establish qualifications of each individual welder; minimum of 40 welds per welder. If rejectable defects occur in less than 5 percent of welds tested, 100 percent testing may be reduced to 25 percent. Percentage shall be calculated for each welder independently.
 - 2. When ultrasonic indications arising from weld root can be interpreted as either a weld defect or the backing strip, backing strip shall be removed at no additional cost to Owner, and if no root defect is visible the weld shall be re-tested.
 - 3. Ultrasonic instrumentation shall be calibrated to evaluate quality of welds in accordance with AWS D1.1, Section 6, Part C.
 - 4. Cooperate with Testing Agency if other methods of inspections, for example, X-ray, gamma ray, magnetic particle, or dye penetrant, are deemed necessary by inspection agency for use on welds.
- F. Ultrasonic Material Testing: All column material within one foot (6 inches either side of a direct butt weld for girder flange connections) shall be ultrasonically tested for lamination in accordance with ASTM A578, Level II.
- 1. Material in designated location shall be tested for laminations by ultrasonic means prior to fabrication, with written reports submitted to DSA.
 - 2. Rejectable defects discovered by ultrasonic means are defined as follows: Using suitable calibrated ultrasonic equipment, any recordable discontinuity causing complete loss of back reflection, and which cannot be encompassed with a 3-inch diameter circle, is unacceptable (Level II Standard of Acceptance). Should such flaws be detected subject to Architect's approval they may be repaired by welding.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00.

- B. Shop Drawings: Show fabrication, assembly and erection details, welded connections with standard AWS welding symbols, sizes of members, fastenings, supports and anchors, patterns, clearances, holes, camber and necessary connections to work of other trades. Obtain approval before beginning fabrication or delivery.
- C. Product data or manufacturer's specifications and installation instructions for the following products: structural steel (each type), including certified copies of mill reports; structural steel primer paint; shrinkage-resisting grout.
- D. Inspection reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and results.
- E. Welding procedure specifications with information required by AWS D1.1.
- F. Welding qualifications with information required by AWS D1.1.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. In general, material shall be of exact sizes, shapes, weight and kinds provided for on drawings and specifications. All structural steel is to be hot dipped galvanized.
- B. Structural Steel, Plates, Shapes and Bars shall conform to the appropriate ASTM standard as indicated:
 - 1. Miscellaneous Plates: ASTM A36
 - 2. Angles and Channels: ASTM A36
 - 3. Rectangular and Square HSS Members: ASTM A500, Grade B
 - 4. Wide Flange Members: ASTM A992, Grade 50
 - 5. Requirements for delivery shall conform to ASTM A6.
- C. High Strength Bolts: ASTM A325N
 - 1. Conform to the provisions of the Research Council on Structural Connections (RCSC) "Specifications for Structural Joints using ASTM A325 or A490 Bolts" except that nuts shall be ASTM A563 Grades DH or DH3 (hardened) for both A325 bolts. Twist off type bolts (Tension Control bolts) shall additionally conform to ASTM F1852 or ASTM F2280.
 - 2. All bolts shall be new, and not re-used.

D. Washers:

1. Round washers shall conform to American Standard B 27.2 type b
2. Washers in contact with high-strength bolt heads and nuts shall be hardened in accordance with ASTM Standard F436.
3. Beveled washers shall be square, smooth and sloped so that contact surfaces of the bolt head and nut are parallel.
4. The diameter of the hole of square beveled washers shall be 1/16 inch (1.5mm) greater than the bolt size for bolts smaller than one inch (25mm), and shall be 1/8 inch (3.0mm) greater than the bolt size for bolts larger than one inch (25mm).
5. Comply with requirements of RCSC for all washers including thickness, size and hardness, depending on connection details.

E. Anchor Bolts at Base Plates: F1554, Grade 36, as shown.

F. Arc-Welding Electrodes: Conforming to AWS D1.1 for filler metal requirement, and recommended by their manufacturers for position and other conditions of actual use.

G. Structural Steel Shapes: Material shall conform to information provided in General Notes of Structural Drawings.

H. Headed Welded Studs: As specified in General Notes of Structural Drawings.

I. Grout: Refer to Specification Section 03 30 00.

I. Shop Primer: Manufacturer's or fabricator's standard, fast curing, V.O.C. compliant, lead-free, "universal" primer; selected for good resistance to normal atmosphere corrosion and for compatibility with subsequent painting.

2.2 SHOP PAINTING

A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel, which is partially exposed on exposed portions and initial 2 inches of embedded areas only.

1. Do not paint surfaces, which are to be welded or high-strength bolted with friction-type connections.
2. Do not paint surfaces, which are scheduled to receive sprayed-on fireproofing.
3. Apply 2 coats of paint to all structural steel except as noted. Change color of second coat to distinguish it from first.

- B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 - 1. SP-1 "Solvent Cleaning"
 - 2. SP-3 "Power Tool Cleaning"
 - 3. AESS: SP-6 "Commercial Blast Cleaning."
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods, which result in full coverage of joints, corners, edges and exposed surfaces.
- D. Field touch up shop-applied primer wherever damaged or bare, with same type shop primer.

2.3 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural members in shop to greatest extent possible. Fabricate in accordance with AISC Specifications and as indicated on final, approved shop drawings.
- B. Connections: Weld or bolt shop connections, as indicated.
- C. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame-cut holes of enlarge holes by burning. Drill holes in bearing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Erect structural steel with proper equipment and qualified riggers.
- B. Actively cooperate with other trades and provide incidental welding, connections, etc., for securement of work of others to structural steel framing.

3.2 ERECTION TOLERANCES

- A. Erection tolerances for structural steel work shall be in accordance with latest AISC Code of Standard Practice for Steel Buildings and Bridges.

3.3 WELDING

- A. Welding and welded joints shall be in accordance with AWS Standards. Work shall be performed by operators who have been qualified by test in accordance

with AWS D1.1, "Structural Welding Code - Steel", to perform type of work required for this project.

3.4 SETTING AND GROUTING COLUMN BASE PLATES

- A. Provide necessary templates and diagrams for setting of such anchor bolts in concrete forms.
- B. Be jointly responsible with others for proper locating and installing, and make good any deficiencies and errors.
- C. Set base plates to elevations indicated on drawings and place grout through grout holes provided in base plates where indicated.
- D. Provide forms at least one inch clear around edges of base plate, with top of form not less than one inch above bottom of base plate.
- E. Allow grout to rise above bottom of base plate, making sure that all voids under base plate are completely filled.
- F. The use of specified grout shall be in strict compliance with manufacturer's printed instructions.

END OF SECTION

SECTION 05 12 10

STRUCTURAL STEEL – ADDITIONAL SEISMIC REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the fabrication and installation of structural steel, noted as part of Seismic Load Resisting System (SLRS) on the Contract Drawings.

- A. Provisions included herein apply to all members and connections denoted as “SLRS” in the contract documents.
- B. Provisions included herein are supplementary to the requirements of Section 05 12 00.
- C. Where provisions included herein conflict with the requirements of Section 05 12 00, the provisions of this section shall govern.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Section 05 12 00: Structural Steel

1.3 CODES AND STANDARDS

- A. Building Code: Structural steel work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.
- B. Standards:
 - 1. ANSI/AISC 341 – Seismic Provisions for Structural Steel Buildings; American Institute of Steel Construction, Inc., 2016.
 - 2. ANSI/AISC 358 and 358s1 – Prequalified connections for special and intermediate steel moment frames for seismic applications; American Institute of Steel Construction, Inc., 2016.
 - 3. “Seismic Welding Supplement” (AWS D1.8), 2016

C. Definitions:

1. Demand-Critical Welds: Demand-Critical Welds are designated on the structural drawings. All Demand-Critical Welds are part of the Seismic-Force-Resisting System.
2. Extra Smooth: Surfaces noted herein as “Extra Smooth” require a finish with surface variation of 500 micro-inches or less (AWS C4.1, Sample #4).
3. Heavy Sections: Rolled and built-up sections as defined below.
 - a) Hot rolled shapes with flanges thicker than 1 ½”.
 - b) Welded built-up members with plates exceeding 2” in thickness.
 - c) Column base plates exceeding 2” in thickness.
4. Protected Zone: The Protected Zone is defined as structural members, or portions thereof, to which connections of structural and non-structural elements are limited. The Protected Zone is designated on the structural drawings.
5. Seismic Load Resisting System (SLRS): The Seismic Load Resisting System (SLRS) is defined as all items designated “SLRS” on the Structural Drawings, including columns, beams, and braces, and their connections along grid lines denoted “SLRS” on the framing plans.

1.4 CONTRACTOR QUALIFICATIONS

- A. Welder Qualifications: Welders, welding operators, and tackers shall be qualified in accordance with AWS D1.8.
 1. Supplemental Welding Personnel Testing: Welders and welding operators performing work on bottom-flange Demand-Critical Welds shall pass the Supplemental Welder Qualification Testing, as required by AWS D1.8, Section 5.1. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.5 SUBMITTALS

- A. Shop and Erection Drawings: Detailed shop and erection drawings for structural steel and connections that are part of the SLRS shall show:
 1. Identification of members and connections of the Seismic-Force-Resisting System.
 2. Location and dimensions of the Protected Zone.

3. Identification of welds in the Seismic-Force-Resisting System.
 4. Identification of Demand-Critical Welds.
 5. Other items as required by AISC 341, Section 5.
 6. Shop drawings shall include connection details drawn to scale for members of the Seismic-Force-Resisting System.
- B. Welding Procedure Specifications (WPSs): Welding Procedure Specifications (WPSs) shall conform to the requirements of AWS D1.8.
1. If the maximum interpass temperature is to exceed 550 degrees Fahrenheit, provide qualification testing per AWS D1.8, Section 6.5.2.
- C. Welding Performance Qualification Records (WPQRs): Submit documentation that the welder has passed all designated supplemental welder qualification testing required for the types of welding to be performed. Submit documentation showing that the welder continued to use the applicable welding process on an ongoing basis since the WPQR test was conducted, in accordance with AWS D1.8, Section 5.2.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Electrode Storage and Exposure Limits for Demand-Critical Welds: The exposure time limit for electrodes shall be in conformance with AWS D1.8 Section 6.4.

1.7 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

- A. Submittals: The Owner's Testing Agency will submit the following items:
1. Written Practice for Owner's Testing Agencies shall include welding inspection procedures to meet the requirements of AWS D1.8.
- B. Duties of the Owner's testing Agencies:
1. Inspect Heavy Sections:
 - a) A reinspection shall be done a minimum of 48 hours after welding on flanges at SLRS moment connections with a thickness of 3" or greater.
 2. Welding Inspection: The Welding Inspector shall perform inspection tasks necessary to meet the requirements of AWS D1.8, AISC 341 Appendix Q, and the requirements of the Contract Documents.
 3. Non-destructive Testing of Welded Joints
 - a) Visually inspect all welds.

- b) Non-destructive testing shall be conducted at locations required by AWS D1.8 and AISC 341 Appendix Q5.2. Frequency of testing shall be as required by AISC 341 Appendix Q5.2 and Table 1-1.
 - c) Magnetic Particle Testing (MT) shall be performed in accordance with AWS D1.1, and AWS D1.8 Annex F.
 - d) Ultrasonic testing (UT) shall be performed in accordance with AWS D1.1 and AWS D1.8.
 - e) Weld Acceptance Criteria shall be in accordance with AWS D1.1 and AWS D1.8. Regions of welds that cannot be inspected shall be identified and recorded, and the Design Professionals shall be notified.
 - f) K-Area Welding Inspection: A minimum of 48 hours after completion of welding, test column webs for cracking using liquid penetrant (PT) or magnetic particle testing (MT) over a zone 3" above and below each weld.
4. Inspect structural steel to verify that the Protected Zones of members of the Seismic-Force-Resisting System are free of damage and attachments not approved by the Design Professionals

Table 1-1: Nondestructive Testing (NDT) Requirements

Weld Category	Nondestructive Testing Requirements	
	Complete-Joint-Penetration Welds ¹	Partial-Joint-Penetration Welds and Fillet Welds
SLRS welds not described below	MT 25% of joints, full length ² and UT 100% of joints, full length ²	MT 25% of fillet welds, 6" length at random ² MT 100% of partial-joint penetration welds ²
Top-flange joints at cantilever beam connections ³ Splices in beam flanges	MT 100% of joints, full length and UT 100% of joints, full length	MT 100% of joints, full length
Demand-Critical Welds; Butt joints in SLRS column splices	MT 100% of joints, full length ² and UT 100% of joints, full length ²	MT 100% of joints, full length ²

Notes:

1. UT is required only when the weld thickness is $\frac{5}{16}$ " or greater.
2. Reduction of the rate of UT and MT testing per AISC 341, Appendix Q5.2, items (g) and (h) is permissible.
3. Test joint on each side of cantilever beam or column support.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Shapes, Plates, Tube, Pipe, and other sections

1. Steel using complete joint penetration groove welds that fuse through the thickness of the flange or web that is part of the SLRS shall have a minimum Charpy V-notch impact testing value of 20 ft-lbs at 70 degrees Fahrenheit.
2. Heavy Sections in the Seismic-Force-Resisting System shall be supplied with Charpy V-notch (CVN) testing in accordance with AISC 341 requirements.

B. High Strength Bolts, Nuts, and Washers:

1. Bolted joints in the Seismic-Force-Resisting System shall be Slip-Critical, with pretensioned high-strength bolts and a Class A faying surface or better.
- C. Welding materials:
1. Weld electrodes shall meet the requirements of AWS D1.8 Section 6.3.

PART 3 - EXECUTION

3.1 ERECTION

- A. Requirements for bolted and welded joints specified in Part 2 of this Specification shall also apply to field connections unless otherwise noted.
- B. Attachments to structural steel in the Protected Zone, other than spot welding of metal deck to beams, are not allowed.

3.2 FABRICATION

- A. General Requirements:
 1. Holes and attachments to structural steel in areas designated as the Protected Zone are not allowed except as explicitly shown or noted on structural drawings.
- B. Bolted Joints:
 1. Seismic-Force Resisting System joints shall be slip-critical (friction-type) as defined in AISC 348 with Class A or better faying surfaces.
- C. Welded Construction: (shop and field)
 1. Weld in accordance with AWS D1.8.
 2. Welded Joint Details:
 - a) Weld Backing: The use of weld backing shall be in accordance with AWS D1.1. Weld backing shall be removed where required by the Contract Documents or for the WPS by AWS D1.1.
 - i. Connections of the SLRS in which backing is not removed: backing shall be attached to the member or plate that does not have its surface prepared for the groove weld. Attachment shall be by either a 5/16" fillet or 3/16" groove weld along the complete bar length on the side of the bar opposite the groove weld.

- ii. Beam-Column Connection Joints Requiring Removal of Weld Backing: Conform with AWS D1.8, Sections 6.7 and 6.8. Perform MT on the fillet weld and the immediately adjacent area.
- b) SLRS Beam-Column Connection Weld Tab Removal and Finish:
 - i. Weld tabs of SLRS connections shall be removed where required by contract documents. Removal shall conform to AWS D1.8 Section 6.10.
 - ii. Gouges deeper than 1/16" at locations of removal of weld tabs shall be repaired by welding according to the requirements of Section 05 12 00 for Repair of Gouges - Deep Gouges. Weld filler metal requirements for Demand-Critical Welds apply. The contour of the weld at the ends shall provide a smooth transition, free of gouges and sharp corners. A minimum radius at the corner need not be provided.
 - iii. Following weld tab removal, finishing, and completion of any necessary repairs, the exposed ends of the weld shall be inspected using Magnetic Particle testing (MT) or Penetrant Testing (PT).
- c) Weld access holes:
 - i. The weld access hole shall conform to AWS D1.8 Section 6.10 unless the section is a Heavy Section.
 - ii. SLRS weld access holes shall be inspected using magnetic particle testing (MT) or liquid penetrant testing (PT) and shall be free of cracks. If a welded gouge repair has been performed, magnetic particle testing (MT) shall be performed.
- d) Web weld details: A minimum clear distance of ½" shall be provided between the weld access hole and fillet welds connecting the shear plate and beam web.
- e) Weave passes are not permitted in groove welds in the SLRS.
- f) Column continuity plate details:
 - i. If weld backing are used and remain in place, they shall receive a reinforcing fillet weld between the backing bar and column flange. No fillet weld should be placed between backing bar and continuity plate.

- ii. Weld terminations near the end of the column flange tips may be completed using weld tabs. Weld tabs shall be removed. Conform to AWS D1.8 Sections 6.10.3 and 6.10.4. Following finishing, the edge shall be inspected using MT. Fillet weld terminations between the continuity plate and column web shall be approximately $\frac{1}{4}$ " from each end of the joint
 - g) Tack Welds in the SLRS Protected Zones: Tack welds in the SLRS protected zone are permitted only if they are incorporated into a required weld, in accordance with AWS D1.8, Section 6.16.
 - h) Heavy Section Joint Weld Tab Removal and Finish: All welded tension splices in Heavy Sections, shall have the weld tabs removed and ground Extra Smooth.
- D. Repair of Discontinuities in Protected Zone of Seismic-Force-Resisting System.
 - 1. Repair of Discontinuities: If erection aids within the Protected Zone cannot be avoided, the Design Professionals' approval of the aid's placement, use, and the repair method is required. Conform to AWS D1.8 Section 6.15.4.
 - 2. Air Carbon Arc Cutting and Thermal Cutting: Air carbon arc cutting (CAC-A) and thermal cutting is permitted in the Protected Zone with the prior approval of the Design Professionals for the removal of weld backing and weld tabs, as specified in these documents.
 - 3. Gouges in members and connections in the Seismic-Force-Resisting System shall be repaired according to the requirements of this Specification. Weld filler metal requirements for the Seismic-Force-Resisting System apply, unless otherwise noted.
- E. Repair of Gouges: Gouges are not permitted in areas requiring an Extra Smooth finish surface, or where specifically prohibited by AWS D1.8 or this Specification. Repair of gouges shall meet the requirements of Section 05 12 00, Section titled "Repair of Gouges".

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All items of miscellaneous metal and related accessories and fasteners, including but not necessarily limited to the following:
 - 1. Steel pipe railing, handrails, guardrails and brackets.
 - 2. Steel stairs.
 - 3. Continuous inserts for pipe and conduit supports.
 - 4. Ladders.
 - 5. Backing and mounting plates for equipment items.
 - 6. Ceiling support system.
 - 7. Metal grating with frames and ledger angles.
 - 8. Anchor bolts.
 - 9. Sun shade framing.
 - 10. Seismic joints.
 - 11. Auxiliary angles brackets.
 - 12. Exterior gates.

1.2 RELATED SECTIONS

- A. Section 05 12 00: Structural Steel.
- B. Section 08 71 00: Door Hardware (for exterior gates).
- C. Section 14 20 00: Elevators.

1.3 REFERENCES

- A. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest additions apply).

1. California Code of Regulations, Title 24, latest edition, also known as California Building Code (CBC), with 2001 amendments.
2. American Society for Testing and Materials (ASTM).
3. Federal Specifications (FS).
4. American Institute of Steel Construction's "Specification for Structural Steel Building".
5. American Welding Society's "Structural Welding Code" (AWS D1.1).
6. American Iron and Steel Institute's "Specifications for Design of Light Gauge Cold-Formed Stainless Steel Structural Members".
7. National Association of Architectural Metal Manufacturer's: "Metal Stairs" (NAAMM-MS).
8. Steel Structures Painting Council's "Painting Manual":
 - a. Solvent Cleaning (SSPCC-SP 1).
 - b. Hand Tool Cleaning (SSPC-SP 2).
 - c. Brush-Off Blast Cleaning (SSPC-SP 7).
 - d. Hot Phosphate Surface treatment (SSPC-PT 4).
9. American Hot Dip Galvanizers Association, Inc. (AHDGA):
 - a. Inspection manual for hot dip galvanized products.

1.4 QUALITY ASSURANCE

- A. Welded Qualifications: Welders shall be qualified in accordance with AWS D1.1.
- B. Design Criteria:
 1. Work shall be designed to support normally imposed loads and conform to AISC requirements.
 2. Built-up parts shall not exhibit warp.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Manufacturer's literature describing products including details and dimensions.
- C. Shop Drawings:

1. Show a large scale construction of various parts, methods of joining, thickness of metals, profiles of surfaces, reinforcing, anchorage, and structural supports. Include information regarding concealed and exposed joints, welds, and fastenings.
2. Where welded connectors and concrete inserts are required to receive Work, show size and locations required.

D. Samples: Only as requested by the Architect.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area.

1.7 JOB CONDITIONS

- A. Scheduling, Sequencing:
 1. Ensure timely fabrication of items to be embedded or enclosed by other Work.
 2. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND ACCESSORIES

- A. Ferrous Metals:
 1. Structural Steel Shapes: ASTM A36, conforming to AISC specifications.
 2. Architectural and Miscellaneous Steel Items: ASTM A283.
 3. Steel Sheets: ASTM A570, Grade 36.
 4. Steel Pipe: ASTM A53.
 5. Steel Bars: ASTM A36.
 6. Steel Tubing: ASTM A500, Grade B.
 7. Steel Plate: ASTM A36.
 8. Checker Plate: FS QQ-F461c, flat back carbon steel, pattern 15 or 16.

9. Zinc for Galvanizing: ASTM B06 as specified in ASTM A123.
10. Welding Electrodes: E-70XX.
11. Grout: Embeco "636" or approved equal.
12. Stair Treads: Irving, Reliance, or approved equal with abrasive metal nosing.
13. Grating: Irving, Reliance or approved equal typical one-inch X 3/16-inch beaming bars at 1-3/6-inch centers with 1/4-inch twisted cross bars welded at 4-inch centers, galvanized with bolted anchorage.

B. Fastenings:

1. Typical Unfinished Bolts, Nuts, and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307 Grade A; malleable washers.
2. Expansion Bolts: FS FF-S-325, Group II, Type 4. Same as Hilti's "Kwik-Bolt II Concrete Anchors"; Wej-It Expansion Products, Inc.'s "Wej-It Concrete Anchors"; or approved equal.

C. Primer: Zinc-chromate type. Same as manufactured by Fuller-O'Brien Corp.'s Ne. 121-00; The Glidden Co.'s No. 4570; Sinclair Paint Co.'s 20; or approved equal.

2.2 SPECIALTY FABRICATED PRODUCTS

A. Preparation:

1. Coordinate with other Work supporting or adjoining miscellaneous metal and verify requirements of cutting out, fitting, and attaching.
2. Verify sizes, designs, and locations of items; do so at site whenever construction progress permits.

B. General Requirements:

1. Fabricate items from materials noted and make true to profiles shown. Obtain the Architect's approval of proposed variations.
2. Miter corners and angles of frames and moldings unless otherwise noted.
3. Perform cutting, shearing, drilling, punching, threading, tapping as required for items or their adjacent Work.
4. Drill or punch holes; do not use cutting torch.
5. Ensure shearing and punching leaves true lines and surfaces.

6. Items to be Galvanized: Fabricate in accordance with recommended practices of ASTM A385 and A386 unless specifically noted otherwise.
7. Fabricate exterior items for assembly and installation on site without field-welding of joint.
8. Ensure metal thickness and assembly details provide ample strength and stiffness.
9. Size sleeves for approximately 1/4-inch clearance all around.

C. Fastening:

1. Provide fasteners and anchor assemblies required for complete fabrication, field assembly, and erection.
2. Conceal fastenings wherever practicable.
3. Size internally threaded diameters to accommodate galvanized threaded bolts where galvanizing is required.
4. Permanent Connections in Ferrous Metal Items: Employ welding wherever practicable; avoid bolts and screws.

D. Welding:

1. Use electric shielded-arc process according to AWS D1.1.
2. Maintain shape and profile of item welded.
3. Prevent heat blisters, run-throughs, and surface distortions.
4. Welds Normally Exposed to View in Finished Work: Make uniform and grind smooth.
5. Exposed Welds: Remove burrs, flux, welding oxide, air spots and discoloration; grind smooth, polish, or otherwise finish to match material welded.

E. Bolted and Screwed Connections:

1. Use bolts for field connections only, and then only as noted. Countersink heads; finish smooth and flush.
 - a. Provide washers under heads and nuts bearing on wood.
 - b. Draw nuts tight and prevent loosening of permanent connections by nicking threads.
 - c. Use beveled washers where bearing is on sloped surfaces.

2. Where necessary to use screws for permanent connections in ferrous metal, use flat head type, countersink, fill screw slots, and finish smooth and flush.
 3. Evenly space exposed heads.
- F. Steel Stairs: Fabricate in accordance with NAAMM-MS standards from steel sections as noted.
- G. Ferrous Metal Pipe Railings:
1. Fabricate in largest sections practicable.
 2. Weld shop joints; fit field joints with concealed pins and sleeves.
 3. Flush fittings may be used for crosses and tees.
 4. Return rails to wall as noted.
 5. Close ends with welded cap and ease edges.
- H. Handrail Bracket for Pipe Railings: Fabricate according to details on Drawings.

2.3 FINISHES

- A. Preparations of Surfaces:
1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing, hot phosphate treatment or painting.
 2. Where hand cleaning methods are not adequate, clean in accordance with SSPC-SP 1, SSPC-SP 2, or SSPC-SP 7 as required.
 3. Completely eliminate burrs, rough spots and pitting from normally exposed ferrous metal items.
- B. Galvanizing:
1. Galvanize items after fabrication in largest sections practicable unless otherwise permitted or recommended by ASTM A 384 and A385.
 2. Where galvanizing is removed by welding or other assembly procedures, touch up abraded areas with molten zinc or zinc-rich paint.
 3. Where ferrous metal item is noted to be galvanized, perform galvanizing in accordance with following standards as applicable to item:
 - a. Hardware items Including Fasteners: ASTM A153.
 - b. Items Both under 1/8-inch Thickness and Fabricated from Rolled, Pressed, and Forged Shapes, Plates, Bars, and Strips: ASTM A383.

- c. Other Fabricated items: ASTM A123.
- C. Finish Schedule: Unless noted otherwise in Materials or Standard Catalog Products Articles.
 - 1. Ferrous Metal, Interior Items:
 - a. Concealed: Clean, chemically etch, and shop-apply one prime-coat.
 - b. Exposed: Clean, treat with hot phosphate, chemically etch, and shop-apply one prime-coat.
 - 2. Ferrous Metal, Exterior Items:
 - a. Concealed: Clean and hot-dip galvanize in accordance with galvanizing standards.
 - b. Exposed: Clean, then hot-dip galvanize in accordance with galvanizing standards, chemically etch, and shop-apply one prime-coat.
 - 3. Special Ferrous Metal Items as Noted Below: Clean and hot-dip galvanize in accordance with galvanizing standards. Do not prime coat.
 - a. Miscellaneous metal items such as stairs and railings.
 - 4. Items Noted as Chrome-Plated: Same as US26D finish.
 - 5. Hardware Including Fasteners (Bolts, Nuts, Washers, Etc.):
 - a. Finish to match items fastened.
 - b. Where galvanizing is required, hot-dip galvanize according to ASTM A153.

2.4 SOURCE QUALITY CONTROL

- A. Tests and Inspections: The Owner will employ testing laboratory to test welds per CBC, Section 2212A.5.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas to receive Work and verify that setting conditions and dimensions are correct to receive items.
- B. Do not start installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install Work plumb, true, rigid, and neatly trimmed out.
- B. Do not tighten fastener through finish alone without spacer washers.
- C. Provide concrete inserts or predrilled expansion bolts in fastening items into concrete.
- D. Protect dissimilar metals from contact with each other or with other materials causing corrosion.
- E. Fasten Work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.
- F. Use nonshrink grout mixed in accordance with manufacturer's direction for setting frames, plates, sills, bolts and similar items.
- G. Set items shown or required to be installed in sleeves with quicksetting anchor cement unless otherwise noted.
- H. Protect metal from damage to surface, profile and shape.

3.3 CLEANING

- A. Remove protective devices only when items will safe from other construction operations or removal is required to permit related Work.
- B. Clean prime-coated items as required for finish painting.

END OF SECTION

SECTION 05 75 13 DECORATIVE PERFORATED PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Laser cut decorative perforated metal panels.
- B. Component-based, decorative perforated metal panel assemblies:
 - 1. Wall screens at Building 100.

1.2 RELATED REQUIREMENTS

- A. Embedded anchor plates and structural connections. Coordinate support sizes and locations.

1.3 SUBMITTALS

- A. Product Data: Supplier's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Description of materials, components, fabrication and finishes.
- B. LEED Submittals:
 - 1. Product Data for Credits EA1, MR 3.1, MR 3.2, MR 4.1, MR 4.2, MR 5.1, MR 5.2, EQ 4.1, EQ 4.2, and EQ 7.1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: Supplier's shop drawings, including plans, elevations, sections and details indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories and installation methods. Provide details of attaching metal panels to supports.
- D. Verification Samples: For each product specified, provide two 3" x 6" samples of powder coat or Kynar color chips, or three 2" x 2" anodized aluminum samples representing supplier's full range of available finishes and colors. If needed, up to six different powder coat samples may be provided for design review.
- E. Pattern Samples: One 12" x 12" flat panel, without finish. Pattern scaling may vary depending on selection.

- F. Closeout Submittals: Supplier's maintenance and cleaning instructions and warranty.

1.4 QUALITY ASSURANCE

- A. Mockup: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups at client's request as indicated on the Drawings, cost to be determined by design.
 - 2. Demonstrate the proposed range of aesthetic effects and fabrication.
 - 3. Retain and maintain mockup during construction in an undisturbed condition as a standard for judging the completed work.
 - 4. Approved mockup in an undisturbed condition at the time of Substantial Completion may become part of the completed work.
- B. Engineering:
 - 1. Standard railing/guardrails, stair guardrails, wall screen, canopies, sunscreens & rain-screen assemblies to be engineered by supplier for standard loading criteria and geometry layout.
 - 2. Custom railing/guardrails, stair guardrails, wall screen, canopies, sunscreens & rain-screen assemblies' structural design to be prepared by the supplier or registered structural engineer licensed in state in which Project is located. Engineering for panels and panel assembly will be provided; any structural attachments or connections to be provided by the Engineer of Record.
- C. Fabricator Qualifications:
 - 1. Fabricator Qualifications: A firm with a minimum of 8 years experienced in producing decorative formed perforated panels similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.

1.5 PROJECT CONDITIONS

- A. Installer must be a BOK-certified installer, or pre-approved by BOK Modern.
- B. Installer to verify actual locations of walls and other construction contiguous with metal panels by field measurements before fabrication and indicate measurements on shop drawings. Coordinate construction to ensure that panels conform to built openings.
- C. Where measurements cannot be taken without delaying the Work, Installer to guarantee panel dimensions will fit and proceed with fabrication of product without

field verification. Coordinate construction to ensure that panels conform to guaranteed openings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials in manufacturer's original packaging with corresponding labels and identifying information.

1. Unload, store, and erect panels in a manner to prevent bending, warping, twisting, and surface damage.

B. Storage and Handling Requirements

1. Store panels vertically, covered with appropriate weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
2. Do not stack pallets. Panels that are stacked need to be protected from each successive panel above and below.
3. Avoid overhandling and excessively moving panels in order maintain protective packaging.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SUPPLIER

A. BOK Modern Inc., San Francisco, CA 94109 (415) 749-6500
info@bokmodern.com www.bokmodern.com

B. Substitutions: None.

2.2 SYSTEM DESCRIPTION

A. Structural Performance:

1. Top Rail of Guards: Shall withstand the following loads:
 - a. Concentrated load of 200 lbf (0.89kN) applied at any point and in any direction.
 - b. Uniform load of 50 lbf-ft. (0.07kN-m) applied horizontally and concurrently with uniform load of 100 lbf-ft. (0.14kN-m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving As Top Rails: Shall withstand the following loads:
 - a. Concentrated load of 200 lbf (0.89 kN) applied at any point and in any direction.
 - b. Uniform load of 50 lbf-ft. (0.07kN-m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Guard Infill Area: Shall withstand the following loads:
 - a. Concentrated horizontal load of 200 lbf (0.89 kN) applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Loads need not be assumed to act concurrently with loads on top rails in determining stress on guard.
 - b. Thermal Movements: Panels shall allow for movements resulting from 120 deg F (49 deg C) changes in ambient and 180 deg F (82 deg C) surface temperatures and base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - c. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

2.3 MATERIALS

- A. Fasteners for Anchoring Metal Panels to Other Construction: Select fasteners of type, grade and class required to produce connections suitable for anchoring metal panels to other types of construction indicated and capable of withstanding design loads.
- B. Fasteners for Interconnecting Metal Panel Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or non-compatible with materials joined. Avoid fastening dissimilar materials, separate with isolating hardware where necessary.
- C. Brackets, Flanges and Anchors: Same metal and finish as supported metal panels, unless otherwise indicated.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.4 ORNAMENTAL PERFORATED METAL PANELS

- A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations or blemishes; unless allowed for specific metal types and finishes.

- B. Perforated Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel Type B, 0.074 inch thick.
- C. Laser Cut Proprietary Pattern: BOK Modern A31, with 25% scale factor.

2.5 FABRICATION

- A. Fabricate metal panel assemblies to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish and anchorage, but not less than required to support structural loads.
- B. Fabricate systems in accordance with approved shop drawings and the supplier's instructions. Form work true to line and level with accurate angles and surfaces.
- C. Assemble metal panels in the shop to greatest extent possible to minimize field splicing and assembly.
- D. Cut, drill and laser cut metals cleanly and accurately. Remove burrs and ease edges; unless allowed for specific metal types and finishes. Remove sharp or rough areas on exposed surfaces.
- E. Cut, reinforce, drill and tap as indicated to receive finish hardware, screws and similar items.
- F. Use grommets, bushings and washers or methods as recommended by the supplier for separation of dissimilar metals.

2.6 FINISHES

- A. Comply with NAAMM's MFM for recommendations for applying and designating finishes.
- B. Appearance of Finished Work:
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples.
 - 2. Noticeable variations in same piece are not acceptable, except for steel and anodized aluminum.
 - 3. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.
 - 4. Coating method to maintain full thickness of coating at all edges, to provide full protection against corrosion.

2.7 FINISHES FOR STEEL

- A. Powder Coating: Tiger Drylac "Super Durable" powder coating, Series 38 2-coat system. Pretreat according to AAMA 2604; to withstand a minimum of 3,000 hrs. ASTM B117 or 700 hrs. ASTM G85 Annex A2. Apply TIGER 60/70000 at

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minimum of 2.0 mils 50% or less cure to ensure proper inter-coat adhesion to topcoat. Apply TIGER Series 38 AAMA 2604 compliant topcoat at a minimum of 2.5 mils and process according to manufacturer's recommendations.

1. Color and Gloss: As selected by Architect, from manufacturer's full range of Satin and Glossy colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Installer to verify field measurements are acceptable to suit assembly tolerances.
- C. Installer to verify supports and anchors are correctly positioned and set.

3.2 PREPARATION

- A. Provide items required to be cast into concrete or embedded in masonry with setting templates.
- B. Installer to take field measurements after permanent end terminations are in place and prior to preparation of shop drawings and fabrication, to ensure fitting of work.
- C. Prepare surfaces using the methods recommended by the supplier for achieving the best result for the substrate under the Project conditions.

3.3 INSTALLATION

- A. Installation to be completed by certified BOK Modern Installer with minimum 5 years of experience, or pre-approved by BOK Modern.
- B. Install metal panels in accordance with supplier's instructions.
- C. Install metal panels plumb, level, square, true to line and rigid. Fit exposed connections together to form tight, hairline joints.
- D. Adjust metal panels before anchoring to ensure alignment at abutting joints.
- E. Use supplier's supplied hardware for panel-to-panel connections.
- F. Attach metal panels securely in place using anchorage devices and fasteners as indicated by EOR.
- G. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

3.4 ADJUSTING

- A. Touch-up, repair, or replace damaged products before Substantial Completion. Manufacturer to provide proper coating for repainting any exposed steel surfaces.
- B. Return items that cannot be refinished in field.

3.5 CLEANING

- A. Clean metal panels with water and light detergent promptly after installation in accordance with supplier's instructions.
- B. Do not use harsh cleaning materials or methods that will damage finish.
- C. Do not use abrasive cleaners.

3.6 PROTECTION

- A. Protect finishes of metal panels from damage during construction period with temporary protective coverings approved by metal panel supplier. Remove protective coverings at the time of Substantial Completion.
- B. Replace defective or damaged components. Restore finishes damaged during installation and construction period so no evidence remains of correction work.
- C. Touch-up, repair or replace damaged products before Substantial Completion. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit or provide new unit.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Provision of all lumber framing, rough hardware and blocking as indicated in the contract drawings.
- B. Related Sections:
 - 1. Section 06 17 00 - Shop Fabricated Structural Wood

1.2 REFERENCES

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. The following published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section (latest editions apply).
 - 1. California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC) with DSA Amendments.
 - 2. (APA) - American Plywood Association, "Guide to Plywood Grades."
 - 3. (PS) - United States Product Standard, PS-1 and PS-2 "Construction and Industrial Plywood."
 - 4. (UL) - Underwriters' Laboratories, Inc., "Fire Hazard Classification, FR-S."
 - 5. (WCLIB) - West Coast Lumber Inspection Bureau, "Standard Grading Rules No. 17."
 - 6. (WWPA) - Western Wood Products Association, "Grading Rules for Lumber."
 - 7. (AWPA) - American Wood Preservers Association Standards.
 - a. T1 – "Processing and Treatment Standard"
 - b. U1 – "User Specification for Treated Wood"
 - 8. (AF&PA) - American Forest and Paper Association, "National Design Specification for Wood Construction." "Special Design Provisions for Wood & Seismic."
 - 9. (ASTM) - American Society of Testing and Materials.

1.3 SUBMITTALS

- A. Shop Drawings of all specially fabricated rough hardware.
- B. Samples only as requested by the architect.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.
- B. Keep materials dry. Where necessary, stack materials off ground on level flat forms, fully protected from weather.

1.5 JOB CONDITIONS

- A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19-percent during and after installation.
- B. New lumber adjacent and connected to existing lumber shall have a moisture content of not more than 15 percent at the time of installation.
- C. Sequencing, Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Rough Carpentry:
 - 1. Sills on Concrete: Douglas Fir with Preservative Treatment.
 - 2. Lumber (Wood Framing): Meet requirements of following minimum grades.

<u>Item</u>	
Studs	D.F. No. 1
Plates	D.F. No. 1
Beams	D.F. No. 1
Joists	D.F. No. 1
Posts	D.F. No. 1
Blocking	D.F. No. 2
 - 3. Plywood: Provide thickness, grade, and panel identification index shown on drawings. For plywood thickness 15/32 or greater provide a minimum of 5 ply.
- B. Rough Hardware: All exterior hardware shall be hot-dipped galvanized.

1. Nails: Common wire per ASTM F1667, typical; hot-dipped zinc-coated galvanized, stainless steel, silicon bronze, or copper at exposed conditions, fire-retardant-treated, and preservative-treated lumber.
2. Metal Framing Connectors: Fabricate from hot-dipped galvanized steel (G90 coating). Connectors in contact with preservative-treated lumber shall have G185 hot dipped galvanized coating per ASTM A653. Connectors in contact with fire-treated lumber or are in high corrosive environments shall be manufactured with Type 316L stainless steel. Connectors shall be at least 16-gauge material, 1/8-inch plate materials where welded, unless otherwise shown or specified, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions, including coating and material where applicable, with a nail provided for each punched nail hole. Use maximum nail size listed by manufacturer. Manufactured by Simpson Company or equal product substituted per Section 01 25 13.
3. Miscellaneous Hardware: Provide all common screws, bolts, fastenings, washers and nuts required to complete rough carpentry Work.
4. Bolts and sill bolts in wood shall be ASTM A307 with standard cut threads; full diameter bolts (no rolled or "upset" threads permitted) per ANSI/ASME standard B18.2.1.
5. Fasteners used for attachment of exterior wall coverings shall be hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze, or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc-coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

2.2 TREATMENTS

- A. Fire-Retardant Treatment: Furnish in accordance with AWWA Standards T1, U1, and P17, "Fire Retardant Formulations."
- B. Preservative Treatment: Furnish in accordance with AWWA Standards T1 and U1. Preservatives with an ammonia base, including Ammoniacal Copper Zinc Arsenate (ACZA) are not permitted.

2.3 FABRICATION

- A. Preparation:
 1. Verify measurements at job site.
 2. Verify details and dimensions of equipment and fixtures integral with finish carpentry for proper fit and accurate alignment.
 3. Coordinate details with other work supporting, adjoining, or fastening to casework.

B. Lumber:

1. Air- or kiln-dry to maximum 19-percent moisture content at time of surfacing.
2. Furnish surfaced four sides, S4S, unless otherwise noted.
3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

C. Wood Treatments:

1. Fire-Retardant Treatment:

- a. Treat in accordance with AWPAs Standards T1 and U1 and approved manufacturer's recommendations. Verify AWPAs Use Category with proposed application prior to selected preservative. Fire treated lumber shall conform to the requirements of CBC Section 2303.2.

2. Preservative Treatment:

- a. Treat lumber and plywood sheathing that is:
 - i. In contact with concrete and masonry less than six feet above the ground.
 - ii. Exposed to weather permanently.
 - iii. Where specified in the Contract Documents.
- b. Treat in accordance with AWPAs Standards T1 and U1. Verify AWPAs Use Category with proposed application prior to selecting preservative.
- c. Treated lumber shall be marked per CBC Section 2303.1.8.1.
- d. After Treatment and prior to shipping, air- or kiln-dry lumber to maximum 19-percent moisture content.

2.4 SOURCE QUALITY CONTROL

- A. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.
- B. Plywood shall bear APAs grade-trademark.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive rough carpentry Work and verify following:
 - 1. Completion of installation of building components to receive rough carpentry Work.
 - 2. That surfaces are satisfactory to receive Work.
 - 3. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailers.
 - 4. That all anchor bolts and holdown bolts are properly installed.

3.2 INSTALLATION

- A. Cutting: Perform all cutting, boring, and similar Work required.
- B. Studs, Joists, Beams, and Posts: Install all members true to line. No wood shingle shims are permitted. Place joists with crown up; maximum 1/4-inch crown permitted.
- C. Nail joints in accordance with applicable requirements of the CBC Table 2304.9.1 unless otherwise shown or specified. Predrill where nails tend to split wood. Nails into preservative-treated lumber shall be hot-dipped galvanized.
- D. Bolt holes to be 1/16-inch oversize. Threads shall not bear on wood. Use standard malleable iron washers against wood. Carriage bolts require washers under the nut only.
- E. Provide blocking, grounds, nailers, stripping, and backing as shown and as required to secure other Work.
- F. Adjoining sheathing panel edges shall bear and be attached to the framing members. Nails shall be placed not less than 3/8-inch from the panel edge.
- G. Plywood flooring shall be field glued with adhesive meeting APA specification AFG-01 applied in accordance with the manufacturer's recommendations. Apply continuous line of glue on joists and in groove of tongue and groove panels.
- H. Protect preservative-treated and fire-treated lumber per APWA Standard M4, "Standard for the Care of Preservative-Treated Wood Products."
- I. Where wood is cut, sawed, planed, bored or marred after preservative or fire-retardant treatment, apply two heavy brush coats of same material used in treatment.

- J. Nail heads shall be driven flush with plywood surface. Overdriven nails (nails which fracture the outer ply layer) shall be replaced one for one.
- K. Screws (Wood or Lag): Screws shall be screwed and not driven into place. Screw holes for the unthreaded portion shall be predrilled to the same diameter and depth of shank. Holes for threaded portion shall be predrilled less than or equal to the diameter of the root of the thread. Provide standard cut washers under head of lag screws.
- L. Sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system shall be applied directly to framing members. Sheathing is permitted to be fastened over solid lumber planking or laminated decking, provided the sheathing panel joints do not align with the planking or decking joints.
- M. Bolts shall be retightened immediately prior to covering or closing them in.

3.3 CLEANING AND ADJUSTING EXPOSED TIMBER

- A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.
- B. Wash finished Work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed surfaces. Any difference will be considered unsatisfactory work.

3.4 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency shall:
 - 1. Inspect erected timber framing as required to establish conformity of work with Drawings.
 - 2. Inspect all timber connectors per CBC Section 1705A.5.6.
 - 3. Inspect high-load diaphragm nailing and support framing per CBC Section 1705A.5.1.
- B. Machine Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval of the Project Inspector, the Structural Engineer and DSA. The approval is subject to continued satisfactory performance. If the nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued.

END OF SECTION

SECTION 06 17 00

SHOP-FABRICATED STRUCTURAL WOOD

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Provision and installation of all Laminated Veneer Lumber, as shown and specified per Contract Documents.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.

2.1 REFERENCES

- A. The GENERAL CONDITIONS, SPECIAL CONDITIONS, and DIVISION 1 shall apply to work in this Section.
- B. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section when cited by abbreviations noted below (latest editions apply).
 - 1. California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC), with DSA Amendments
 - 2. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
 - 3. National Design Specification for Wood Construction (NDS) published by the American Forest and Paper Association.
 - 4. Reports:
 - a. International Code Council (ICC): ICC Report ESR-1387.

3.1 QUALITY REQUIREMENTS

- A. Qualifications of Manufacturer: Structural Composite Lumber shall be manufactured by Redbuilt, LLC or equal manufacturer substituted per Section 01 25 13. Substitutions are subject to review by the Structural Engineer. Manufacturer to have a minimum of 5 years experience. Fabricating plant shall be approved by an independent ICC certified testing agency.
- B. Inspection: Fabrication of Structural Composite Lumber shall take place under the supervision of an independent inspection agency.

4.1 SUBMITTALS

- A. Shop Drawings: Submit manufacture, and installation details, including size, type, location and fastening of members, for review.
- B. Samples: If specifically requested.
- C. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.

5.1 DELIVERY, STORAGE AND HANDLING

- A. Deliver members tagged, unloaded carefully, store in a vertical position and handle only as recommended by the manufacturer; protect from adverse environmental conditions until members are installed and protected by permanent means.

6.1 WARRANTY

- A. The products delivered will be free from manufacturing errors or defects in workmanship and material.

PART 2 - PRODUCTS

1.1 MATERIALS

- A. Structural Composite Lumber:
 - 1. General: SCL joists conforming to ASTM D2559, manufactured by Weyerhaeuser; types, sizes and accessories as shown.
 - 2. Laminated Veneer Lumber (LVL): "Microlam" conforming to ICC Report ESR-1387. Species shall be Douglas Fir, Southern Pine or Western Hemlock. Provide:
 - a. Grade for 1.4E or better for rim joists and ledgers.
 - b. Grade for 2.0E for beams, headers, joists, studs and all other members.
 - 3. Parallel Strand Lumber (PSL): "Parallam" conforming to ICC Report ESR-1387. Species shall be Douglas Fir, Southern Pine or Western Hemlock. Provide grade 2.0E.
 - 4. Accessories:
 - a. General: Blocking, backing, etc., as shown.
 - b. Hardware: Hangers, brackets, straps, ties, etc., as shown.
 - 5. Adhesives: ASTM 2259, exterior type.

- B. Fasteners: As shown.

2.1 FABRICATION

- A. General: In accordance with best practices with adequate plant and equipment and under supervision of properly qualified personnel.
- B. Moisture Content of components at time of gluing shall not be less than 7 percent or more than 16 percent.

PART 3 - EXECUTION

1.1 PREPARATION

- A. Examination: Examine conditions of work in place before beginning work; report defects.
- B. Measurements: Take field measurements; report variance between plan and field dimensions.
- C. Delivery:
 - 1. Handling: Use equipment and methods that avoid damages that may impair strength of SCL members. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.
 - 2. Storage: Store in a vertical position off the ground, covered and protected from the weather.
- D. Site Preparation: Coordinate placement of bearing and support items.

2.1 INSTALLATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Erection: Set structural members level and plumb, in correct position. Make provision for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

3.1 ADJUSTMENT

- A. General: Prior to acceptance, adjust moveable parts to assure smooth operation.

4.1 CLEANING

- A. General: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.

END OF SECTION

SECTION 06 20 00 FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items, other than shop prefabricated casework.
- B. Hardware and attachment accessories.

1.2 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E152 - Methods for Fire Tests of Door Assemblies.
- C. AWPA - American Wood Preservers Association.
- D. NFPA 80 - Fire Doors and Other Opening Protectives.
- E. CBC - California Building Code.
- F. UL - Underwriters' Laboratories, Inc.
- G. WI - Woodwork Institute: Manual of Millwork.

1.3 QUALITY ASSURANCE

- A. Manufacture millwork and finish carpentry items in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.
- B. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of millwork.
- C. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- D. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing results of the reinspection.
- E. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.4 REGULATORY REQUIREMENTS

- A. Conform to UBC and UL requirements for fire ratings.

- B. Conform to Flame Spread Classifications of Interior Millwork contained within the Appendix of the WI Manual of Millwork for flame spread ratings.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories to a minimum scale of 1-1/2 inch to one foot. Provide WI Certified Compliance label on first page of each set.
- C. Submit two samples 6 x 6 inch in size illustrating wood grain and specified finish.
- D. Submit two samples 6 inch long of wood trim.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 01 87 00.
- B. Conform to Section 1 of Millwork Manual.
- C. Store materials in ventilated, interior locations under constant minimum temperatures of 70 degrees F and maximum relative humidity of 50 to 55 percent.

PART 2 - PRODUCTS

2.1 FABRICATORS

- 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 (916) 372-9943.
- B. Substitutions: Under provisions of Section 01 25 00.

2.2 MATERIALS

- A. Materials specified under Millwork Manual Section Numbers refer to lumber grades in Millwork Manual as follows: Section 3, Lumber - Hardwood/Softwoods; Section 4, Plywood - Hardwood/Softwood; Section 6, Exterior Trim; Section 9, Interior Trim.

2.3 EXTERIOR TRIM

- A. Fabricate in accordance with Section 6 of Millwork Manual:

<u>Item</u>	<u>Species</u>	<u>Grade</u>	<u>Intended Finish</u>
Exterior Wood Trim Fascias & Rakes	Redwood	Custom	Opaque

2.4 MISCELLANEOUS EXTERIOR MILLWORK

- A. Fabricate in accordance with Section 6 of Millwork Manual, from redwood or ipe. Custom Grade, with transparent finish unless otherwise noted.

2.5 INTERIOR TRIM - PAINT GRADE

- A. Finger jointed kiln-dried pine is acceptable for all areas except high moisture areas.
- B. Trim profiles shall be mill standard shape numbers as indicated.
- C. All paint-grade trim shall be pre-painted at mill.

2.6 INTERIOR TRIM - STAIN GRADE

- A. Fabricate in accordance with Section 9 of Millwork Manual:

<u>Item</u>	<u>Species</u>	<u>Grade</u>	<u>Intended Finish</u>
Base, Casing & Trim	Red Oak	Custom	Transparent
Tackboard Frames, Chalk Rail & Frame	Red Oak	Custom	Transparent

2.7 MISCELLANEOUS INTERIOR MILLWORK

- A. Fabricate in accordance with Section 9 of Millwork Manual:

<u>Item</u>	<u>Species</u>	<u>Grade</u>	<u>Intended Finish</u>
1x6 T&G Vee Joint Wainscot	Red Oak	Custom	Transparent
Handrails	Red Oak	Custom	Transparent
1x6 T&G Vee Joint Ceiling	Redwood	Custom	Transparent
Prefinished Wainscot	Medium Density Fiberboard	Custom	Plastic Laminate

2.8 ADHESIVE

- A. Adhesives: Type 1 adhesive recommended by WI to accommodate application in accordance with the Appendix to the Millwork Manual.
- B. Formulation: Exterior type per AWPA C20, consisting of organic-resin solution, insoluble in water, thermally set in wood by kiln drying.

- C. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.

2.9 WOOD TREATMENT PROCESS

- A. Fire Retardant Type: Listed by Underwriters' Laboratories, Inc. (UL); capable of providing a maximum flame spread/smoke development rating of 20/25 in accordance with ASTM E84.
- B. The following items are to be treated:
 - 1. x

2.10 ACCESSORIES

- A. Nails: Size and type to suit application, galvanized finish for interior use, stainless steel for exterior use.
- B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; galvanized finish for interior use, stainless steel for exterior use.
- C. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir species.
- D. Primer: Alkyd primer sealer.
- E. Wood Filler: Solvent base, tinted to match surface finish color.

2.11 FABRICATION

- A. Fabricate work in accordance with WI Custom grade standards.
- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
- E. Cap exposed plastic laminate finish edges with [material of same finish and pattern] [aluminum trim] [hardwood trim].
- F. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work and field measurements are as instructed by the fabricator.
- B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.
- C. Verify adequacy of backing and support framing.
- D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials or that will be permanently concealed from view.

3.3 INSTALLATION

- A. Install work in accordance with WI Manual of Millwork, [Custom] [Premium] quality standard.
- B. Install fire rated door frames in accordance with NFPA 80.

3.4 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.5 PREPARATION FOR FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand Work smooth.

3.6 FINISHING

- A. Site finish under provisions of Section 09 91 00.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 87 00.

END OF SECTION

SECTION 06 40 00 WOOD COMPOSITE PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hardwood plywood with thermally fused laminate face.

1.2 RELATED SECTIONS

- A. Section 06 20 00 - Finish Carpentry.
- B. Section 12 35 50 - Educational Casework.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI/HVPA HP-1, latest edition.
- B. ASTM International (ASTM):
 - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. Architectural Woodwork Institute (AWI):
 - 1. AWI Quality Standards; Sections 100, 200, 400, 500, 600, 700, 1500, and 1700.
- D. Composite Panel Association (CPA):
 - 1. CPA-4-11 - Eco-Certified Composite (ECC) Sustainability Standard.
- E. California Air Resources Board (CARB):
 - 1. CARB ATCM 93120 - California Ultra Low Emitting Formaldehyde Emission Limits Regulation (ULEF).
- F. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LD3 - Laminate Testing.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's printed installation instructions, showing required preparation, method of attachment and installation procedures.

2. Storage and handling requirements and recommendations.
 3. Installation methods.
 4. Cleaning and maintenance instructions.
- C. Verification Samples:
1. Three samples, 4 inch by 8 inch, for each color.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. Panel manufacturer shall have 2 consecutive years of experience in manufacture of no-added formaldehyde medium density fiberboard panels.
- B. Fabricator Qualifications:
1. Woodwork fabricator shall have 5 consecutive years of experience in fabrication of casework, paneling, and trim.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged pallets with identification labels intact.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions in strict compliance with manufacturer's instructions and industry standards.
1. If unloaded outdoors, move and store under shelter as soon as possible. Avoid unloading in inclement weather.
 2. Inspect delivered products to verify products are not damaged, soiled or have been exposed to water.
- C. 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 recommended limits.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard limited warranty against defects in manufacturing.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturer: Roseburg, which is located at: 3660 Gateway St.; Springfield, OR 97477; Toll Free Tel: 800-245-1115; Tel: 541-679-3311 ; Fax: 541-679-2543; Email: [request info \(MarkN@rfpco.com\)](mailto:request info (MarkN@rfpco.com)); Web: www.roseburg.com
- B. Or approved equal.

2.2 THERMALLY FUSED LAMINATE PANEL

- A. Basis of Design: Duramine TFL panel, as manufactured and supplied by Roseburg Forest Products Company.
 - 1. Core/Substrate: Roseburg SkyPly hardwood plywood, Grade K, Type 2 (Interior).
 - 2. Facing: NEMA LD 3; back face to match front face if exposed, otherwise balancing or glueable backer as required.
 - 3. Edgebanding: matching.
 - 4. Finish: To be selected by Architect from manufacturer's full range of colors and designs in the Quick Ship program.
 - 5. Panel Thickness: As indicated on Drawings.
 - 6. Panel Size: As indicated on Drawings.
 - 7. Low Emitting Materials:
 - a. CARB Approved Ultra-Low Emitting Formaldehyde (ULEF) Resins.
 - b. Complies with CARB ATCM 93120 ULEF Exemption for Formaldehyde Emission Limits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions to ensure that work can be completed with no adverse effects.

3.2 PREPARATION

- A. Prepare substrates using methods recommended by the manufacturer to achieve the best results for the panels under proper conditions.
- B. Do not proceed with installation until substrates have been fabricated based on recommended methods from the manufacturer. Commencement of installation constitutes acceptance of conditions of substrate.

3.3 INSTALLATION

- A. Comply with AWI AWS fabrication and installation standard as applicable to the project.
- B. Install fabricated panels according to approved architectural drawings, shop drawings and manufacturer's published installation instructions, Shim as required for proper installation.

3.4 CLEANING AND PROTECTION

- A. Clean panels in accordance to manufacturer's published care and maintenance instructions.
- B. Touch up, repair or replace damaged products before completing installation.

END OF SECTION

SECTION 07 01 52 ROOFING REPAIR

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all labor, equipment, and materials to maintain and protect the existing roof system. Install new turn up base flashings and roof penetrations while maintaining the existing system warranty at all new skylights, HVAC units, and roof penetrations.

1.2 RELATED SECTIONS

- A. 07 62 00, Sheet Metal Flashing and Trim..
- B. 07 71 23, Gutters and Downspouts.
- C. 08 62 23, Tubular Skylights.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Installer (Roofer) shall be specialized in roof application with minimum 5 years experience. Installer shall be certified by the roofing system manufacturer as qualified to install manufacturer's roofing materials.
- B. Installer's Field Supervision: Installer shall maintain a full-time Supervisor/Foreman on job site during all phases of bituminous sheet roofing Work and at any time roofing Work is in progress, proper supervision of workers shall be maintained. A copy of the Specification shall be in the possession of the Supervisor/Foreman and on the roof at all times.
- C. It shall be the Contractor's responsibility to respond immediately to correction of roof leakage during construction. If the Contractor does not respond within 24 hours, the [Owner] [District] has the right to hire a qualified contractor and backcharge the Contractor.

1.4 SUBMITTAL

- A. Provide Submittal for required products, per Spec Section 01 33 00, Submittal Procedures.
- B. Do not begin work which requires submittals until submittals have been returned indicating the submittals have been reviewed.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.

- B. Store and handle roofing materials in a dry, well-ventilated, weather-tight place to ensure no possibility of significant moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (polyethylene not acceptable).
- C. Do not leave unused rolled goods on the roof overnight or when roofing Work is not in progress unless protected from weather and other moisture sources.
- D. It is the responsibility of the Contractor to secure all material and equipment on the job site. If any material or equipment is stored on the roof, the Contractor shall make sure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the Contractor will be the sole responsibility of the Contractor and will be repaired or replaced at the Contractor's expense.

1.6 MANUFACTURER'S INSPECTIONS

- A. Manufacturer shall inspect Work in progress at least 3 days per week and shall inspect the completed Work.

1.7 PROJECT CONDITIONS

- A. Weather Condition Limitations: Do not apply materials during inclement weather or when there is a 40 percent or greater chance of precipitation.
- B. Materials shall be stored at room temperature until immediately prior to application when the ambient temperature is 40 degrees F or below. Discontinue the application if the material cannot be stored at a temperature which permits even distribution during application.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Existing Roofs Under Warranty: Repairs to existing roofs under warranty shall be made only by certified applicators of the manufacturer issuing the warranty.
- B. Existing Roofs Not Under Warranty: Firestone, Johns Manville, GAF, Carlisle, or approved equal.
- C. Substitutions: Under provisions of Section 01 25 00.

2.2 DESCRIPTION

- A. Maintenance Roofing Work (Including But Not Limited To):

1. Two ply hot asphalt applied modified turn up base flashing installation.
2. Two ply modified pipe penetration strip in over lead jack.

B. Base Flashing Installation:

1. 1 inch insulation fill board shall be installed as needed at transition area between cut away field roofing and new base flashing. Provide an even transition area. Insulation height shall equal that of existing field roofing.
2. All flashings shall be set in Type III hot steep asphalt. Modified reinforcing ply shall be one ply of smooth surface modified membrane covered by an additional layer of mineral surface modified bitumen membrane. Pipe penetration flashings and turn-up base flashing corners shall be dressed with three courses of mastic/webbing and aluminized surfacing.

2.3 BITUMINOUS MATERIALS

- A. Asphalt Primer: VOC-compliant, ASTM D41.
- B. Roofing Asphalt: VOC-compliant, ASTM D312, Type III.
- C. Asphalt Mastic: VOC-compliant, ASTM D2822, Type II.
- D. Fibered Aluminum Paint: VOC-compliant, ASTM D93.

2.4 SHEET MATERIALS

- A. Fiberglass Webbing: Reinforcing fabric for turned-up base flashing corners.
- B. Base Flashing Ply: SBS modified base sheet with two laminated layers of fiber glass.
- C. Modified Flashing Ply: torch-applied SBS-modified cap sheet, with factory-applied reflective granules.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate surfaces to receive roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to roof system manufacturer and installer.

3.2 FLASHING MEMBRANE INSTALLATION

- A. Install 1 inch insulation fill board as needed to provide an even transition area between cut away field roofing and new base flashing.
- B. Prepare all penetrations to be flashed and where shown on the Drawings with asphalt primer at the rate of one hundred square feet per gallon. Allow primer to dry tack-free.
- C. The two modified plies shall be adhered with the following:
 - 1. Hot steep asphalt. The smooth modified membrane and the modified cap membrane shall be used as the flashing and nailed off 8 inches on center at all vertical surfaces.
 - 2. At pipe penetrations, the smooth sheet shall be minimum 12 inches x 12 inches and feather at least 6 inches beyond the roof cut transition area. The mineral surface flashing sheet shall extend a minimum 6 inches beyond the edge of the smooth sheet.
- D. The entire sheet of the base flashing and the flashing membrane shall be solidly adhered to the substrate.
- E. Seal all vertical laps of flashing membrane with a three-course application of mastic and fiberglass mesh. Aluminize with two coats of non-fiberglass aluminum paint.
- F. Aluminize all pipe penetration flashings with two coats of non-fiberglass aluminum paint.
- G. Roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices to be coordinated with the roofing Work is specified in other Sections.

3.3 FINAL INSPECTION

- A. At completion of roofing installation and associated Work, meet with installer, installer of associated Work, District Representative, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.
- B. Walk roof surface areas of the building, inspect perimeter building edges and flashing of roof penetrations, curbs, and other equipment. List all items requiring correction or completion and furnish copy of list to each party attending.
- C. The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the roofing subcontractor at a negotiated price.
- D. If core cuts verify the presence of damp or wet materials, the roofing subcontractor shall be required to replace the damaged areas at his own expense.

- E. Repair or replace (as required) deteriorated or defective Work found at time of inspection to a condition free of damage and deterioration at time of Substantial Completion to comply with warranty requirements.
- F. The Contractor shall notify the District upon completion of corrections.
- G. Following the final inspection, acceptance will be made in writing by the material manufacturer.

END OF SECTION

SECTION 07 13 00
SHEET WATERPROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.2 SUMMARY

- A. The work of this section includes, but is not limited to, the following:
 - 1. Below-grade waterproofing membrane system.
 - 2. Pre-applied sheet waterproof membrane (for vertical applications).
 - 3. Prefabricated drainage panel.
- B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 31 30 00 - Earthwork
 - 2. Section 03 30 00 - Cast-In-Place Concrete
 - 3. Section 07 26 50 - Vapor Barriers
 - 4. Section 07 62 00 - Flashing and Sheet Metal
 - 5. Section 07 90 00 - Joint Sealers
 - 6. Section 15 40 00 - Plumbing

1.3 REFERENCE STANDARDS

- A. Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- B. American Society for Testing and Materials (ASTM)
 - 1. 836 - Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
 - 2. 412 - Standard Test Methods for Rubber Properties in Tension
 - 3. 570 - Standard Test Method for Water Absorption of Plastics

4. 882 - Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
5. 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
6. 1876 - Standard Test Method for Peel Release of Adhesives (T-Peel)
7. 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
8. 3767 - Standard Practice for Rubber - Measurements of Dimensions
9. 5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
10. 96 - Standard Test Methods for Water Vapor Transmission of Materials
11. 154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.
- B. Samples: Submit representative samples of the following for approval:
 1. Below-grade waterproofing sheet membrane.
 2. Pre-applied sheet waterproof membrane.
 3. Prefabricated drainage panel.
 4. Waterstop

1.5 QUALITY ASSURANCE

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
- B. Installer: A firm which has at least 3 years' experience in work of the type required by this section.
- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

- E. Schedule Coordination: Schedule work such that membranes will not be left exposed to weather for longer than that recommended by the manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
 - 1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
 - 2. Protect mastic and adhesive from moisture and potential sources of ignition.
 - 3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
 - 4. Protect surface conditioner from freezing.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.7 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.8 WARRANTY

- A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

PART 2 – PRODUCTS

2.1 MATERIALS: W.R. Grace or approved equal.

- A. Below Grade Waterproofing Membrane System: Bituthene System 4000 Membrane by Grace Construction Products or approved equal; a self-adhesive, cold-applied composite sheet consisting of a thickness of 1.4 mm (0.056 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps.

PHYSICAL PROPERTIES FOR BITUTHENE SYSTEM 4000 MEMBRANE:

Property	Test Method	Typical Value
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	1.5 mm (0.060 in.) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -43°C (-45°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412 Modified ¹	2240 kPa (325 lbs/in. ²) minimum
Tensile Strength, Film	ASTM D 882 Modified ¹	34.5 MPa (5,000 lbs/in. ²) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 Modified ¹	300% minimum
Crack Cycling at -32°C (-25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Adhesion at Minimum Application Temperature	ASTM D 1876 Modified ²	880 N/m (5 lbs/in.)
Peel Strength	ASTM D 903 Modified ³	1576 N/m (9 lbs/in.)
Puncture Resistance, Membrane	ASTM E 154	222 N (50 lbs) minimum
Resistance to Hydrostatic Head	ASTM D 5385	70 m (231 ft) of water
Permeance	ASTM E 96, Section 12 – Water Method	2.9 ng/m ² sPa (0.05 perms) maximum
Water Absorption	ASTM D 570	0.1% maximum

Footnotes:

1. The test is run at a rate of 50 mm (2 in.) per minute.
2. The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.) per minute at -4°C (25°F).
3. The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.

- B. Pre-applied Sheet Waterproofing Membrane: Preprufe 300R by Grace Construction Products or approved equal; a 1.2mm (0.046 in.) nominal thickness composite sheet membrane comprising 0.8 mm (0.030 in.) of high density polyethylene film, and layers of synthetic adhesive. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

PHYSICAL PROPERTIES FOR PREFRUF 300R MEMBRANE

Property	Test Method	Typical Value
Color		White
Thickness	ASTM D 3767 Method A	1.2 mm (0.046 in.) nominal
Low Temperature Flexibility	ASTM D 1970	Unaffected at -23°C (-10°F)
Elongation	ASTM D 412 Modified ¹	>300%
Crack Cycling at -23°C (-10°F), 100 Cycles	ASTM C 836	Unaffected
Tensile Strength, Film	ASTM D 412	27.6 MPa (4,000 lbs/in. ²) minimum
Peel Adhesion to Concrete	ASTM D 903 Modified ²	880 N/m (5.0 lbs/in.)
Lap Adhesion	ASTM D 1876 Modified ³	440 N/m (2.5 lbs/in.)
Resistance to Hydrostatic Head	ASTM D 5385 Modified ⁴	>70 m (231 ft)
Puncture Resistance	ASTM E 154	990 N (180 lbs) minimum
Permeance	ASTM E 96 Method B	<0.6 ng/m ² sPa (0.01 perms)
Water Absorption	ASTM D 570	<0.5%

Footnotes:

1. *Elongation of membrane is run at a rate of 50 mm (2 in.) per minute. Concrete is cast against the protective coating surface of the membrane and allowed to cure (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 50 mm (2 in.) per minute at room temperature.*
2. *The test is conducted 15 minutes after the lap is formed as per manufacturer's instructions and run at a rate of 50 mm (2 in.) per minute at -4°C (25°F).*
3. *Hydrostatic head tests are performed by casting concrete against the membrane with a lap. Before the concrete sets a 3 mm (0.125 in.) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to a head of 70 m (231 ft) of water which is the limit of the apparatus.*

- C. Prefabricated Drainage Panel: Hydroduct 220 Drainage Composite by Grace Construction Products or approved equal. Drainage Composite shall be designed to promote positive drainage while serving as a protection course.
- D. Preprufe 160R: Water proofing membrane, edges taped with Preprufe Tape Lt, penetrations sealed with Bituthene Liquid Membrane.
- E. Miscellaneous Materials:

1. Primer: Bituthene Primer B2
2. Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing systems.
3. Insulation Board: 2-inch XPS Insulation Board

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturers' warranty requirements. Contractor to adjust work to achieve compliance with manufacturer's requirements.
- B. Cast-In-Place Concrete Substrates:
 1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).
 2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
 4. Remove scaling to sound, unaffected concrete and repair exposed area.
 5. Grind irregular construction joints to suitable flush surface.
- C. Wood Substrates: Apply waterproofing membrane over securely fastened sound surface. All joints and fasteners shall be flush to create a smooth surface.
- D. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION - BELOW GRADE WATERPROOFING MEMBRANE SYSTEM

- A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:
 - 1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.
 - 2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.
 - 3. Seal daily terminations with troweled bead of mastic.
 - 4. Apply prefabricated drainage panel, waterstop and related materials in accordance with manufacturer's recommendations.
- 3.4 INSTALLATION - PRE-APPLIED SHEET WATERPROOFING MEMBRANE
- A. Substrates shall be smooth and sound.
 - B. Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:
 - 1. Apply membrane with the HDPE film facing the prepared soil retention system (wood lagging, sheet piling, gunite, shotcrete, etc.). Remove the release liner and fasten membrane along uncoated edge to Hydroduct drainage composite with large head nails or to plywood with large head nails or staples.
 - 2. Apply succeeding sheets by overlapping the previous sheet 75 mm (3 in.) along the uncoated edge of the membrane. Side laps must be firmly rolled to ensure a tight seal.
 - 3. Overlap the ends of the membrane 75 mm (3 in.). Apply Preprufe Tape centered over the end lap and roll firmly to ensure a tight seal. Remove release liner.
- 3.6 CLEANING AND PROTECTION
- A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
 - B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 07 21 16 BLANKET INSULATION

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, and crevices in exterior wall and roof.
- C. Batt sound insulation in interior walls and partitions [and above ceiling].
- D. Blow-in insulation for filling cavities in existing construction.

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. CCR - California Code of Regulations.
- D. CBC - California Building Code.
- 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 118 of the California Code of Regulations (CCR) that insulation complies with Title 20, Chapter 4, Article 3 of the California Quality Standards for Insulating Materials.
- B. Insulation materials shall be certified in compliance with Business and Professions Code Section 19165.

- C. Insulation manufacturer shall 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 under provisions of Section 01 33 00.
- B. Submit Product Data for each type of insulation specified.
- C. Submit manufacturer's certification that materials meet or exceed specified regulatory requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

- A. Certain Teed Corp.
- B. Manville Corp.
- C. Owens-Corning Fiberglass Corporation.

Select Class A insulation with a flame spread of 25 or less if insulation will be exposed to an air plenum or exposed in a ceiling space. If all insulation will be concealed beneath gypsum board or other wall finish, select Class B insulation with a plain foil face.

2.2 MATERIALS

- A. Batt Insulation: ASTM C665 preformed glass fiber batt, Type III, Class [A] [B], [with reflective membrane faced surface with a flame spread of 25 or less, and a smoke density of less than 50 when tested in accordance with CBC Standard No. 8-1.] [with reflective membrane surface covering.] Category 1 with stapling flanges for attachment of blanket to applicable construction. Equivalent continuous roll membrane facing may be utilized in lieu of individual faced glass fiber batts. Provide R30 at ceilings and roofs, R19 at walls.
- B. Batt Sound Insulation: ASTM C665 preformed glass fiber batt, Type I unfaced, with flame spread of 25 or less, and a smoke density of less than 450 when tested in accordance with UL 723-03. Provide [R-7, 2-1/2] [R-11, 3-1/2] inch minimum thickness.
- C. Blow-in insulation: Class 1, ASTM C739 and C1149, 85% recycled cellulose; Applegate "ThermoCon" or approved equal.
- D. Nails or Staples: Steel wire; electroplated; type and size to suit application.
- E. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.

- F. Support Wire: 16 gauge steel wire.
- G. Support Rods: 13 gauge, pointed spring steel length as required for stud spacing.
- H. Spindle Fasteners: Steel impale spindle and clip on flat metal base, spot-welded to substrate or with self-adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.
- B. Do not install until building is fully enclosed to weather.

3.2 INSTALLATION

- A. Install insulation in accordance with insulation manufacturer's instructions and ASTM C739, C1149 and C1320. Cut "blow-in" holes only where specifically needed.
- B. Install batt insulation in exterior walls, ceiling furring, and roof spaces without gaps or voids. Where wood framed furred ceiling occur, install insulation over the furring strips rather than between the rafters.
- C. Install batt sound insulation in interior walls and where indicated or scheduled.
- D. Install blow-in insulation in cavities where it is unfeasible to install batt insulation.
- E. Trim insulation neatly to fit spaces.
- F. 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.
- G. Install with factory-applied membrane facing on warm side of building spaces.
- H. Lap ends and side flanges of vapor barrier membrane over face of framing members.
- I. Extend vapor barrier on to any adjacent construction and tape seal edge of vapor barrier.
- J. Seal butt ends, lapped flanges, and tears or cuts in membrane with tape or another layer of membrane.
- K. Seal joints in vapor barrier caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier.

Select one or more of the appropriate option statements in the following paragraphs depending on project requirements.

- L. [Face staple flange over flange of adjacent blanket to wood studs at maximum 6 inches on center.]
- M. [Tape stapling flange over flange of adjacent blanket to flange of metal stud.]
- N. Friction fit sound insulation between studs as required to completely fill space between the wall finishes.
- O. Where wall finish does not occur, [use support rods spaced not more than 16 inches on center vertically at wood studs.] [use 16 gauge support wire through studs at not more than 16 inches on center vertically at metal studs.]
- P. Retain unsupported roof insulation to metal or concrete substrate with spindle fasteners at 24 inches on center.
- Q. Coordinate patching of “blow-in” holes with Work under other Sections.
- R. Remove all unused insulation and related products and dispose of correctly.

END OF SECTION

SECTION 07 26 00 VAPOR RETARDERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Vapor retarder under concrete slab-on-grade.
- B. Crush and fine protection course or pouring concrete on vapor barrier.

1.2 RELATED SECTIONS

- A. Section 31 00 00: Earthwork.
- B. Section 03 30 00: Cast-in-Place Concrete.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit Product Data, including product description and performance.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vapor Retarder: High tensile strength, high puncture resistance, ultralow moisture vapor permeability "VaporBlock" 10 by Raven Industries, "Moistop Plus" by Fortifiber Corp., "Perminator10" by WR Meadows.
 - 1. ASTM E154 Section 13 after conditioning—ASTM E96: <0.099 perms.
 - 2. ASTM D1709 Method B Puncture Resistance: > 2,600grams.
 - 3. ASTM E154 - Section 9 Tensile Strength after conditioning exposure: >93 N/cm (53 lbs/in).
- B. Sand: ASTM C33, uniformly graded, clean sand, free from excessive fines, organic materials, and other deleterious substances.
- C. Vapor-Retarder Tape: Minimum 4-inch-wide self-adhering type designed to maintain vapor retarder integrity.
- B. Pipe Boots: Pre-fabricated penetration kit for securing around pipes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check that areas to receive vapor barrier are clean and dry.
- B. Check that pipes, vents, drains, and other penetrations of the membrane are secured with pipe boots, lapped and taped.
- C. Where nails, screws, or other penetrations exist, apply heavy beads of calking compound or manufacturer's pressure-sensitive tape.
- D. Do not commence installation of vapor retarder until conditions are satisfactory.

3.2 INSTALLATION UNDER SLAB-ON-GRADE

- A. Install vapor retarder over rock base course.
 - 1. Lap 6 inches, and tape edges.
 - 2. Turn up membrane at edges, and secure to foundations or footings with tape, concrete nails every 6 feet or mastic.
- B. Seal all penetrations of vapor retarder with tape to create air-tight seal between penetrating objects and vapor retarder.
- C. Repair tears and punctures in vapor retarder immediately before concealment by other work. Cover with tape or another layer of vapor retarder.
- D. Provide nominal 2-inch-thick protection cover of crush and fine rock over vapor retarder.
 - 1. Screed and level before reinforcing or concrete is placed.
- E. Concrete may be poured directly on vapor barrier per ACI 302 recommendations with prior approval by Architect.

END OF SECTION

SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Materials and installation methods for fluid applied, vapor permeable air barrier membrane system located in the non-accessible part of the wall.
 - 2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.
- B. Related Sections include the following:
 - 1. Section 03 30 00 – Cast-In-Place Concrete
 - 2. Section 07 13 00 – Sheet Membrane Waterproofing
 - 3. Section 07 26 00 – Vapor Retarders
 - 4. Section 07 62 00 – Sheet Metal Flashing and Trim
 - 5. Section 07 92 00 – Joint Sealants

1.3 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion

and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.5 REFERENCES

- A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM)

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- 1. C920 Specifications for Elastomeric Joint Sealants
- 2. C1193 Guide for Use of Joint Sealants
- 3. D412 Standard Test Methods for Rubber Properties in Tension
- 4. D570 Test Method for Water Absorption of Plastics
- 5. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
- 6. D1876 Test Method for Peel Resistance of Adhesives
- 7. D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting
- 8. D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 9. D4258 Practice for Surface Cleaning Concrete for Coating
- 10. D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
- 11. E96 Test Methods for Water Vapor Transmission of Materials
- 12. E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- 13. E162 Test Method for Surface Flammability of Materials Using a Radiant Heat Source

14. E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems
15. E2178-01 Standard Test Method for Air Permeance of Building Materials
16. E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.6 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 1. Include details of interfaces with other materials that form part of air barrier.
 2. Include details of mockups.
- C. Samples: Submit representative samples of the following for approval:
 1. Fluid applied membrane
 2. Transition Membrane
 3. Through Wall Flashing
- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
- E. Qualification Data: For Applicator.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.
- G. Warranty: Submit a sample warranty identifying the terms and conditions stated in Article 1.10.

1.7 QUALITY ASSURANCE

- A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and

include a list of projects of similar design and complexity completed within the past five years.

- B. Source Limitations: Obtain primary air-barrier material and through wall flashing through one source from a single manufacturer. Should project require a vapor permeable and a vapor impermeable air barrier on same project, obtain vapor-permeable and vapor impermeable air barrier and through wall flashing from one source from a single manufacturer. See specification Section 07270 for fully-adhered vapor impermeable air barrier.
- C. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- D. Mockups: Before beginning installation of air barrier, provide air barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
 - 2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
- E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
 - 1. Review of submittals.
 - 2. Review of surface preparation, minimum curing period and installation procedures.
 - 3. Review of special details and flashings.
 - 4. Sequence of construction, responsibilities and schedule for subsequent operations.
 - 5. Review of mock-up requirements.
 - 6. Review of inspection, testing, protection and repair procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect fluid-applied membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTY

- A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials, that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to maintain air permeance rating not to exceed .004 cfm/sq. ft (0.02 L/s/sq. m.) when tested per ASTM E2178, within specified warranty period.
 - b. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96, Method B.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED, VAPOR-PERMEABLE MEMBRANE AIR BARRIER

- A. Fluid-Applied, Fully-Adhered, Vapor-Permeable Membrane Air Barrier, Basis of Design: Subject to compliance with requirements, provide the following:
 - 1. Single Component Acrylic Membrane: Perm-A-Barrier VP, as manufactured by Grace Construction Products, or approved equal.

- B. Physical and Performance Properties: Provide products with the following minimum properties:
1. Membrane Air Permeance: Not to exceed 0.0004 cfm/sq. ft. of surface area (at specified thickness) at 1.57-lbf/sq. ft. pressure difference (0.002 L/s x sq. m of surface area at 75-Pa) when applied to CMU wall; when tested per ASTM E2178.
 2. Membrane Vapor Permeance: Not less than 11.2 perms (649.6 ng/Pa x s x sq. m); when tested per ASTM E96.
 3. Assembly Performance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.0008 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 pounds per square foot) (0.004 L/s x sq. m of surface area at 75-Pa) when tested in accordance with ASTM E 2357.
 4. UV Exposure Limit: Not more than 180 calendar days; per ASTM D412 and ASTM E96-Method B.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Liquid Membrane for Details and Terminations: Provide Bituthene Liquid Membrane as manufactured by Grace Construction Products, or approved equal.
- C. Wall Primer (for Use with Throughwall Flashing and Tapes Applied to Substrate): Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.
1. Flash Point: No flash to boiling point
 2. Solvent Type: Water
 3. VOC Content: Not to exceed 10 g/l
 4. Application Temperature: -4°C (25°F) and above
 5. Freezing point (as packaged): -7°C (21°F)
 6. Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products.
- D. Flexible Membrane Wall Flashing: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m²sPa (0.05 perms) max.
 2. Water Absorption: ASTM D570: max. 0.1% by weight
 3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
 4. Tear Resistance
 - a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
 - b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
 5. Lap Adhesion at -4°C (25°F): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
 6. Low Temperature Flexibility ASTM D1970: Unaffected to -43°C (-45°F)
 7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
 8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.
 9. Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.
- E. Joint Reinforcing Strip: Air barrier manufacturer's approved tape.
- F. Transition Membrane: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m²sPa (0.05 perms) max.
 2. Water Absorption: ASTM D570: max. 0.1% by weight
 3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
 4. Tear Resistance
 - a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
 - b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
 5. Lap Adhesion at -4°C (25°F): ASTM D1876: 880 N/m (5.0 lbs./in.) of width

6. Low Temperature Flexibility ASTM D1970: Unaffected to -43°C (-45°F)
 7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
 8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.
 9. Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.
- G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
1. Product: Bituthene Liquid Membrane, manufactured by Grace Construction Products.
- H. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- I. Joint Sealant: ASTM C920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust,

dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.

- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 50 - 75mm (2-3 in.) wide, manufacturer's recommended self-adhesive tape. Gaps greater than 6mm (1/4 in.) shall be filled with mastic or caulk, allowing sufficient time to fully cure before application of the tape and fluid applied air barrier system.
- C. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- D. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- E. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
- H. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.
- J. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.
 - 1. Prime substrate as required.
- B. Plywood Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C1193 and with air barrier manufacturer's written instructions. Apply tape to joint prior to installing fluid air barrier membrane.

3.4 AIR BARRIER MEMBRANE INSTALLATION

- A. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Membrane Air Barrier: 90-mil (2.4-mm) wet film thickness, 45-mil (1.2-mm) dry film thickness.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.5 TRANSITION MEMBRANE INSTALLATION

- A. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
 - 3. Install all flashings only after application of air barrier.
- B. Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm)

of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

1. Transition Membrane: Roll firmly to enhance adhesion.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air barrier system has been provided.
 3. Concrete surfaces are smooth, clean and free of cavities, and protrusions.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.

12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
 14. Conform that site conditions and substrates are ready for air barrier work to commence. If not, Contractor to make suitable repairs or adjustments to the work.
- C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.
- D. Remove and replace deficient air barrier components and retest as specified above.
- 3.7 CLEANING AND PROTECTION
- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 150 days.
 - C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
 - D. Remove masking materials after installation.

END OF SECTION

SECTION 07 42 13 METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior “snap batten” steel wall panels.
- B. Accessories including fasteners and perimeter trim.

1.2 RELATED SECTIONS

- A. Section 07 27 26 - Fluid-Applied Membrane Air Barriers .
- B. Section 07 62 00 – Sheet Metal Flashing and Trim.
- C. Section 07 92 00 - Joint Sealants.
- D. Section 09 28 13 - Cementitious Backing Boards.
- E. Section 08 91 00 - Louvers.

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 501.1 - Standard Test Method for Metal Curtain Walls for water penetration using Dynamic Pressure.
 - 2. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
- B. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM):
 - 1. ASTM A755 - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 3. ASTM D2244 - Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - 4. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

- 5. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
- 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. California Building Code (CBC) - current edition.
- E. National Fire Protection Agency (NFPA):
 - 1. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
 - 2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- F. Underwriters Laboratory, USA (UL):
 - 1. UL 263 - Standard for Fire Tests of Building Construction and Materials.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Shop Drawings: Submit detailed drawings and panel analysis showing: Profile, gauge of exterior sheet, location, layout and dimensions of panels, location and type of fasteners, shape and method of attachment of all trim, locations and type of sealants, and Installation sequence.
 - 1. Coordination Drawings: Provide elevation drawings and building sections which show panels in relationship to required locations for structural support. Include panel details and details showing attachment to structural support.
 - 2. Other details as may be required for a weathertight installation.
- D. Panel Analysis: Verify panels will withstand design loads indicated without detrimental effects or deflection. Include thermal differential effects between exterior and interior panel facings and resistance to fastener pullout.

- E. Verification Samples: For each finish product specified, two samples, representing actual product, color, and patterns.
- F. Quality Assurance Submittals
 - 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.
 - 2. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall have a minimum of five (5) years experience in the production of metal wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.
- B. Installer Qualifications: Authorized by the manufacturer and the work shall be supervised by a person having a minimum of five (5) years experience installing metal wall panels on similar type and size projects.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Install one complete unit including accessories, then test operation and make adjustments required for proper operation.
 - 3. Do not proceed with remaining work until workmanship is approved by Architect.
 - 4. Rebuild mock-up area as required to produce acceptable work.

1.6 PRE-INSTALLATION MEETINGS

- A. Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to metal panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

- B. Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

- A. Limited Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance including bond integrity, deflection and buckling.
 - 1. Warranty Period: Two years from date of Substantial Completion, or 2 years and 6 months from the date of shipment from manufacturer's plant, whichever occurs first.
- B. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 ΔE Hunter units on panels when tested in accordance with ASTM D2244.
 - 1. Warranty Period: Twenty years from date of Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bridger Steel, Inc., 1558 Amsterdam Road, Belgrade, MT 59714.
Phone: (866) 388-9555; Web: www.BridgerSteel.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures.

2.2 METAL WALL PANELS

- A. Basis of Design: Bridger Steel Snap Batten.
- B. Performance Criteria:
 - 1. Structural Test: Structural performance shall be verifiable by witnessed structural testing for simulated wind loads in accordance with ASTM E72 and E330.
 - a. Deflection criteria shall be $L/180$.
 - 2. Water Penetration: There shall be no uncontrolled water penetration through the panel joints at a pressure differential of 20 psf, when tested in accordance with ASTM E331.
 - 3. Air Infiltration: Air infiltration through the panel shall not exceed 0.001 cfm/sf at 20 psf air pressure differential when tested in accordance with ASTM E283.
 - 4. Seismic Performance: Comply with ASCE 7, Section 13, "Seismic Design Requirements for Non-Structural Components". Panels shall be hard-fastened to structure along one edge only such that lateral slippage between panels can occur in the event of seismic activity.
- C. Paint Finish Characteristics:
 - 1. Gloss: 15 plus or minus 5 measured at 60 degree angle tested in accordance with ASTM D523.
- D. Panel Assembly:
 - 1. Panel width: varies, custom, 6"-24", see drawings.
 - 2. Panel Lengths: one piece, up to 100'.
 - 3. Panel Attachment: Shall consist of fasteners and stainless steel attachment clip completely concealed within the panel side joint.
 - 4. Exterior Face of Panel:
 - a. Material:
 - 1) Steel coil material shall be in accordance with ASTM A755.
 - 2) Gauge: 24 gauge.
 - b. Profile: Snap Batten.
 - c. Exterior Paint Finish:
 - 1) Selected from current full-range Bridger Steel color chart.

2.3 ACCESSORIES

A. Fasteners:

1. Self-drilling fasteners shall be corrosion resistant plated steel with neoprene washer, as recommended by manufacturer.
2. Material: Hex-head type with steel and neoprene washer and 12 gauge stainless steel clip supplied by the manufacturer.
3. Size: As recommended by manufacturer.

B. Perimeter Trim:

1. Fabricated perimeter trim and metal flashing: Shall be same gauge, material and coating color as exterior face of insulated metal wall panel.
2. Extruded perimeter trim: Shall be extruded aluminum 6063-T5 alloy with spray applied PVF coating in same color as exterior face of insulated metal wall panel.

C. Sealants: Butyl, non-skinning/curing type as recommended by manufacturer.

D. Butyl Tape: As recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Provide field measurements to manufacturer as required to achieve proper fit of the preformed wall panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.
- B. Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:
 1. Plus or minus 1/8 inch in 5 feet (3 mm in 1524 mm) in any direction along plane of framing.
 2. Plus or minus 1/4 inch (6 mm) cumulative in 20 feet (6096 mm) in any direction along plane of framing.
 3. Plus or minus 1/2 inch (13 mm) from framing plane on any elevation.
 4. Plumb or level within 1/8 inch (3 mm) at all changes of transverse for pre-formed corner panel applications.

5. Verify that bearing support has been provided behind vertical joints of horizontal panel systems and horizontal joints of vertical panel systems. Width of support shall be as recommended by manufacturer.
- C. Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

3.2 PANEL INSTALLATION

- A. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
- B. Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.
- C. Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions. Personnel should wear respiratory and eye protection devices.
- D. Butyl Weather Barrier Sealant:
 1. Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.
 2. Use non-skinning butyl tube sealant only for tight metal-to-metal contact.
 3. Do not use non-skinning butyl tube sealant to bridge gaps.
- E. Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

3.3 TRIM INSTALLATION

- A. Place trim and trim fasteners only as indicated per details on the approved shop drawings.
- B. Field drill weep holes where appropriate in horizontal trim; minimum 1/4 inch (6 mm) diameter at 24 inches (610 mm) on center.
- C. Place a continuous strip of butyl tube sealant between the inside back face of closure trims and interior panel faces for proper vapor seal.

3.4 SEALANT INSTALLATION FOR EXPOSED JOINTS

- A. Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.

- B. Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.
- C. Direct contact between butyl and silicone sealants shall not be permitted.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: General Contractor shall engage an independent testing and inspection agency acceptable to the architect to perform field tests and inspections and to prepare reports of findings.
- B. Field Water Test: After completing portion of metal wall panel assembly including accessories and trim, test a 2-bay area selected by the architect for water penetration in accordance with AAMA 501.2.

3.6 CLEANING AND PROTECTION

- A. Remove protective film immediately after installation.
- B. Touch-up, repair or replace metal panels and trim that have been damaged.
- C. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

SECTION 07 42 33 PHENOLIC WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen system.
 - 1. Wall panels.
 - 2. Fascia.
 - 3. Horizontal soffits.
 - 4. Storefront panels.
- B. Interior solid phenolic wall lining panels.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications; additional sub framing, Z girts to accommodate exterior insulation is not in the scope of Section 07 42 33.
- B. Section 07 20 00 – Thermal Protection; exterior insulation, if required for NFPA 285 compliance, is not included in the scope of Section 07 42 33.
- C. Section 07 25 00- Weather Barriers, is not included in the scope of section 07 42 33
- D. Section 08 41 00 - Entrances and Storefronts.
- E. Section 08 44 12 - Metal Framed Curtain Wall.
- F. Section 09 29 00 - Gypsum Board.

1.3 REFERENCES

- A. International Code Council Evaluation Service (ICC-ES):
 - 1. ESR-1687 – Trespa Meteon FR Wall Panel Cladding System, current edition.
- B. ASTM International (ASTM):
 - 1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. ASTM D 635 - Standard Test Method for Small Scale Burning.
 - 3. ASTM D 1929 - Standard Test Method for Ignition Temperature.
 - 4. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

5. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 7. ASTM E 119 - Standard Test Method for Fire Rated or Fire Resistive Construction.
 8. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.
- C. European Standards (EN):
1. EN 438-2 - Decorative High Pressure Laminate (HPL) Sheets Based on Thermosetting Resins - Determination of Properties.
 2. EN 12524 - Building Materials and Products, Hygrothermal Properties, Tabulated Design Values.
- D. International Organization for Standardization (ISO):
1. ISO 105 A02-93 - Tests for Color Fastness -- Part A02: Grey scale for assessing change in color.
 2. ISO 178 - Determination of Flexural Properties.
 3. ISO 527-3 - Determination of Tensile Properties.
 4. ISO 846 - Evaluation of the Action of Organisms.
- E. National Fire Protection Association (NFPA):
1. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
 2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- 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 plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components,

including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.

- D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Independent Evaluation Reports compliant with current 2015 State or Commonwealth IBC Code and/or test reports supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.
- E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachments system meets the wind load requirements for the project.
- F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. Please note that samples are only representative for color and pattern and not for thickness or edge finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from batch to batch.
- G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches (89 mm by 89 mm) representing actual product, color, and patterns. Sample edges may vary from field panel edges.
- H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.
- I. Project Compliance: Documents showing product compliance with project specifications to include FSC Certification, Greenguard, LEED, Environmental Product Declarations, etc.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All panel products specified in this section will be supplied by a single manufacturer with a minimum of 25 years' experience.
 - 1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.
 - 2. Products covered under the work listed in this section are to be manufactured in an ISO 14001 Certified facility.
- B. Installer Qualifications: All products listed in this section are to be installed by an installing firm who can prove 3 years in business and exemplary workmanship. Installing firm must have evidence of installing rainscreen wall panel systems and is suitable for the execution of the work.
- C. Mock-Up: Provide a mock-up for evaluation of the product and application workmanship.
 - 1. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

- D. Pre-Installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.

B. Storage:

1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
2. Store products in manufacturer's and/or fabricators unopened packaging until ready for installation.
3. Stack panels using protective dividers to avoid damage to decorative surface.
4. For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
5. Do not store sheets, or fabricated panels vertically.

C. Handling:

1. Remove protective film within 24 hours of the panels being removed from the pallet.
2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
3. Remove all labels and stickers immediately after installation.

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.
- B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

- A. Warranty: At project closeout, provide Manufacturer's limited ten year warranty covering defects in materials from date of shipment to fabricator. Warranty only available when material is fabricated and installed by companies trained by the Manufacturer or Manufacturer's representative. Warranty coverage is based on the Manufacturer's Material Property Datasheet to include, but not limited to, ASTM D5420-04 Impact Resistance and Resistance to artificial weathering, Florida cycle 3000 hours with a grey scale of 4-5. Warranty to be adjudicated in North America.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Trespa International B.V.; P.O. Box 110, 6000 AC Weert Wetering 20, 6002 SM Weert The Netherlands; www.trespa.com.
- B. Acceptable Manufacturer's Representative: Trespa North America, Ltd.; 350 5th Ave Suite 4610 New York, New York 10118. ASD. Toll Free Tel: (800) 4-TRESPA. Tel: (858) 679-2090. Fax: (858) 679-9568. Email: info.northamerica@trespa.com. Web: <http://www.trespa.com/na>. Trespa Territory Manager: John Krajewski, j.krajewski@trespa.com. Telephone: 443-307-3041.

2.2 WALL PANELS

- A. Solid Phenolic Wall Panels: Trespa Meteon by Trespa International B. V. as represented by Trespa North America, LTD.
 - 1. Material: Solid panel manufactured using a combination of high pressure and temperature to create a flat panel created from thermosetting resins, homogenously reinforced with natural fibers and an integrated decorative surface or printed décor.
 - 2. Panel Size: 14'x7', or 12'x6', or 8'x6', or 10'x5'
 - 3. Panel Thickness: 8mm (5/16") and 10mm (3/8")
 - 4. Panel Type: Single sided decorative
 - 5. Panel Decor: Meteon "Uni Colours" and "Wood Decors"; Architect to select from manufacturer's full range of colors and finish types.
 - 6. Panel Core: Fire retardant (FR) black core.
 - 7. Physical Properties:
 - a. Modulus of Elasticity: 1,300,000 psi (9000 N/mm²) minimum, ISO 178.
 - b. Tensile Strength: 10,100 psi (70 N/mm²) minimum, ISO 527-2.
 - c. Flexural Strength: 14,500psi (120 N/mm²) minimum, ISO 178.

d. Thermal Conductivity: 2.1 BTU/inch/ft².hr.°F, EN 12524.

e. Structural Performance (ASTM E330):

1) Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtain the following results:

2) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175

3) Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less

a) At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.

b) If system tests are not available, mock ups shall be constructed and tests performed under the direction of an independent third party laboratory which show compliance to the minimum standards listed above.

8. Fire Performance:

a. Flame Spread: Class A, Less than 25, ASTM E 84.

b. Smoke Development: Less than 450, ASTM E 84.

c. Ignition Temperature: Greater than 650 degree F (350 degree C) above ambient, ASTM D1929.

d. Burning Classification: CC1 or CC2, ASTM D635.

e. When required for compliance with local building codes, the wall cladding assembly shall show no degradation of the rating of Fire Resistant Assemblies, ASTM E119.

f. When required for compliance with local building codes, the wall cladding assembly including cladding and non-cladding elements such as, but not limited to, specific weather resistive barriers and/or exterior insulation materials, shall meet the performance requirements of NFPA 285. Performance shall be determined by actual testing in accordance with NFPA 285 or through an equivalency analysis provided by a recognized fire protection expert.

g. When required for compliance with local building codes, the wall cladding assembly shall not ignite when exposed to a radiant heat energy source, NFPA 268.

9. Finish Performance: Electron Beam Cure resin in conformance with the following general requirements:
 - a. Decor: As selected by the architect/engineer from manufacturer's standard decors or a custom color to be matched by the panel supplier.
 - b. Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100 degree F (38 degree C) for 3000 hours, ASTM D 2247.
 - c. Salt Spray Resistance: Corrosion creepage from scribe line (1/16 inch (1.6 mm) max.) and minimum blister rating of 8 within the test specimen field, ASTM B117.
 - d. Weather Exposure: Tested to two standards using a Xenon Arc Light and water to simulate weather exposure.
 1. Florida test cycle of 3000 hours=10 years (vertical application)
 2. EN 438-2:29 Western European test cycle of 1000 hours=10 years (vertical application)
 - e. Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-93 according to test method EN 438-2:29.
 - f. Microbial Characteristics: Will not support micro-organic growth (ISO 846).
- B. Mounting Systems:
 1. TS110-285 - Exposed fastening on fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
 2. TS210-285 - Concealed fastening over fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
- C. Aluminum Sub-Structure: Aluminum sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.
 1. Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.
- D. Extruded Aluminum Trim: Color as specified in the finish schedule.
- E. Fasteners (Concealed And Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels where required by the architect.

2.3 FABRICATION

- A. Panels: Solid phenolic wall panels with no voids, air spaces or foamed insulation in the core material.

Accessory items in accordance with manufacturer's recommendations and approved submittals
- B. Panel Weight: 8 mm (2.4 lb/ft²)
- C. Panel Bow: = 2 mm / m (= 0.079 inch/39.38 inches).
- D. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to a minimum. All fabrication shall be done under controlled shop conditions when possible.
- E. Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.
- C. Confirm exterior sheathing is plumb and level, with no deflection greater than 1/4 inch (6 mm) in 20 feet (6096 mm).
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install solid phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.

- B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.
- C. Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.
- D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.
- E. Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.
- F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alteration to the shop for re-fabrication or replacement.
- G. Install profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.4 ADJUSTING AND CLEANING

- A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.
- B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.
- C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.
- D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the General Contractor.

END OF SECTION

SECTION 07 42 33 PHENOLIC WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen system.
 - 1. Wall panels.
 - 2. Fascia.
 - 3. Horizontal soffits.
 - 4. Storefront panels.
- B. Interior solid phenolic wall lining panels.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications; additional sub framing, Z girts to accommodate exterior insulation is not in the scope of Section 07 42 33.
- B. Section 07 20 00 – Thermal Protection; exterior insulation, if required for NFPA 285 compliance, is not included in the scope of Section 07 42 33.
- C. Section 07 25 00- Weather Barriers, is not included in the scope of section 07 42 33
- D. Section 08 41 00 - Entrances and Storefronts.
- E. Section 08 44 12 - Metal Framed Curtain Wall.
- F. Section 09 29 00 - Gypsum Board.

1.3 REFERENCES

- A. International Code Council Evaluation Service (ICC-ES):
 - 1. ESR-1687 – Trespa Meteon FR Wall Panel Cladding System, current edition.
- B. ASTM International (ASTM):
 - 1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. ASTM D 635 - Standard Test Method for Small Scale Burning.
 - 3. ASTM D 1929 - Standard Test Method for Ignition Temperature.
 - 4. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

5. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 7. ASTM E 119 - Standard Test Method for Fire Rated or Fire Resistive Construction.
 8. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.
- C. European Standards (EN):
1. EN 438-2 - Decorative High Pressure Laminate (HPL) Sheets Based on Thermosetting Resins - Determination of Properties.
 2. EN 12524 - Building Materials and Products, Hygrothermal Properties, Tabulated Design Values.
- D. International Organization for Standardization (ISO):
1. ISO 105 A02-93 - Tests for Color Fastness -- Part A02: Grey scale for assessing change in color.
 2. ISO 178 - Determination of Flexural Properties.
 3. ISO 527-3 - Determination of Tensile Properties.
 4. ISO 846 - Evaluation of the Action of Organisms.
- E. National Fire Protection Association (NFPA):
1. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
 2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- 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 plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components,

including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.

- D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Independent Evaluation Reports compliant with current 2015 State or Commonwealth IBC Code and/or test reports supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.
- E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachments system meets the wind load requirements for the project.
- F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. Please note that samples are only representative for color and pattern and not for thickness or edge finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from batch to batch.
- G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches (89 mm by 89 mm) representing actual product, color, and patterns. Sample edges may vary from field panel edges.
- H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.
- I. Project Compliance: Documents showing product compliance with project specifications to include FSC Certification, Greenguard, LEED, Environmental Product Declarations, etc.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All panel products specified in this section will be supplied by a single manufacturer with a minimum of 25 years' experience.
 - 1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.
 - 2. Products covered under the work listed in this section are to be manufactured in an ISO 14001 Certified facility.
- B. Installer Qualifications: All products listed in this section are to be installed by an installing firm who can prove 3 years in business and exemplary workmanship. Installing firm must have evidence of installing rainscreen wall panel systems and is suitable for the execution of the work.
- C. Mock-Up: Provide a mock-up for evaluation of the product and application workmanship.
 - 1. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

- D. Pre-Installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.

B. Storage:

1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
2. Store products in manufacturer's and/or fabricators unopened packaging until ready for installation.
3. Stack panels using protective dividers to avoid damage to decorative surface.
4. For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
5. Do not store sheets, or fabricated panels vertically.

C. Handling:

1. Remove protective film within 24 hours of the panels being removed from the pallet.
2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
3. Remove all labels and stickers immediately after installation.

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.
- B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

- A. Warranty: At project closeout, provide Manufacturer's limited ten year warranty covering defects in materials from date of shipment to fabricator. Warranty only available when material is fabricated and installed by companies trained by the Manufacturer or Manufacturer's representative. Warranty coverage is based on the Manufacturer's Material Property Datasheet to include, but not limited to, ASTM D5420-04 Impact Resistance and Resistance to artificial weathering, Florida cycle 3000 hours with a grey scale of 4-5. Warranty to be adjudicated in North America.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Trespa International B.V.; P.O. Box 110, 6000 AC Weert Wetering 20, 6002 SM Weert The Netherlands; www.trespa.com.
- B. Acceptable Manufacturer's Representative: Trespa North America, Ltd.; 350 5th Ave Suite 4610 New York, New York 10118. ASD. Toll Free Tel: (800) 4-TRESPA. Tel: (858) 679-2090. Fax: (858) 679-9568. Email: info.northamerica@trespa.com. Web: <http://www.trespa.com/na>. Trespa Territory Manager: John Krajewski, j.krajewski@trespa.com. Telephone: 443-307-3041.

2.2 WALL PANELS

- A. Solid Phenolic Wall Panels: Trespa Meteon by Trespa International B. V. as represented by Trespa North America, LTD.
 - 1. Material: Solid panel manufactured using a combination of high pressure and temperature to create a flat panel created from thermosetting resins, homogenously reinforced with natural fibers and an integrated decorative surface or printed décor.
 - 2. Panel Size: 14'x7', or 12'x6', or 8'x6', or 10'x5'
 - 3. Panel Thickness: 8mm (5/16") and 10mm (3/8")
 - 4. Panel Type: Single sided decorative
 - 5. Panel Decor: Meteon "Uni Colours" and "Wood Decors"; Architect to select from manufacturer's full range of colors and finish types.
 - 6. Panel Core: Fire retardant (FR) black core.
 - 7. Physical Properties:
 - a. Modulus of Elasticity: 1,300,000 psi (9000 N/mm2) minimum, ISO 178.
 - b. Tensile Strength: 10,100 psi (70 N/mm2) minimum, ISO 527-2.
 - c. Flexural Strength: 14,500psi (120 N/mm2) minimum, ISO 178.

d. Thermal Conductivity: 2.1 BTU/inch/ft².hr.°F, EN 12524.

e. Structural Performance (ASTM E330):

1) Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtain the following results:

2) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175

3) Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less

a) At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.

b) If system tests are not available, mock ups shall be constructed and tests performed under the direction of an independent third party laboratory which show compliance to the minimum standards listed above.

8. Fire Performance:

a. Flame Spread: Class A, Less than 25, ASTM E 84.

b. Smoke Development: Less than 450, ASTM E 84.

c. Ignition Temperature: Greater than 650 degree F (350 degree C) above ambient, ASTM D1929.

d. Burning Classification: CC1 or CC2, ASTM D635.

e. When required for compliance with local building codes, the wall cladding assembly shall show no degradation of the rating of Fire Resistant Assemblies, ASTM E119.

f. When required for compliance with local building codes, the wall cladding assembly including cladding and non-cladding elements such as, but not limited to, specific weather resistive barriers and/or exterior insulation materials, shall meet the performance requirements of NFPA 285. Performance shall be determined by actual testing in accordance with NFPA 285 or through an equivalency analysis provided by a recognized fire protection expert.

g. When required for compliance with local building codes, the wall cladding assembly shall not ignite when exposed to a radiant heat energy source, NFPA 268.

9. Finish Performance: Electron Beam Cure resin in conformance with the following general requirements:
- a. Decor: As selected by the architect/engineer from manufacturer's standard decors or a custom color to be matched by the panel supplier.
 - b. Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100 degree F (38 degree C) for 3000 hours, ASTM D 2247.
 - c. Salt Spray Resistance: Corrosion creepage from scribe line (1/16 inch (1.6 mm) max.) and minimum blister rating of 8 within the test specimen field, ASTM B117.
 - d. Weather Exposure: Tested to two standards using a Xenon Arc Light and water to simulate weather exposure.
 - 1. Florida test cycle of 3000 hours=10 years (vertical application)
 - 2. EN 438-2:29 Western European test cycle of 1000 hours=10 years (vertical application)
 - e. Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-93 according to test method EN 438-2:29.
 - f. Microbial Characteristics: Will not support micro-organic growth (ISO 846).
- B. Mounting Systems:
- 1. TS110-285 - Exposed fastening on fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
 - 2. TS210-285 - Concealed fastening over fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
- C. Aluminum Sub-Structure: Aluminum sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.
- 1. Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.
- D. Extruded Aluminum Trim: Color as specified in the finish schedule.
- E. Fasteners (Concealed And Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels where required by the architect.

2.3 FABRICATION

- A. Panels: Solid phenolic wall panels with no voids, air spaces or foamed insulation in the core material.

Accessory items in accordance with manufacturer's recommendations and approved submittals
- B. Panel Weight: 8 mm (2.4 lb/ft²)
- C. Panel Bow: = 2 mm / m (= 0.079 inch/39.38 inches).
- D. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to a minimum. All fabrication shall be done under controlled shop conditions when possible.
- E. Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.
- C. Confirm exterior sheathing is plumb and level, with no deflection greater than 1/4 inch (6 mm) in 20 feet (6096 mm).
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install solid phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.

- B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.
- C. Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.
- D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.
- E. Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.
- F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alteration to the shop for re-fabrication or replacement.
- G. Install profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.4 ADJUSTING AND CLEANING

- A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.
- B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.
- C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.
- D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the General Contractor.

END OF SECTION

SECTION 07 42 43 COMPOSITE WALL PANELS

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 aluminum composite material (ACM) wall panels.

1.3 DEFINITIONS

- A. ACM: Aluminum composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at project site.
 - 1. Meet with Owner, Construction Manager, Architect, ACM panel fabricator and installer, ACM sheet manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects ACM panels, including installers of doors, windows, and louvers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of ACM panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches=1 foot.
- C. Samples for Initial Selection: For each type of ACM panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
 - D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. ACM Panels: 12 inches long by actual panel width. Include fasteners, closures, and other ACM panel accessories. Submit custom color samples in paint manufacturer's standard size.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For each product, tests performed by a qualified testing agency.
 1. ACM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.
 2. ACM System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on ACM system type provided.
 - a. Wet System: Tested to AAMA 501.
 - b. Dry System: Tested to AAMA 501.
 - c. DBVR System: Tested to AAMA 509.
 - d. PER System: Tested to AAMA 508.
 - C. Field quality-control reports.
 - D. Sample Warranties: For special warranties.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For ACM panels to include in maintenance manuals.
- 1.8 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by ACM Fabricator.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, ACM panels, and other manufactured items so as not to be damaged or deformed. Package ACM panels for protection during transportation and handling.

- B. Unload, store, and erect ACM panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack ACM panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store ACM panels to ensure dryness, with positive slope for drainage of water. Do not store ACM panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on ACM panels during installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of ACM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

- A. Coordinate ACM panel installation with other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. Warranty on Panel Material: Manufacturer's standard form in which manufacturer agrees to replace ACM that fails within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace ACM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide ACM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, panel deflection no greater than L/60 of the span.

- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. of wall area when tested in accordance with ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Include expansion and contraction points as needed to allow for free and noiseless thermal movements from surface temperature changes.
 - 1. Temperature Change (Range): minus 20 deg F to 175 deg F, material surfaces.
- E. Fire Propagation Characteristics: ACM wall assembly passes NFPA 285 testing.

2.2 ACM GLAZED-IN PANELS

- A. ACM Glazed-in Panel Systems: Provide factory-formed ACM panels fabricated from two aluminum facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include stiffeners, attachment assembly components and accessories required for weathertight system.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Arconic Inc. Reynobond, or comparable product by one of the following:
 - a. 3A Composites USA Inc.: Alucobond Plus.
 - b. Mitsubishi Chemical Composites.
 - c. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00, Substitution Procedures.
- B. Aluminum-Faced Composite Panels: formed with 0.020-inch thick aluminum sheet facings, both sides.
 - 1. Panel Thickness: 6 mm.
 - 2. Core: Fire retardant.
 - 3. Finish: coil-coated from manufacturer's full range of colors, as required to match adjacent aluminum framing, as shown on Drawings. Where inside of panel is exposed, finish to match opposite side.
- 4. Peel Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
 - 5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.

- C. Attachment Assembly Components: Formed from extruded aluminum or material compatible with panel.

2.3 FABRICATION

- A. General: Fabricate and finish ACM panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate ACM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.4 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other

components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. PVDF Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. FEVE Fluoropolymer: One-coat clear or tinted fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Siliconized Modified Polyester (SMP): Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and ACM panel manufacturer's written recommendations.

3.3 ACM PANEL INSTALLATION

- A. General: Install ACM panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor ACM panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- B. Fasteners:
 1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior or interior.

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

3.4 ERECTION TOLERANCES

A. Site Verification of Conditions:

- 1. Verify conditions of components or substrate previously installed under other Sections are acceptable for the ACM installation. Provide documentation indicating detrimental conditions to the ACM system performance.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency if necessary to perform field tests and inspections.
- B. ACM wall panels will be considered defective if they do not pass test and inspections.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as ACM panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of ACM panel installation, clean finished surfaces as recommended by ACM panel manufacturer. Maintain in a clean condition during construction.
- B. Replace ACM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 52 00
MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1– GENERAL

1.1 REFERENCES

- A. Examine all Drawings and all other Sections of the Specifications for requirements affecting the work of this Section.

1.2 SCOPE

- A. Furnish and install a new two-ply reinforced SBS modified membrane assembly as described herein.
- B. In the event these Specifications deviate from the manufacturer's current specifications, these specifications prevail, except where they conflict with the manufacturer's requirements for the specified guarantee. In the case where the specifications conflict with the manufacturer's requirements for the specified guarantee, the Contractor shall consult with the Owner.
- C. Install roofing materials by personnel who have been previously trained by the roof membrane manufacturer in the proper application of the roofing system specified in this Section of the Specifications.
- D. Coordination: Coordinate the work of this Section with other work of the Contract for Construction.
 - 1. Verify the placement of wood blocking at all locations where nailing of the materials of this Section of the Specifications is required.
 - 2. Related work such as roof drains, sheet metal edging/gravel stops, sheet metal flashing assemblies, gutters, and lead collars for pipes shall either be in place or shall be available for installation.
- E. Definitions:
 - 1. See ASTM D 1079 - Standard Terminology Relating to Roofing and Waterproofing.
 - 2. See The NRCA Roofing and Waterproofing Manual, fifth edition; Glossary.
 - 3. Roof System or Roofing System: A system of interacting roof components, generally consisting of a membrane or primary roof covering and roof insulation (not including the roof deck) designed to weatherproof a building's top surface.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 05 50 00, Metal Fabrication
2. Blocking and nailers: Section 06 10 00, Rough Carpentry
3. Section 07 22 00, Roof and Deck Insulation
4. Section 07 41 00, Structural Standing Seam Metal Roofing
5. Section 07 62 00, Flashing & Sheet Metal
6. Section 07 72 40, Roof Hatches
7. Section 07 90 00, Joint Sealers
8. Section 08 45 00, Translucent Roof Assemblies
9. Section 09 90 00, Painting
10. Applicable Sections of the Specifications included in Division 15 and 16.

1.4 SYSTEM DESCRIPTION

- A. Roofing system description as follows:
 1. Apply a base sheet.
 2. Apply rigid insulation board using hot asphalt.
 3. Apply one layer smooth surfaced modified bitumen interply using hot asphalt.
 4. Apply one layer granule surfaced modified bitumen finish ply using hot asphalt.
 5. Apply flashing plies.
- B. The completed roofing system shall arrest water migration from entering the building.
- C. Provide a Class "A" rated fire hazard assembly.
- D. Maximum sheet lengths and special fastening of the specified roof membrane may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot (1:24). The manufacturer shall provide the contractor acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes, and the roof membrane shall be installed in accordance with the manufacturer's recommendations with regard to supplemental nailing that may be required when roof slopes exceed 3/8 inch per foot.

1.5 QUALITY ASSURANCE

- A. Provide primary roofing products supplied by a single manufacturer which has been successfully producing the specified types of primary products for not less than ten (10) years. Provide secondary or accessory products which are acceptable to the manufacturer of the primary roofing products.

- B. Applicator qualifications: All roofing materials and sheet metal flashings shall be applied by roofing contractors with 10 years or more experience of successful application of the specified roofing systems in the local region. The roofing contractor shall be prepared to provide written evidence of his experience in the successful application of the materials specified herein. The written evidence shall include information related to the completion of five similar projects completed in the last five years, and shall include the name and telephone number of the Owner for whom the work was provided.
- C. The roofing contractor must be currently certified by the manufacturer to install the roofing system as specified herein. Furnish to the Owner written documentation that installer is certified to install roofing systems of the type specified in this Section of the Specifications. The roofing system shall be applied only by an approved contractor authorized by the manufacturer prior to solicitation.
- D. Contractor must present to the Owner a statement of current insurance coverage for any insurance required by the owner. The insurance coverage(s) must remain in force for the duration of the project.
- E. Upon completion of roofing work, provide an inspection by a representative of the sheet roofing membrane manufacturer to assure installation is in accordance with the sheet roofing membrane manufacturer's requirements. The representative of the sheet roofing membrane manufacturer shall state in a letter to the Owner that he has reviewed the installation of the sheet roofing membrane and that the installation complies with the written specifications and recommended installation details of the sheet roofing membrane manufacturer.
- F. In addition to comply with other legal requirements, comply with:
1. Underwriters Laboratories Inc. (UL) Fire Hazard Classification: UL Standard 790, Class A including mopping asphalt without additional requirements for gravel or coatings.
 2. Wind-uplift loadings: In accordance with the applicable building code and as noted herein.
 - i. Design uplift pressure: Calculate in accordance with procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems" before multiplication by a safety factor unless FM, ASCE 7, or the applicable building code require design uplift pressures greater than those noted in the referenced guide.
 - ii. Provide a roofing system that is similar to systems that have been successfully tested by a qualified testing and inspection agency to resist uplift pressures as noted in the referenced guide, or if design uplift pressures are greater than those noted in the referenced guide in accordance with ASCE 7 or other reference standard required by FM or the applicable building code.
 - iii. Factory Mutual Research Corporation (FMRC): Approved roof assembly FMRC Standard 4470, Class 1-90 Windstorm Classification.

- iv. ASCE 7, "Minimum Design Loads for Buildings and other Structures", latest edition. Design wind-uplift loads shall be determined as noted in ASCE 7 using the basic wind speed for the applicable geographic area.
- v. In case of a conflict between FM standards and data sheets, and ASCE 7 use the highest loading for design purposes.

G. Reference specifications and standards:

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- 1. The NRCA Roofing and Waterproofing Manual, fifth edition including applicable NRCA Construction Details; publication of the National Roofing Contractors Association. The referenced manual establishes minimum requirements. The drawings and specifications may modify guidelines included in the manual.
- 2. Applicable NRCA quality control guidelines.
- 3. The roofing system shall comply with applicable NRCA Construction Details. Unless otherwise specifically shown on the drawings, comply with the recommended details as illustrated and noted in the referenced NRCA manual.
- 4. ASTM (American Society for Testing and Materials) latest edition of applicable standards including but not limited to the following:
 - i. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board.
 - ii. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 - iii. ASTM D 312 - Standard Specification for Asphalt used in Roofing.
 - iv. ASTM D 4586 - Standard Specification for Asphalt Roof Cement.
 - v. ASTM - D 6162, D 6163, D 6164, and D 6298; Standard Specifications related to Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets.
 - vi. ASTM E 108 - Standard Specifications for Fire Tests of Roof Coverings.
- 5. FM (Factory Mutual Engineering and Research) applicable standards and guidelines including but not limited to the following:
 - i. FM AS 4470 Class I Roof Covers.

- ii. FM P7825 - Approval Guide; Factory Mutual Engineering and Research, current edition.
- 6. UL (Underwriters Laboratories) applicable standards and guidelines including but not limited to:
 - i. UL 790; Test Methods for Fire Tests of Roof Covering.
 - ii. UL RMSD; Roofing Materials and Systems Directory.
- 7. Polyisocyanurate Insulation Manufacturers Association (PIMA): Applicable Technical Bulletins, Advisories, and other applicable publications.
- H. Product quality: Primary roofing materials shall be manufactured under a quality management system that is monitored regularly by a third party auditor. Certificates of analysis confirming the tested values of the actual materials being supplied for the project will be required prior to project close-out.

1.6 QUALITY CONTROL

- A. Quality control shall be performed by the contractor. The Owner may choose to implement a quality assurance program but implementation of a quality assurance program by the Owner shall not relieve the contractor of the requirement of providing a quality control program as described herein.
- B. Quality control program:
 - 1. A representative of the contractor or his designated subcontractor shall implement a quality control program to ensure that the roofing system is installed in accordance with the requirements noted on the drawings and in the specifications, and in accordance with reference standards. The representative shall be knowledgeable of the system and shall have the authority to bring roofing work back into compliance if non-complying work is observed.
 - 2. Minimum requirements:
 - i. Minimum standards are described in applicable NRCA publications. Unless otherwise accepted, the NRCA "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" shall be incorporated into the quality control program and reports shall reference the applicable recommendations, criteria, and corrective action recommendations.
 - ii. The requirements noted in the referenced NRCA publication are minimum standards, and shall not be construed as superseding the requirements depicted on the drawings and noted in the specifications.
 - 3. Daily reports:
 - i. A representative of the contractor or his designated subcontractor shall file daily reports each day that work included in this Section

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of the Specifications is executed. The daily reports shall be in accordance with the guidelines established by NRCA and shall be similar to those included in applicable NRCA quality control publications. The daily reports shall clearly demonstrate that the work complies with the requirements depicted on the drawings and noted in the specifications, and has been executed in accordance with referenced guidelines and standards. The use of applicable NRCA documents is encouraged and annotated applicable NRCA documents shall be deemed acceptable as a daily report. A sample of a typical daily report format is attached to this Section of the Specifications.

- ii. Daily reports shall be provided to the Owner at the end of each day that roofing work is executed.

C. Manufacturer's technical assistance:

- 1. The manufacturer of the roofing materials shall provide manufacturer's technical representative to attend necessary job meetings, assist with answering technical questions as they arise, perform periodic inspections as necessary, assist any third party independent inspector as may be required, and conduct a final inspection upon successful completion of the project.

- i. The manufacturer's technical representative shall provide an inspection report after each site review and shall provide a copy of the inspection report to the Owner, the Contractor, the Architect-of-Record, and the Owner's independent consultant, if the Owner retains an independent roofing consultant or third party independent inspection agency. The inspection report shall be provided to all parties no later than twenty four hours after the inspection via email or fax.

2. Qualifications:

- i. The manufacturer's technical representative shall be an employee of the roof membrane manufacturer who is technically qualified in the design, installation, and servicing of the roof membrane manufacturer's products. Personnel involved solely in sales do not qualify as a manufacturer's technical representative.
- ii. The manufacturer's technical representative shall be competent and thoroughly trained and experienced with regard to the work specified in this Section of the Specifications, and shall be completely familiar with general roofing requirements, the specified roofing products, and the methods needed for proper installation of the roofing system.
- iii. In lieu of providing a manufacturer's technical representative who is an employee of the roof membrane manufacturer, the roof membrane manufacturer may contract with an organization who specializes in providing technical assistance with regard to the design, installation, and servicing of the roof membrane manufacturer's products.

1.7 REGULATORY REQUIREMENTS AND SAFETY

- A. Compliance with regulatory requirements: Perform all roofing work in compliance with all applicable Federal, State, regional, and local statutes, laws, regulations, rules, and ordinances.
- B. Comply with applicable building codes and authorities having jurisdiction including amendments by local authorities. Unless otherwise specified or specifically approved by the local building authority having jurisdiction, comply with the latest edition of the applicable building code, standard, or regulation. Comply with applicable amendments by local jurisdictions as though they were specifically identified and included herein.
- C. In addition to complying with OSHA safety standards and regulations including but not limited to Section 29 CFR 1910 and applicable Cal/OSHA regulations comply with the following:
 - 1. Provide sufficient temporary barricades in order to contain passage ways around tankers, trash chutes, hoisting areas, and areas below roof edges where work is executed.
 - 2. Provide an attendant at tankers and kettles at all times.
 - 3. Do not place kettles or tankers next to exterior building openings allowing fumes to enter the building. Do not allow fumes to enter the building at air intakes.
 - 4. Do not place kettles or tankers on roof decks. Coordinate the location of kettles and tankers with the Owner and obtain the Owner's approval for the location.
 - 5. Do not introduce flammable or explosive substances or equipment into a building of normally low or ordinary hazard classification while the building is occupied.
 - 6. A 2-hour fire watch is required after torch-on roofing.

1.8 SUBMITTALS

- A. See Section 01 30 00, Submittals.
- B. Do not begin work which requires submittals until submittals have been returned indicating the submittals have been reviewed.
- C. Submit the following prior to commencing roofing work:
 - 1. Letter from the proposed primary roofing membrane manufacturer confirming that the roofing contractor or subcontractor is authorized to install the proposed system.
 - 2. Letter from the primary roofing membrane manufacturer stating that the proposed application will comply with the manufacturer's requirements in order to qualify the project for the specified guarantee.

3. Submit documentation of manufacturer's proposed assembly based on substrate conditions as shown on Contract Documents. Such documentation shall indicate compliance with requirements as specified in the QUALITY CONTROL paragraph.
- D. Shop Drawings:
1. Submittals shall clearly show that the rigid insulation board and roof membrane installation complies with the referenced specifications and standards in the QUALITY ASSURANCE paragraph.
 2. Submit dimensioned shop drawings which shall include:
 - i. Roof plan:
 - (i) Depicting an outline of the roof and roof size.
 - (ii) For mechanically attached systems include wind loads, and boundaries of enhanced perimeter and corner attachments. Show the location and pattern of all fasteners.
 - ii. Proposed installation method for rigid insulation board if applicable and roof membrane plies for each different section of roof. Include fastener patterns.
 - iii. Shop drawings shall show installation details, and associated wood blocking and sheet metal assemblies for each condition encountered. The shop drawings shall clearly show all applicable dimensions.
 - iv. Shop drawings shall show fastening devices for each condition encountered.
 - v. Omission in shop drawings of any materials shown on the design drawings, mentioned in specifications, or required for proper execution and completion of all roofing work does not relieve the Contractor of responsibility for providing such materials. The Contractor is responsible for the accuracy, dimensions, quantities, coordination with various trades, and conformance to project requirements.
- E. Product data: Catalog sheets and specifications for each material specified.
- F. Material Safety Data Sheets (MSDS): Submit an MSDS for each material specified, and for all other materials the Contractor intends to use in the execution of the work included in this Section of the Specifications.
- G. Samples: Submit three samples of all specified materials to the Owner for approval. Submit samples of each type of mechanical fastener.
- H. Submit manufacturer's application manual, which describes completely the preparation of surfaces and application of specified materials.

- I. Submit a copy of the membrane manufacturer's warranty and a copy of the roofing contractor's warranty covering workmanship for review.
 - J. Fire hazard certification: Submit written certification that the roof system, including the specified rigid insulation board, has been tested in conjunction with the type of structural roof deck and roof slope applicable to the project and has achieved an Underwriters Laboratories [UL] Class A external fire resistance rating.
 - K. Wind uplift certification: Submit written certification that the roof system, including the specified rigid insulation board, has been tested in conjunction with the type of structural roof deck applicable to the project and has achieved a minimum of a Factory Mutual Class 1-90 Wind uplift rating.
 - L. Rigid insulation board certification: Written certification from the manufacturer of the roof membrane that the rigid board insulation and the means of securing the rigid board insulation are approved for use with the specified roof membrane products. Attach applicable wind uplift and fire rating classification listings and approvals.
 - M. Submit locations and names of building owners that demonstrate the roofing contractor complies with applicator qualifications as described in the QUALITY ASSURANCE paragraph.
 - N. Submit "Certificate of Analysis" for all products supplied to the project site. The certificates shall state that the material being supplied is equal to or exceeds the physical and mechanical properties published in the manufacturer's published material specifications.
 - O. Closeout submittals:
 - 1. Executed warranties.
 - 2. Maintenance guidelines and instructions.
 - 3. Information card; See attached sample.
 - P. Deviations: Submit for approval proposed deviations from the specifications and design drawings. Deviations shall be clearly noted "PROPOSED DEVIATION". Proposed deviations that are submitted after the roofing system has been approved will be rejected. The Owner reserves the right to reject any or all deviations for any reason or no reason.
- 1.9 PRODUCT HANDLING
- A. See DIVISION 1, Material and Equipment.
 - B. Ensure that overloading of the deck and structure does not occur due to and during application and storage of materials.
 - C. Deliver all materials in manufacturer's original packaging in unbroken containers with clearly visible labeling. Avoid crushing or crinkling of roll materials. Do not remove materials from factory packaging until ready for use.
 - D. Factory seconds or blems will not be accepted or allowed onsite.

- E. Store all rolled materials on end.
- F. Store all materials on raised platforms covered with properly secured breathable water resistant covers.
- G. Keep materials dry while they are transported, stored, and installed. Do not allow materials to be exposed to any moisture, anywhere, at any time. Use pallets and breathable water resistant material, canvas tarpaulins or similar material (not polyethylene), to cover all stored material, top and bottom. Do not permit condensation to accumulate in shrink wrapped packaging; slit shrink wrapping and cover with a breathable water resistant material. Materials that are exposed to moisture at any time shall be clearly marked as "rejected material" and shall be removed from the site.
- H. Handle all materials to avoid damage. Store rolled goods on ends only. Discard rolls which have been flattened, creased, or otherwise damaged.
- I. All materials must be clearly labeled with all pertinent information for specified roof system installation. Bituminous materials delivered in hot bulk equipment are to be accompanied by a certificate from the manufacturer clearly stating the type, quality, and stiffening point.
- J. Comply with PIMA Technical Bulletin #109 with regard to the handling and storage of polyiso roof insulation.

1.10 PROJECT CONDITIONS

- A. Schedule and perform work without exposing interior building areas to effects of inclement weather. The building and its contents shall be protected against risks, and damages shall be repaired or replaced at the sole expense of the Contractor. Exterior site improvements shall be protected from damage.
- B. Ensure that all surfaces to receive rigid insulation board, membrane plies, or flashing plies are clean and dry. Provide all equipment and labor to dry substrate surfaces prior to application of roofing materials. Do not apply any new roofing materials until the surface of the deck is clean, dry, and properly attached to the supporting structure. If any unusual conditions are discovered, stop work and promptly report this finding to the Owner.
- C. Do not apply roofing materials and flashings if moisture content of the substrate is above that recommended by the roofing membrane manufacturer or as specified herein. Wood or plywood shall be deemed "dry" if the moisture content is 15% or less.
- D. Do not apply roofing materials during inclement weather. Do not apply roofing materials to damp or frozen deck surface or when precipitation is forecast to occur within 48 hours.
- E. Do not apply roofing materials when ambient temperature is below 40 degrees F.
- F. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- G. Arrange work sequence to avoid use of newly constructed roof for storage, walking surface, and equipment movement. Protect surface with plywood

runways where access is absolutely required, and ensure full protection of roofing surface against damage.

- H. Contractor shall test drains prior to and upon completion of roofing work to ensure that no blockage exists or has occurred.
- I. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing (letter copy to the manufacturer) to the Owner's Representative for corrective action prior to installation of the roof system.

1.11 PROTECTION REQUIREMENTS

- A. Protect the substrate from moisture and water at all times. Failure to protect the substrate from rain shall be deemed sufficient cause for rejecting the substrate.
- B. Torch safety:
 - 1. Comply with NRCA CERTA torch safety guidelines for application of roofing and flashing materials.
 - 2. Designate one person on each crew to perform a daily fire watch for all torch work. The designated crew member shall watch for fires or smoldering materials on all areas of roof construction. Continue the fire watch for a minimum one and one-half hours after torching work has been completed or for additional time as required to ensure no potential ignition conditions exist.
 - 3. If torching work is being executed do not leave the roof unattended at any time.
 - 4. Ensure any and all conditions related to potential ignition conditions are eliminated prior to leaving the roof at the end of each day.
- C. Membrane load protection:
 - 1. Do not support or lay equipment directly on the surface of the roof membrane. Equipment weighting more than two hundred pounds shall be supported as shown on the drawings and shall not be temporarily laid on a protected roof membrane surface unless approved in writing by the Owner.
 - 2. Provide plywood protection for all new and existing roof areas which receive traffic during construction.
- D. Protect newly applied roofing and adjacent surfaces against staining and mechanical damage throughout the execution this project.
- E. Provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.
- F. Prevent access by the public to materials, tools, and equipment during the course of the project.

1.12 ENVIRONMENTAL CONDITIONS

- A. Do not apply roofing materials or rigid insulation board during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that roofing materials, incomplete and completed portions of the roofing system, and building interiors are protected from possible moisture damage.
- B. Temperature restrictions with regard to asphalt: At ambient temperatures of 40°F and below, special precautions must be taken to ensure that the specified Type IV asphalt maintains a minimum acceptable temperature of 410°F at the point of application of the sheet membrane. The asphalt must not be overheated to compensate for cold conditions; use insulated handling equipment. Use insulated hot luggers, mop carts, and kettle-to-roof supply lines. Hand mops should be constructed with a smaller yarn head to facilitate short moppings. Luggers and mop carts should never be more than half-filled at all times.

1.13 SEQUENCING

- A. Phased application of the roofing system is prohibited unless otherwise approved by the Owner and the concurrence of the roof membrane manufacturer is obtained. Delays in application of the finish ply may result in requirements for additional cleaning and priming of the interply surface at the discretion of the Owner. The Owner shall not be liable for any additional costs the Contractor may incur related to additional cleaning or priming of the interply.
- B. Coordinate the work of this Section of the Specifications with all related work specified in other Sections of the Specifications to ensure that components which are to be secured to or stripped into the roofing system are available and that wood blocking, sheet metal flashing assemblies, and plumbing pipes, and roof drains are installed as the work progresses.
- C. Coordinate the preparation of submittals and the installation of rough carpentry, sheet metal, and plumbing work with other Sections of the Specifications.
- D. Ensure that temporary protection measures are in place to preclude moisture intrusion or damage to installed roofing materials, or incomplete and completed portions of the roofing system.

1.14 PRE-ROOFING CONFERENCE

- A. Prior to the beginning of the roofing work, a conference is to be held at the site, attended by the Owner or the Owner's designated representative, the Contractor, the Roofing and Sheet Metal Subcontractors (including foremen), a representative of the roofing manufacturer, and other party(ies) as the Owner may arrange for. The purpose of this conference shall be to review the specifications, details, application requirements, onsite inspection and/or testing requirements, and other pertinent aspects of the work. The Contractor shall make all arrangements and provide all facilities, for the meeting. All parties shall be notified in writing of date, time, and place at least 2 weeks before the proposed meeting.
- B. The specifications, roof plans, and all roofing and flashing details shall be reviewed at the pre-roofing conference. Any discrepancies between the contract documents and the manufacturer's specifications shall be discussed and resolved.

- C. Specific items to be discussed include:
1. Administrative procedures and requirements.
 - i. Project schedule: Trade-related job schedules, and appropriate sequencing of the work, including timely installation or removal and reinstallation of any rooftop mechanical equipment or skylights to avoid or limit traffic on the roof.
 - ii. Payment procedures.
 - iii. Communications procedures.
 - iv. Progress meetings.
 - v. Submittal procedures.
 - vi. RFI procedures.
 - vii. RFP procedures.
 - viii. Requirements for a daily log/report.
 2. Safety requirements; review all related EPA and/or OSHA regulations and other safety requirements, including considerations for safety of occupants.
 3. Use of the project site.
 - i. Access.
 - ii. Hours of construction.
 - iii. Use of existing utilities and requirements for connections.
 - iv. Scheduling of shutdown of utilities.
 - v. Site storage locations; areas on the job site that will be used for delivering, staging, and storing materials.
 - vi. Temporary field office location.
 - vii. Parking area for contractor's personnel.
 - viii. Lunch area for contractor's personnel.
 - ix. Location of kettle (only if hot asphalt is used).
 4. Quality control:
 - i. Requirements for pre-roofing training.
 - ii. Requirements for Quality Control reports.
 - iii. Procedures related to the manufacturer's technical representative's inspections, pre-roofing training course, approval of substrate, distribution of inspection forms, and final acceptance.

- iv. Procedures related to 3rd Party inspection.
- v. Appropriate weather conditions for executing the work.
- vi. Methods and procedures related to roofing installation, including manufacturer's written instructions.

1.15 PRE-ROOFING TRAINING

- A. Arrange for a representative of the roof membrane manufacturer to conduct a training session prior to the beginning of the roofing work. The training session shall include a detailed discussion and demonstrations regarding appropriate procedures for storing, applying, and protecting the specified roof membrane. In addition to reviewing roofing procedures, the representative of the roof membrane manufacturer shall review fire and safety regulations recommended by OSHA and NRCA, and other industry or local governmental groups to ensure that every member of the application crew is familiar with the applicable regulations.
- B. All personnel who will be applying roofing materials shall attend the training session including the project foremen and superintendent. Only personnel who have attended the training session shall apply roofing materials. Any roofing materials specified in this Section of the Specifications that are applied by personnel who did not attend the training session will be rejected.
- C. Provide the Owner at least 72 hours notice of the scheduled time for the training session. Representatives of the Owner may choose to attend the training session and the contractor shall provide the required accommodations.
- D. Furnish to the Owner a list of all personnel who attended the training session.
- E. Do not proceed with roofing work until the training session has been completed and the Owner has been provided with a list of the attendees.

1.16 WARRANTY

- A. Contractor warranty:
 - 1. Submit written agreement signed by the installer and the Contractor, guaranteeing to correct failures in product and workmanship for a five [5] year period from date of substantial completion, without reducing or otherwise limiting other rights to correction which the Owner may have under the contract documents. The roofing system shall be guaranteed watertight and weatherproof. Provisions of the warranty must cover defects in workmanship and materials. In addition, the Contractor shall agree to undertake any and all corrective action required by poor workmanship or defective materials that may be uncovered by periodic inspections by the Owner for five years from date of acceptance of the roofing system even if roof leaks are not discovered during the warranty period.
 - 2. Provisions of the warranty must cover the following:
 - i. Errors or defects in workmanship and in supplying roofing and flashing materials. The Contractor shall agree to undertake any

and all corrective action required by poor workmanship or defective materials that may be uncovered by periodic inspections by the Owner or the Owner's designated representative for five years from date of acceptance of the roofing system even if roof leaks are not discovered during the warranty period.

- ii. Deterioration of the roofing system, including associated flashing assemblies, from customary and ordinary effects of wear and weather including damage due to extreme fluctuations in temperature. The Contractor shall agree to replace any and all deteriorated materials that may be uncovered by periodic inspections by the Owner or the Owner's designated representative for five years from date of acceptance of the roofing system even if roof leaks are not discovered during the warranty period.
- iii. Blisters, bare spots, buckles, wrinkles and ridges, and splits (unless caused by structural failure), in the roof membrane. The Contractor shall agree to undertake any and all corrective action required to correct or eliminate blisters, bare spots, buckles, wrinkles and ridges, and splits (unless caused by structural failure), in the roof membrane that may be uncovered by periodic inspections by the Owner or the Owner's designated representative for five years from date of acceptance of the roofing system even if roof leaks are not discovered during the warranty period.
- iv. Breaks in flashing plies where the flashing ply is adhered to sheet metal. The Contractor shall agree to undertake any and all corrective action required to correct or eliminate breaks in flashing plies where the flashing ply is adhered to sheet metal that may be uncovered by periodic inspections by the Owner or the Owner's designated representative for five years from date of acceptance of the roofing system even if roof leaks are not discovered during the warranty period.
- v. Slippage of the roof membrane including flashing plies. The Contractor shall agree to undertake any and all corrective action required to correct or eliminate slippage of the roof membrane, including flashing plies, that may be uncovered by periodic inspections by the Owner or the Owner's designated representative for five years from date of acceptance of the roofing system even if roof leaks are not discovered during the warranty period.
- vi. Repairing damage to building interiors, contents of the building, and the roofing system due to water intrusion through the roof membrane and associated flashing assemblies.
- vii. In the event that water intrusion occurs or the Owner uncovers any defect as described herein within the time period stipulated herein, the Owner will promptly notify the contractor in writing. The Contractor agrees to promptly inspect the roof system with a

representative of the Owner, and to promptly make all necessary repairs at its own expense. All costs associated with the repair or replacement of the roof system and substrate shall be the joint responsibility of the Contractor and installer.

3. Contractor's and installer's maintenance inspection:
 - i. Two maintenance inspections are required as follows: On or about two years and four years after the date of Substantial Completion the Contractor and installer shall jointly inspect the roof with a representative of the Owner.
 - ii. The Contractor and/or installer shall correct any roofing system or flashing assembly deficiencies at no cost to the Owner. Roofing system or flashing assembly deficiencies include but are not limited to those noted in the NRCA "Repair Manual for Low-Slope Membrane Roof Systems". In addition, repair any blister exceeding six inches in any dimension and re-adhere all open seams.
- B. Roof membrane manufacturer's warranty: Provide manufacturer's non-prorated fifteen year unlimited penal sum guarantee with no deductible and no dollar limit. This warranty shall not exclude random areas of ponding from coverage.
- C. It is mutually understood that the following may be excluded from any warranties, but the exclusion shall apply only if the following are the sole cause of failure of the roof membrane assembly.
 1. Natural disasters including but not limited to floods, lightning, hurricane force winds, windstorms as defined in applicable FM literature (localized occurrences of wind speeds exceeding 74 mph), earthquakes, and tornadoes. This exclusion applies only if the contractor or membrane manufacturer providing the warranty can demonstrate that the natural disasters could not have been reasonably anticipated as part of local weather and climactic patterns in the geographic area in which the building or buildings are located.
 2. Structural failures such as cracks in decks, walls, and foundations.
 3. Storage of materials by the Owner on the roof after substantial completion.
 4. Erection of any additional construction assembly on or through the roof assembly after the date of substantial completion unless the erection of any additional construction assembly is in a manner prescribed by the contractor and the roof membrane manufacturer providing the warranties and the contractor and roof membrane manufacturer providing the warranties are provided written notification and the opportunity to review the scope of the proposed additional construction prior to execution of the construction work.
 5. Damage due to modifications to existing mechanical and electrical assemblies located on the roof after the date of substantial completion unless the modifications are executed in a manner prescribed by the

contractor and roof membrane manufacturer providing the warranties and the contractor and roof membrane manufacturer providing the warranties are provided written notification and the opportunity to review the scope of the proposed modifications prior to execution of the construction work.

6. Use of the roof, or any part thereof, for a purpose for which it was not intended.
7. Additions, alterations, or repairs to the roof membrane assembly (excepting emergency repairs to halt water intrusion) authorized by anyone except the contractor and/or the roof membrane manufacturer.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM

A. General:

1. This section of the specifications establishes minimum standards for the sheet roofing membrane system. This specification is based on a modified bitumen membrane system and warranties as noted herein shall be provided for the roof.
2. No asbestos containing materials shall be used in the execution of the work included in this Section of the Specifications.

B. Approved manufacturers: Firestone, Johns Manville, GAF or Carlisle.

1. The reference to manufacturer's materials on the drawings or in the specifications shall not be construed as allowing any work that does not comply with the requirements for the application of roofing materials as depicted on the drawings and specified in the specifications.
2. The roofing system shall include only materials of a single manufacturer.

C. Roofing membrane assembly: A roof membrane assembly consisting of a minimum of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, secured to a prepared substrate. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen interply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system. The modified bitumen finish ply or cap sheet shall be fully adhered to the modified bitumen interply.

D. Base Sheet: See PART 4 - TABLE OF APPROVED MATERIALS.

E. Modified bitumen interply: See PART 4 - TABLE OF APPROVED MATERIALS.

F. Modified bitumen finish ply (cap sheet): See PART 4 - TABLE OF APPROVED MATERIALS.

- G. Mopping asphalt: Certify asphalt for full compliance with the requirements for Type IV asphalt listed in Table I, ASTM D 312-84; See PART 4 - TABLE OF APPROVED MATERIALS.
- H. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D 41 -85 requirements; See PART 4 - TABLE OF APPROVED MATERIALS.
- I. Mastic: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting sheet metal flanges and conforming to ASTM D 4586-86 Type II; See PART 4 - TABLE OF APPROVED MATERIALS.

2.2 FLASHING SYSTEMS

- A. Stripping plies: Same as modified bitumen interply except use torch grade plies at base flashings that extend onto vertical surfaces.
- B. Finish flashing ply: See PART 4 - TABLE OF APPROVED MATERIALS except use torch-grade plies at base flashings that extend onto vertical surfaces.

2.3 RIGID INSULATION BOARD

- A. Provide rigid insulation boards that are approved in writing by the manufacturer of the rigid insulation board for use as part of a modified bitumen roofing system, and are approved by the roof membrane manufacturer for use with the specified roof materials. Provide rigid insulation board, including tapered systems, that comply with the following:
 - 1. Polyisocyanurate complying with product standard ASTM C 1289 Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board, Type II Class 1, Grade 2; minimum compressive strength shall be 20 psi.
 - 2. California State Insulation Quality Standards and Title 25 Foam Flammability Criteria.
 - 3. Applicable sections of the California Building Code with regard to foam insulation.
 - 4. UL labeled and listed in applicable UL publications as meeting the applicable flame spread and smoke development rating. Testing shall be in accordance with ASTM E 84.
 - i. Compliance with flame spread and smoke developed ratings is not required when the insulation has been tested as part of a roof construction assembly of the type specified for this project and the assembly is listed as fire-classified as specified herein in applicable UL publications.
- B. Maintain a maximum panel size of four feet by four feet.
- C. Tapered rigid insulation board:
 - 1. One layer shall be factory tapered to the slope shown on the drawings; not less than one 1/4 inch per foot (1:48).

2. Provide starter and filler blocks as required to provide the total thickness of rigid insulation board necessary to meet the required slope.
 3. Mitered joints shall be factory fabricated and shall consist of two diagonally cut rigid insulation boards or one rigid insulation board cut or shaped to provide the required slope.
- D. Cover board: DuraBoard manufactured by Johns Manville meeting ASTM C 728; minimum thickness 3/4 inch.

2.4 FASTENERS

- A. General:
1. Comply with the QUALITY ASSURANCE paragraph.
 2. Comply with applicable galvanizing standards; zinc coated per applicable ASTM.
 3. Form to allow the fastener head to be recessed into the plate after the fastener has been driven.
- B. Roofing nails of galvanized steel, 11 or 12 gauge: spiral, annular or barbed shank, one inch diameter round or square cap, length to suit substrate; long enough to penetrate through the plywood by at least 3/4-inch. At wood members the fasteners shall be long enough to penetrate the wood member a minimum of 1 1/2 inches.
- C. Staples: Galvanized steel; size and type as required by the specific fastening condition.
- D. For gypsum roof sheathing at steel decks: FM approved hardened, corrosion resistant screws. Comply with the requirements noted in the QUALITY ASSURANCE paragraph with regard to size and type.

2.5 MISCELLANEOUS

- A. Protection layer: Red rosin heavyweight building paper weighing not less than 4#/100 SF, or roof sheathing paper weighing not less than 6#/100 SF.
- B. Tapered edge strips: Provide perlite tapered edge strips at all parapet walls, curbs, expansion joints, as recommended by membrane manufacturer, and as shown on the drawings.
- C. Cants: Provide preformed 45 degree perlite cant strips at all parapet walls, curbs, expansion joints, as recommended by membrane manufacturer, and as shown on the drawings.
- D. Traffic Pads: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface; See PART 4 - TABLE OF APPROVED MATERIALS.
- E. Elastomeric flashing tape: As noted herein and on the drawings.

1. BRT801 black ridge sealing tape manufactured by Carlisle Coatings and Waterproofing. Color shall be black.
 2. Miscellaneous elastomeric flashings and tapes as noted on the drawings.
- F. Sealant:
1. Moisture-curing, non-slump elastomeric sealant designed for roofing applications.
 2. Chem-Calk 300: Use to seal sheet metal interfaces to any material that contains asphalt (roof plies).
- G. Large pipe and conduit supports: MIRO Industries Model 6-RAH SS unless otherwise specifically noted on the drawings.
- H. Small pipes and conduit supports: Portable Pipe Hangers PPH-SS-8R or PPH-SS-8C, MIRO Industries Model 3-R (for single pipes or conduits), or Thaler Metal Industries Mers 707 unless otherwise specifically noted on the drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that roof substrate has been properly fastened, and that site conditions are ready to receive roofing work. Contractor to confirm that site conditions and substrates are ready for roofing work to commence. If not, make suitable repairs or adjustments to the work.
- B. Verify that roof substrate is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains.
- C. Verify that roof substrate surfaces are dry.
- D. Verify that preservative treated wood nailers and wood blocking are in place and will permit the nailing of flashing assemblies at a minimum height of 8 inches above the finished roof surface unless otherwise noted on the drawings.
- E. Verify that all curbs for rooftop mounted mechanical equipment and skylights have been installed.
- F. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through the roof are solidly set, and cant strips are in place.
- G. Examine surfaces for conditions that will adversely affect execution, permanence, and quality of work.
- H. Do not commence application of the roofing system until all rough carpentry work, required to complete curbs for rooftop mounted mechanical equipment and skylights, and parapet walls, has been completed.
- I. Correct unsatisfactory conditions before proceeding with the Work.

3.2 INSPECTION OF SUBSTRATE

- A. Prior to starting installing roofing materials specified herein, the Contractor, the installer, the manufacturer's technical representative, and a representative of the Owner shall meet at the job-site and examine all surfaces over which roofing materials specified herein will be installed, and adjoining surfaces which will be affected by the roofing work. Correct all unacceptable surfaces and/or conditions prior to the start of the work specified herein.
- B. If unacceptable surfaces and/or conditions are identified, and after the Contractor has made the required corrections, the Contractor, the installer, the manufacturer's technical representative, and a representative of the Owner shall make another inspection. If during the reinspection unacceptable surfaces and/or conditions are identified proceed as noted herein. Manufacturer's technical representative to report in writing to the Owner any defects which may adversely affect the completion or performance of the specified work. Absence of such notification will be construed as acceptance of the work in place.
- C. In the event of a re-roof, care must be given to identify any ponding or run-off problems. Prior to the tear-off of the existing roof, Contractor to flood the roof and identify pre-existing ponding and other drainage conditions that are to be corrected. The flooding of the roof is to be done in the presence of the Owner, Architect (and construction or project manager), and documented by the Architect.

3.3 PROTECTION

- A. Install a protection layer over the existing substrate to prevent asphalt from entering the building interiors and as required to prevent asphalt seeping under the protection layer. The protection layer sheets shall be lapped, sealed with a tape or other material, and secured to the substrate as required to comply with the requirements noted herein. Seal joints in and at edges of the deck if there is a likelihood of asphalt drippage into the building or down exterior walls.
- B. Protect adjacent metal, glass, painted surfaces and other finish materials within wind-borne range of bitumen.
- C. Protect neighboring work, properties, vehicles, and persons from spills and wind-borne bitumen.
- D. Protect roof deck from rain and moisture when weather threatens. Provide adequate weather protection to ensure plywood substrate is protected from rain and water, and that the plywood substrate does not come in contact with water at any time. Failure to protect the substrate or roofing system from rain and moisture will result in the removal of all materials that have absorbed water or come in contact with water.
- E. Remove debris from the roof deck and the project site on a daily basis and dispose of in a legal manner.

3.4 BASE SHEET

- A. Install a base sheet under all rigid insulation board and modified bitumen roof ply assemblies, and at all areas as noted on the drawings.

- B. Fasten the base sheet to the substrate using mechanical fasteners unless specifically otherwise noted on the drawings, in accordance with the requirements noted in the QUALITY ASSURANCE paragraph and as further noted herein.
- C. Lay the base sheet over entire area to be roofed, lapping sides and ends four inches. Base sheet shall be allowed to relax for 1 hour prior to fastening to substrate. After base sheet has been fastened to the substrate, it shall be smooth, free of wrinkles, and suitable for application of the rigid insulation board or roof membrane.
- D. Only install an amount of base sheet sufficient to allow for application of rigid insulation board, if included in the project, and the roof membrane before the end of the day's work.
- E. The requirements described herein establish minimum standards for installation of the base sheet. If referenced standards or manufacturer's recommendations are more stringent, comply with the most stringent requirement.
- F. Do not allow any base sheet to be exposed to the exterior elements at the end of the day's work. Remove any base sheet that is exposed to the exterior elements overnight and replaced with new base sheet. Do not use the base sheet as a temporary roof.

3.5 GENERAL WORKMANSHIP

- A. Do not work in rain or temperatures below 40 degrees Fahrenheit.
- B. Do not allow any water, dew, or frost to be present while executing the work.
- C. Do not allow materials or incomplete roofing work to be exposed to any moisture, anywhere, at any time. Proceed with flashing work immediately as roofing is installed.
- D. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply the specified materials, and exercise care in ensuring that the finished appearance is agreeable to Owner.

3.6 INSTALLATION OF RIGID INSULATION BOARD

- A. Adhere rigid insulation boards using hot bitumen.
- B. Comply with the rigid insulation board and roof membrane manufacturers' guidelines and recommendations, and referenced guidelines and standards. In addition comply with the following:
 - 1. The maximum size of an individual board of rigid insulation board shall be four feet by four feet.
 - 2. Set rigid insulation board in hot Type III or Type IV asphalt. Apply the asphalt in accordance with the Equiviscous Temperature (EVT) concept and applied within the EVT temperature range ($EVT \pm 25^{\circ}F$). Asphalt application shall result in approximately 30 pounds of asphalt ($\pm 25\%$ on a

total job average basis) per roof square beneath each layer. Firmly embed each layer of rigid insulation board in a solid asphalt mopping as described herein. Mop only a sufficient area to provide complete embedment of one board at a time.

3. Apply rigid insulation board in a minimum of two layers with staggered joints. When using multiple layer of rigid insulation boards, joints of each succeeding layer shall parallel and vertically offset a minimum distance of 6 inches in both directions with respect to the layer below.
 4. Install rigid insulation board with sides and ends touching along their lengths. Stagger end joints between adjacent rigid insulation boards. Edges of abutting rigid insulation boards should be in moderate contact. Gaps shall not be greater than 1/4 inch.
 5. Cut and miter rigid insulation boards to fit and fill neatly all surfaces including ridges, irregular surfaces, perimeter blocking, mechanical equipment, and protrusions.
 6. Trim surfaces of rigid insulation board as necessary at roof drains such that the completed surface is flush and does not restrict the flow of water.
 7. Remove rigid insulation boards with broken corners or similar defects and replaced unless the defect can be trimmed and repaired to the satisfaction of the Owner.
 8. The maximum deviation between adjacent rigid insulation board panels shall be 1/16 inch.
- C. Cover installed rigid insulation boards with the cover board and roof membrane by the end of each day's work. Remove installed rigid insulation boards that are not covered with the cover board and roof membrane by the end of each day's work prior to the start of the following days work and shall be replaced with new rigid insulation boards.
1. Remove installed rigid insulation boards that are moist or wet and replace with new rigid insulation boards.
- D. Protection with Nightly Tie-Offs: Install membrane tie-off ply or plies at the end of each day's work as specified herein, adhered to the roof membrane, and adhered or sealed onto the top bearing surface of the substrate, to protect the exposed ends of rigid insulation boards that have been applied that day. Remove entirely the tie-offs before additional rigid insulation board is applied.
- E. All requirements for the installation of rigid insulation board apply to the installation of the cover board.

3.7 SUBSTRATE PREPARATION

- A. Comply with roof membrane manufacturer's published instructions for preparation of substrates to receive modified bituminous sheet roofing.
- B. Prior to priming, clean substrate of all dust, and debris. Remove other substances detrimental to roofing work.

- C. Remove surface irregularities that may damage roofing materials or cause application defects.
- D. Prime substrate if recommended by the roof membrane manufacturer's guidelines and recommendations, and referenced guidelines and standards.

3.8 APPLICATION - GENERAL

- A. General: Comply the requirements of the QUALITY ASSURANCE paragraph, with the manufacturer's written instructions, and as noted herein.
 - 1. Application of roofing plies shall immediately follow application of the rigid insulation board and/or cover board as a continuous operation.
 - 2. Apply all roofing plies using hot asphalt.
 - 3. Laps shall be as recommended by the manufacturer and as specified herein.
 - 4. Asphalt shall bleed out in a continuous line about ¼ inch wide beyond the edge of the sheet.
 - 5. Prime sheet metal flanges with a uniform coating of ASTM D 41 asphalt primer.
 - 6. Cutting or alterations of bitumen, primer, and sealants is not permitted.
 - 7. Install cant strips at the intersection with curbs, walls, and parapets. Cant strips shall be continuous, and set in a heavy mopping of hot asphalt as specified for the rigid insulation board.
- B. The following establishes minimum requirements:
 - 1. Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams in the interply layers should not coincide with the lap seams of the finish ply layer. Stagger courses a minimum of 12 inches to ensure this.
 - 2. Asphalt:
 - a) Kettles shall be equipped with accurate, fully readable thermometers. Asphalt shall not be heated to or above its flash point. Avoid heating at or above the FBT, should conditions make this impractical, heating must be no more than 20 degrees F below the EVT and no more than 20 degrees F above EVT.
 - b) Asphalt temperatures: If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 degrees F. Minimum application temperature shall be 410 degrees F. Continuously verify the application temperature of the asphalt at the point of application with a thermometer.
 - 3. Moppings:

- a) Ensure that all moppings do not exceed a maximum of thirty pounds/square. Mopping shall be total in coverage, leaving no breaks or voids.
- b) When mopping, the temperature of the asphalt at the point of fusing of the interply to the cover board, or fusing the interply to the finish ply shall not be lower than 410 degrees Fahrenheit to ensure a permanent bond. Asphalt temperatures that are lower than those noted herein shall be sufficient cause for rejecting the work.
- c) When rolling the membrane into a mopping of hot asphalt, the hot asphalt shall not extend more than four (4) feet in front of the membrane. As sheets are being rolled into the hot asphalt, immediately and thoroughly apply uniform positive pressure to ensure full adhesion, and eliminate entrapped air. Provide tight, smooth, and fully bonded laminations.

4. INTERPLY:

- a) Begin application at low point of roof.
- b) Apply all layers of roofing parallel to the slope of the deck.
- c) Fully bond the interply to the prepared substrate, having a minimum of three inch side and six inch end laps.
- d) Stagger end laps a minimum of three feet.
- e) Cut dog ear angles on underlying end laps at the finish edge and the overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application.
- f) Lay the interply loose on cants (not adhered).
- g) Check all lap seams after installation, and correct all defects.
- h) Before application of the finish ply, check all roof slopes to ensure positive slope to drainage outlets as described on the drawings. Build-up all areas where additional positive slope is required by mopping in place one or more additional layers of the interply as described herein.

5. FINISH PLY:

- a) Begin application at low point of roof.
- b) Apply all layers of roofing parallel to the slope of the deck.
- c) Fully bond the interply to the prepared substrate, having a minimum of three inch side and six inch end laps.
- d) Stagger end laps a minimum of three feet.

- e) Stagger side laps of the finish ply a minimum twelve inches from side laps in the underlying base ply.
- f) Cut dog ear angles on underlying end laps at the finish edge and the overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application.
- g) Broadcast mineral granules over all bitumen overruns on the finish ply surface to ensure a monolithic surface color.
- h) After installation check all lap seams, and correct all defects.

6. FINISH FLASHING PLY:

- a) Exert sufficient pressure on the finish flashing sheet to ensure the prevention of air pockets.
- b) Prime all end laps of the finish flashing sheet with a uniform coating of the specified asphalt primer and allow to thoroughly dry prior to overlapping of adjoining sheets.
- c) Heat fuse all side laps of the finish flashing sheet to ensure a complete seal.

7. Nail roofing membrane plies on vertical surfaces as noted on the drawings, as recommended by the roof membrane manufacturer, and in accordance with NRCA recommendations.

8. Walkway pads: Set in cold adhesive, or use an alternate method if recommended by the roof membrane manufacturer.

C. Schedule inspections and field tests, if required, for the roofing system with independent testing agencies, and cooperate with the testing agency personnel during field visits.

D. Prevent roofing materials from damaging or spilling on adjacent construction. Replace adjoining materials damaged by installation of the roofing system.

3.9 FLASHINGS

A. Comply with NRCA referenced standards, manufacturer's recommendations, additional requirements specified in this Section of the Specifications and in other Sections of the Specifications, and the flashing requirements as depicted on the drawings. Sheet metal flashings are specified in applicable Sections of the Specifications and as noted on the drawings.

B. Apply flashing plies from the low point of the roof to the high point so that all laps shed water. As the flashing ply is being applied, it must be pressed firmly against the substrate to maximize the adhesion. Particular attention must be taken while the flashing ply is being installed to prevent possible tenting that is a result of stress put on the membrane when the flashing ply is applied improperly.

C. Base flashing assembly: Provide two-ply base flashings at all locations as depicted on the drawings. The first ply shall be a torch grade interply extending a

minimum of four inches beyond the cant onto the field of the roof. The second ply shall be a torch grade finish flashing ply extending a minimum of six inches beyond the cant onto the field of the roof.

1. Prime surfaces to receive flashing plies as recommended by the roof membrane manufacturer.
2. Embed granules of the receiving sheet as recommended by the membrane manufacturer prior to forming laps at granulated surfaces.
3. Mechanically anchor base flashings a maximum of eight inches on center along the top edge at all vertical surfaces unless otherwise shown on the drawings. Apply a layer of flashing cement to extend one inch above the top edge of the base flashings to a line one inch below the nail heads.

D. Sheet metal flanges:

1. Support sheet metal flanges, unless otherwise shown on the drawings, using continuous preservative treated wood blocking or plywood securely fastened to the substrate. Do not extend sheet metal flanges over cover board.
2. Fabricate sheet metal assemblies embedded in the roofing system, unless otherwise shown on the drawings, such that at least a four inch flange is embedded in the roofing system.
3. Set flanges of sheet flashing assemblies in a bed of roofing cement or mastic.
4. Seal sheet metal laps in embedded sheet metal flanges with an asphalt compatible urethane or butyl sealant unless otherwise recommended by the membrane manufacturer.
5. Nail sheet metal flanges as shown on the drawings, except for sheet metal flanges fabricated from lead or as noted herein. Minimum nailing shall be two rows of ring shank nails securely embedded in the substrate; nailing shall be four inches on center in each row, and the nails in each row shall be offset two inches from the nails in the other row.
6. Strip-in sheet metal flanges with the application of the interply.

E. Wall flashing:

1. Flash walls and curbs using a stripping ply and the finish flashing ply. After the interply has been applied to the top of the cant, fully adhere the stripping ply using a torch, utilizing minimum three inch side laps and extend a minimum of four inches onto the base ply surface, or as shown on the drawings, and up the parapet wall above the cant as shown on the drawings; minimum extension up the parapet wall is eight inches above the field of the roof.

2. After the interply, stripping plies, and the finish ply have been applied, prepare the surface area that is to receive finish flashing ply by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the finish flashing ply into place using three foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the finish flashing ply from lap seams in the underlying ply. Extend the finish flashing ply a minimum of 6 inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the finished flashing ply during application to ensure complete contact with the wall/roof surfaces, preventing air pockets. Nail the top edge of the flashing on eight inch centers.
- F. Drain flashing: Install drain flashing as recommended by the manufacturer, NRCA, and as shown on the drawings. Set in thirty inch x thirty inch lead flashing sheet in bed of roofing cement on completed modified bituminous interply. Cover lead sheet with a modified bituminous stripping ply, with the stripping ply extending a minimum of four inches beyond the edge of the lead flashing onto the roof membrane.
- G. Field curing neoprene sheet flashing: Install field curing neoprene sheet flashing at locations as shown on the drawings. To attach the neoprene sheet to metal surfaces, clean and prime the metal surfaces with primer if recommended by the manufacturer of the field curing neoprene sheet flashing. Then apply a full coat of neoprene adhesive to the metal and the back of the neoprene sheet. Allow the adhesive to "tack" dry. Press the neoprene into place and roll it into firm contact with a metal roller. Caulk all exposed neoprene sheet edges as recommended by the manufacturer of the field curing neoprene sheet. Cleaner is to be used only for cleaning and not for thinning primer or adhesive.

3.10 SMALL PIPE AND CONDUIT SUPPORTS

- A. Support all pipe lines and conduits which run horizontally on the roof using the specified pipe and conduit supports, or the pipe and conduit supports shown on the drawings. Pipe and conduit supports shall be set on walktread pads. Cut each walktread pad to a size which extends a minimum of four inches beyond the perimeter of the pipe support. The spacing for the pipe supports shall be of adequate distance to prevent sagging of the pipe and to prevent the pipe support from coming into contact with the new roof system. Set the walktread dry over the new roof system. See the drawings.

3.11 WATER CUT-OFF

- A. Construct a water cut-off at all open edges at the end of the day's work or when precipitation is eminent. Construct the cut-off with the same membrane and asphalt as that used for the roofing system. Cut-off must be able to withstand extended periods of wet weather. The water cut-off shall be completely removed prior to resuming the installation of the roofing system.

3.12 JOB COMPLETION

- A. Inspect the completed roofing system and correct all defects to meet the requirements of this Section of the Specifications.
- B. Arrange for a representative of the membrane manufacturer to inspect the completed roofing system and notify the Contractor of any defects in the application.
- C. Restrict construction traffic and equipment movement on the completed roofing system to only essential personnel. Provide appropriate protection against traffic and construction activities on completed roofs.
- D. Cleaning and protection:
 - 1. Clean up all debris, excess materials, and equipment and remove from site.
 - 2. Clean any drips or spills of asphalt or primers. Asphalt runs, sags, and streaks shall be carefully removed from adjoining surfaces such as not to damage the adjacent surface.
 - 3. Any work or materials that were damaged in the execution of work included in this Section of the Specifications shall be restored to their original undamaged condition or replaced with new work or materials.

3.13 ROOF CONSTRUCTION MONITORING

- A. The Contractor shall undertake periodic inspections as required to ensure the work of this Section of the Specifications is executed as required and described herein. If recurring deficiencies are found, the Contractor shall implement measures the Contractor deems necessary to correct the deficiencies and to ensure that the work is executed in a manner as required and described herein.
- B. Intent of Contractor's periodic inspections:
 - 1. Confirm that roofing materials comply with specified requirements.
 - 2. Confirm that roofing materials are properly stored, handled, and protected from moisture or damage.
 - 3. Confirm that roofing materials are not installed during adverse weather conditions.
 - 4. Confirm that substrates are acceptable and comply with specified requirements.
 - 5. Confirm that wood nailers and blocking have been provided and installed as required.
 - 6. Confirm that the roofing system and required inspections comply with the specified requirements.
 - 7. Confirm that temporary protection requirements are in place at the end of each working day.

3.14 FIELD QUALITY CONTROL

- A. Notify the manufacturer by means of manufacturer's printed Notification of Completion form of job completion in order to schedule a final inspection date.
- B. Hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. Compile a punch list of items required for completion. Complete, sign, and mail the punch list form to the manufacturer's headquarters.
- C. If required by the roofing membrane manufacturer as part of the warranty, perform test cuts and evaluation procedures in accordance with ASTM D 3617 and Chapter V, "Quality Control," of The NRCA Low-Slope Roofing Manual.
 - 1. The following establishes criteria for voids in the interply in accordance with ASTM D 3617:
 - a) Overlapping voids between two or more plies are not acceptable.
 - b) The maximum acceptable length of any individual void is two inches.
 - c) The total length of all voids shall not be greater than four inches between any two plies.
 - d) Dry voids (the absence of bitumen/adhesive between plies) are not acceptable.
 - e) Moisture in voids is not acceptable.
 - 2. In addition to voids the following defects are not acceptable:
 - a) Wrinkles, ridges, and ripples of any length.
 - b) Sagging at vertical surfaces.
 - c) Granule loss; finish ply.
- D. If additional inspections are required by the roofing membrane manufacturer to comply with the requirements of the WARRANTY specified in this Section of the Specifications, perform all required inspections at no additional cost to the Owner.

3.15 PROTECTION AND CLEANING

- A. Protect the roofing system from damage and wear during the duration of the construction.
- B. Repair or replace (as required) roofing work damaged during the execution of the construction work.
- C. Clean overspray or spillage from adjacent construction using cleaning agents and procedures recommended by the roof membrane manufacturer, or replace damaged roofing materials.

3.16 FINAL INSPECTION

- A. At the end of the construction period, the Contractor shall make a final inspection of the new roofing system and prepare a written report to the Owner describing the nature and extent of damage found in the work, if any. Repair or replace defective roofing work found at the time of final inspection.

END OF SECTION

At completion of work under this Section, provide filled-in information card to the Owner in a format similar to that depicted below.

INFORMATION CARD

MODIFIED BITUMEN ROOFING SYSTEM COMPONENTS

BUILDING NUMBER:

ROOF NUMBER:

SUBSTRATE

Deck Type:

Deck Slope:

Sheathing Paper: [] Yes [] No

INSULATION

Insulation Manufacturer:

Insulation Thickness:

Insulation Type:

Insulation R-Value:

SHEET MATERIALS TYPE AND MANUFACTURER:

Base Sheet:

Interply Sheet:

Cap Sheet:

Flashing Sheet:

Bituminous Materials Manufacturer:

Primer:

Flashing Cement:

Statement of Compliance or Exceptions [attach]: [] Yes [] No

Date of Substantial Completion:

Guaranty Period:

Roofing Subcontractor: Attach name, address, and phone number

Signature _____

General Contractor: Attach name, address, and phone number

Signature _____

Roofing Manufacturer: Attach name, address, and phone number

Signature _____

SECTION 07 56 00
FLUID-APPLIED

ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide labor, materials, equipment and supervision necessary to install spray-applied elastomeric acrylic coating system as outlined in this Section to recoat existing sprayed acrylic coating metal roofing.
- B. The manufacturer's application instructions for each product used are to be considered part of these specifications and should be followed at all times.
- C. Refer to Section 01 21 00, Allowances, for additional provisions.

1.2 SUBMITTALS

- A. Submit product data sheets and literature verifying fire ratings and physical properties of materials.
- B. Submit material safety data sheets.

1.3 QUALITY ASSURANCE

- A. Supplier Qualifications: The ACRYSHIELD® Roof Management System for recoating existing coated roofs, as supplied by National Coatings Corporation, is approved for use on the project.
- B. Applicator Qualifications: The applicator shall be approved by National Coatings Corporation to apply the system. Manufacturer's written verification of applicator approval is required.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Containers and Packaging: Deliver materials in original sealed containers, clearly marked with: manufacturer's logo; full product name; and lot number(s).
- B. Storage: Store materials between 40°F and 100°F with careful handling to prevent damage to products. If conditions exceed these ranges, special consideration in storage must be taken. Do not store at high temperatures in direct sunlight.
- C. Protection: Protect all materials from freezing and other damage during transit, handling, storage, and installation.

1.5 PROJECT CONDITIONS

- A. These recommendations are for maintenance of an existing coating system and not intended for correction of badly deteriorated roofing systems that may need replacement.

- B. These minimum recommendations for material usage are for ideal conditions. The number of gallons per 100 square feet may need to increase due to uneven application, rough surface texture, wind conditions while spraying and/or other variables.
- C. Wet insulation must be thoroughly evaluated and then addressed with removal or other measures. Consult a National Coatings Technical Consultant regarding the need for moisture surveys and other assessments.
- D. Structural cracks should be referred to the appropriate National Coatings Technical Consultant.
- E. This installation guide specification assumes that the deck, if plywood, has no dry rot, and is in sound condition, or has been repaired.
- F. Do not apply materials unless surface to receive acrylic roofing system is clean, dry and prepared as specified.
- G. Install all material in strict accordance with all published safety, weather, or applicable regulations of the manufacturer and/or local, state, and/or federal agencies which have jurisdiction.
- H. The entire system shall be fully adhered to the surface on which it is applied. Voids left under the system by creating bridges are not acceptable.
- I. Do not proceed with application of coating or sealing materials when temperature is less than 50°F. No coating system shall be applied if weather will not permit it to dry prior to exposure to precipitation or freezing.
- J. Heavy puddles of coating on the roof are not acceptable.
- K. Instructions for use of all roofing materials and application equipment should be read and followed at all times.
- L. As a general principle, to prevent the ponding of water, install additional drains as necessary or install drainage systems with sprayed polyurethane foam (SPF).

1.6 DETAIL WORK

- A. This specification does not extensively outline procedures for preparation and finishing of drains, vents, ducts, flashings, parapet walls, sheet metal work, etc. This scope shall be coordinated by the contractor before work commences, and shall be completed with manufacturer's written instructions.

1.7 WARRANTY

- A. Furnish manufacturer's standard 10-year written warranty, extendable for an additional 10-year period subject to a 15-mil top coat at that time.

PART 2 - PRODUCTS

2.1 SPRAY APPLIED ELASTOMERIC ACRYLIC COATING SYSTEM

- A. Manufacturers: National Coatings; GAF United Coatings; Metalcrylics.
- B. Basis-of-design roof coating: acrylic, elastomeric, spray-applied ACRYSHIELD Roof Management System manufactured by National Coatings Corporation.
 - 1. Primer over rust: National Coatings RustShield A120 Low VOC, water-based, rust-inhibitive.
 - 2. Base/top coats: AcryShield A550 performance, elastomeric roof coating.
- C. Physical Properties of Cured Roofing System: The testing of the coating shall be done under ASTM-D6083, "Standard Specification for Liquid Applied Acrylic Coating Used in Roofing", unless otherwise specified.
 - 1. The roofing system shall have good resistance to ponding water.
 - 2. The roofing system shall contain no plasticizers.
 - 3. The roofing system shall contain no migrating fire retardants.
 - 4. The roofing system shall have a Class A fire rating on a noncombustible deck when tested according to the procedures outlined in ASTM E-108.
 - 5. The top coat shall also meet the following physical property requirements:

Property	ASTM Method	Results
Tensile Strength, psi (Max @ 73°F)	D6083	Min. 200, typ. 360
% Elongation @ Break (73°F)	D6083	Min. 100, typ. 570
Permeance, perms	D6083	Max. 50, typ. 9
Volume Solids % Weight Solids %	D6083	> 50, typ. 54 > 60, typ. 64

2.2 RELATED MATERIALS

- A. Flashing, adhesives, thinners, elastomeric caulking compounds, primers, and similar materials shall be approved by the manufacturer of the coatings. All materials used shall be applied in accordance with its manufacturer's recommendations.

2.3 EQUIPMENT

- A. For recommended spray equipment guidelines, please refer to National Coatings Technical Paper "TP-102 Guide for Selecting Coating Spray Equipment", or consult the spray equipment manufacturer directly.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins and product guide specification instructions.

3.2 EXAMINATION

- A. Inspect surfaces which will receive the ACRYSHIELD Roof Management System to make sure they are clean, smooth, sound, properly prepared, and free of moisture, dirt, debris, or other contamination.
- B. Verify that all roof penetrations, mechanical equipment, cants, edge metal, and other on-roof items are in place and secure.
- C. Verify that all critical areas around the immediate vicinity of the spray area are suitably protected.
- D. Verify all roof drains are clean and in working order.
- E. Verify that all air conditioning and air intake vents are suitably protected or closed.

3.3 PREPARATION

- A. All surfaces to be coated must be clean, sound, dry and free of any rust, dirt, grease, oil, debris or other contaminants which would interfere with proper adhesion. Pay particular attention to the low areas on the roof, where more contaminants may have settled. Loose coating should be removed prior to application of coating. Any wet areas must be removed and/or dried out prior to application of coating.
- B. At rusty areas, remove any loose and flaky rust, then wire-brush to a bright finish. Apply RustShield A120 over all rusty areas.
- C. Caulk or fill all cracks, holes or other surface imperfections with a high quality elastomeric caulk or sealant designed for roofing applications, such as ACRYFLEX. All caulk or sealant must be thoroughly dry before application of coating. NOTE: Silicone sealants are not compatible with acrylic coatings.

3.4 APPLICATION

- A. After thorough preparation as necessary, the entire roof, including all conduits, supports and sheet metal, shall receive the ACRYSHIELD Roof Management System consisting of 3 gallons per 100 square feet of ACRYSHIELD, applied evenly in two separate coats.
- B. The first coat of ACRYSHIELD should be evenly applied at the rate of 1.5 gallons per 100 square feet by spray or roller. A darker first coat shall be used, to provide contrast and assist in achieving consistent coverage.

- C. Allow the first coat to dry thoroughly, approximately 4 to 12 hours, prior to the application of the second coat.
- D. The second coat of ACRYSHIELD should be evenly applied at the rate of 1.5 gallons per 100 square feet by spray or roller.
- E. Heavy puddles of coating should not be left on the roof. All coating should be distributed evenly at the specified rates of coverage.
- F. The total AcryShield system shall have a minimum dry film thickness at any location of 24 dry mils.
- G. **CLEAN-UP:** ACRYSHIELD is water-based for ease of application and clean-up. Cleaning of hands and tools should be done immediately following application, using warm or hot soapy water.

3.5 FIELD QUALITY REQUIREMENTS

- A. In case of manufacturer's labor and material warranty - Manufacturer's Field Services: Inspection by National Coatings Corporation's representative shall be made to verify the proper installation of the system. Any areas that do not meet the minimum standards for application as specified herein shall be corrected at the contractor's expense. Manufacturer's inspection or verification shall not constitute acceptance of responsibility for any improper application of material.

3.6 CLEANING

- A. Surfaces not intended to receive foam insulation and/or elastomeric coating materials shall be protected during the application of the system. Should this protection not be effective, or not be provided, the respective surfaces shall be restored to their proper conditions by cleaning, repairing or replacing. All debris from completion of work shall be completely removed from the project site.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pre-coated coping, parapet and cap flashings.
- B. Fascias, gutters, valleys, and scuppers.
- C. Counterflashings 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 and skylights.
- G. Flexible sheet flashing.
- H. Manufactured reglets.
- I. Sill pans (sheet metal sub-pans) for windows and storefront units.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- 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 B32 - Solder Metal.
- E. ASTM B101 - Standard Specifications for Lead-Coated Copper Sheet and Strip for Building Construction.

- F. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- G. ASTM D549 - Rosin in Paper and Paperboard.
- 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,] [pre-formed metal 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.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit Shop Drawings of sheet metal items indicating profiles, jointing, terminations, sill pans 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 and flashing accessories.
- E. Submit two 4-inch square Samples illustrating metal finish color for pre-coated steel.

1.6 STORAGE AND HANDLING

- A. Store products under provisions of Division 1.
- 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 manufacturer's 20-year warranty against defective materials and finish.

- B. Provide installer's 2-year warranty coverage for water tightness and integrity of seals.

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; 0.0299 inch thick core steel, factory pre-coated with 'Kynar 500" or "Hylar 5000" coating of roofing specified in Section 07 61 00, color to be selected by Architect.

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 pounds per 100 square feet or more than 15 pounds per 100 square feet 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 shall match pre-coated metal.
- C. Underlayment: ASTM D266; No. 30 asphalt-saturated roofing felt.
- D. Metal Primer: As specified in Section 09 91 00.
- E. Protective Backing Paint: Zinc chromate alkyd.
- F. Slip Sheet: ASTM D549, 0.05 psf, rosin-sized building paper.
- G. Sealant: As specified in Section 07 92 00.
- H. Bedding Compound: Rubber-asphalt type.
- I. Plastic Cement: ASTM D4586, Type I.
- J. Metal Flashing System: Two piece pre-coated galvanized steel similar to Springlok Flashing System, manufactured by Fry Reglet, type as indicated. Include fabricated end closures and mitered corners.
- K. Solder for Lead-Coated Copper: ASTM B32, Grade SN 60 percent tin, 40 percent lead.
- L. Solder for Zinc: ASTM B32; 50/50 tin/lead type, with rosin flux.
- M. Self-Adhesive Flexible Sheet Flashing: 40-mil-thick composite of polyethylene film and self-adhesive rubberized asphalt with embossed slip-resistant surface; "Ice and Water Shield" by W.R. Grace or approved equal.

- N. Manufactured Reglets: Two piece pre-coated galvanized steel, spring-action type similar to "Springlock Flashing System" or approved equal, manufactured by Fry Reglet, type as indicated. Include fabricated end closures and mitered corners. Finish: Manufacturer's gray epoxy primer; exposed portions shall be field finish painted as specified in Section 09 91 00.
- O. Fabricated Galvanized Sill Pans. Shop fabricate sill pans from 24 ga, fully soldered and watertight as per the drawings. Protect underside of pans sitting atop concrete surfaces with continuous layer of self-adhered flashing.

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 4 inches over bituminous base flashings or roofing surface. Return and brake edges.
- K. Fabricate vent pipe and roof penetration flashings of non lead-bearing material with clamping ring and storm collar.

2.4 FINISH

- A. Shop prepare and prime exposed ferrous metal surfaces.
- B. Back-paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.
- C. Site paint exposed to view metal surfaces under provisions of Section 09 91 00.

- D. "Kynar 500" or "Hylar 5000" factory 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. Finish shall be warranted for a minimum of 20 years against all defects.

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. Contractor to confirm that site conditions and substrates are ready for sheet metal work to commence. If not, make suitable repairs or adjustments to the work. 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 on center maximum with no joints within 2 feet of corners. Attach members with clips to permit movement without damage, or provide slotted or oversize holes with washers.
- 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. Make lock seam Work flat and true to line, and sweat full of solder, except where installed to permit expansion and contraction.

- Lap flat lock seams, and lap seams where soldered according to pitch, but in no case less than 3 inches. Make seams in direction of flow.
- 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. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
 - K. Seal metal joints watertight and weathertight throughout.

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.

3.5 CLEANING AND ADJUSTMENT

- A. Leave Work clean and free of stains, scrap and debris.
- B. Repair and replace damaged Work.

END OF SECTION

SECTION 07 71 23 GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel gutters and downspouts.
- B. Steel pipe downspouts.
- C. Repair of existing gutters.
- D. Precast concrete splash blocks and sheet metal splash pans.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- A. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
- 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 A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- E. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submit 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.

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 Division 1.
- 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 manufacturer's 20-year warranty against defective materials and finish.
- B. Provide installer's 2-year warranty coverage for water tightness and integrity of seals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel: ASTM A653, Grade 33, G90 zinc-coating in accordance with ASTM A924; thickness as specified.
- B. Steel Pipe: ASTM A53, Grade B, Schedule 40 steel pipe, standard weight, Type S, one piece without joints, galvanized according to ASTM A53; 1.8 ounces per square foot.

2.2 COMPONENTS

- A. Fascia Gutters: 16 gauge or as indicated. Formed to profiles indicated. Include downspout outlet and integral straps as part of the assembly.
- B. Ogee Gutters: 22 gauge or as indicated, die-formed to profiles indicated.
- C. Steel Pipe Downspouts: Fabricate from Schedule 40 steel pipe, and other steel stock as indicated, all full penetration welded into one assembly, then hot-dip galvanized.
(Use these within 8 feet of finished grade only.)

- D. Sheet Metal Downspouts: 22 gauge continuous lock-seamed tube, round or rectangular as indicated, size to suit. Strainers: Basket-type constructed of 12 gauge stainless steel wire, size to fit correctly into the leader, provide stainless steel strap tie-downs to clamp to the downspout outlet as indicated.
- E. Splash Blocks: Pre-cast concrete type, of sizes and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- F. Splash Pans: Fabricated from same metal as gutters. Tack down to roofing surface with asphalt cement.

2.3 ACCESSORIES

- A. Anchorage Devices: Meet SMACNA requirements.
- B. End Caps, Downspout Outlets, Rain Diverters, Straps, Support Brackets, Joint Fasteners. Profiled to suit gutters and downspouts.
- C. Protective Backing Paint: Zinc chromate alkyd at all concealed surfaces.
- D. Gutter Expansion Joints: Provide at every 50' of length or as recommended by SMACNA. Submit sketches of detail.

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 SHOP FINISHING

- A. Shop prepare and prime exposed ferrous metal surfaces.
- B. Back-paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils.
- C. Site paint exposed to view metal surfaces as specified in Section 09 91 00.

2.6 EXISTING GUTTERS

- A. Perform the following work on existing gutters to remain: cleaning, rustproofing and coating for gutter interiors, unless otherwise noted to replace existing with new.
- B. If existing gutter is rusted through or badly damaged, replace with new.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive Work. Contractor to correct deficiencies in the surfaces at own expense.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Provide concealed solid blocking at all steel pipe downspout brackets.
- B. Coordinate layout of downspouts with site conditions and features on the building not shown in the building elevations.
- C. Install gutters, downspouts, and accessories in accordance with SMACNA requirements.
- D. Coordinate installation of sheet metal gutters with steel pipe downspouts.
- E. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- F. Seal metal joints watertight.
- G. Set splash blocks under downspouts. Tack down all metal rooftop splash pans to roof surface with asphalt cement.
- H. Coordinate downspouts connecting to the storm drain system with other Work.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

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.
- F. Openings between exterior curtainwall and edge of floor slabs.
- G. Opening between top tracks of walls and connecting floor or roof assemblies.
- H. Openings at each floor level in shafts and stairwells.

1.2 REFERENCES

- A. ASTM E814 – Standard Test Method for Fire Tests of Through Penetration Firestop Systems
- B. ASTM E1399 – Standard Test Method of Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
- C. ASTM E1966 – Standard Test Method for Fire-Resistive Joint Systems
- D. ASTM E2307 – Standard test method of perimeter fire barriers.
- E. ASTM C920 - Elastomeric Joint Sealants.
- F. ASTM C1193 - Use of Joint Sealants.
- G. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E119 - Method for Fire Tests of Building Construction and Materials.

- I. UL - Fire Hazard Classifications.
- J. UL 1479 - Fire Tests of Through-Penetration Firestops.
- K. 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. Submit manufacturer's Shop Drawings for each type of firestop or smoke seal required by the Project. Shop Drawings shall indicate the detailing of all necessary anchorages, reinforcements and fastenings required.
- C. Product Data: Provide product characteristics, performance and limitation criteria.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Certification: Submit firestopping manufacturer's certification 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 shall correspond to through-penetration firestop system designations listed in the UL Fire Resistance Directory.
- B. Firestopping and smoke seal Work shall be performed by an installer trained or approved by the firestop or smoke seal manufacturer. Equipment used shall be in accordance with firestop or smoke seal manufacturer's written installation instructions.

1.7 REGULATORY REQUIREMENTS

- A. Conform to 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 with related trades.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed in accordance with manufacturer's instructions and regulatory requirements.

- C. Do not cover up installations that will become concealed behind other construction until Owner's Representative 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.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials in original unopened packages fully identified with manufacturer's name, trade name and UL label.
 - 1. Leave seals unbroken and labels intact until time of use.
 - 2. Remove from job site any rejected or damaged packages found unsuitable for use.
- B. Store materials in a dry place, off of the ground or floor, and away from other material subject to sweating or attraction of moisture or dampness.
- C. Provide ventilation in areas to receive solvent cured materials.

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. Hilti Construction Chemicals Inc., (909) 864-2294.
- B. Minnesota Mining and Mfg. Co., (213) 726-6321.
- C. Tremco, (800) 551-7085.
- D. United States Gypsum Co., (800) 964-4874.
- E. Bio Fireshield, Inc.
- F. Dow-Corning Corp.

- G. International Protective Coatings (IPC.)
- H. Substitutions: Under provisions of Section 01 62 00.

2.3 FILL MATERIALS

- A. General: Firestopping and smoke seal materials shall be asbestos free.
 - 1. The F rating must be a minimum of 1 hour, but not less than the fire resistance rating of the assembly being penetrated, when tested per ASTM E84.
 - 2. Materials being applied in openings between elements of differing fire ratings shall conform to the most restrictive rating.
 - 3. Fire tests shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.
 - 4. Material shall be noncombustible, with flame spread of 25 or less, and smoke development of 50 or less, when tested in accordance with ASTM E84.
- B. Firestop or Smoke Seal Mortar: Single-component Portland cement fly ash mortar, requiring no special supports or anchoring devices to pass water hose stream tests.
- C. Intumescent:
 - 1. Wrap: Single-component, elastomeric sheet with aluminum foil on one side.
 - 2. Calk: Water-based latex calk per UL1479.
- D. 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.
- E. Silicone Foam: Two-component, silicone based liquid elastomer that, when mixed, expands and cures in place to produce a flexible nonshrinking foam.
- F. Firestop or Smoke Seal Sleeve: Prefabricated device used around plastic pipes in fire-rated floors and walls. The sleeve shall be made of a steel collar lined with an intumescent material.
- G. Fiber Stuffing: Mineral fiber stuffing with a minimum density of 3.5 lbs/cu ft.
- H. Mineral fiber board, mineral fiber matting, and mineral fiber putty-forming and damming materials shall be used to contain the fluid material mixture prior to and during filling of penetrations and voids.

1. Fire tested and functionally approved forming materials may be left in place to become an integral part of the formed penetration seal.
 2. Combustible forming and damming materials may be used for containment during installation of materials only, and must be removed from the final completed penetration seal system.
- I. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are suitable for installation of products.
- B. Verify openings are ready to receive the Work of this Section.
- C. Notify the Contractor in writing, with copy to Architect, of conditions detrimental to the timely completion of the Work.
- D. Do not proceed with Work until all unsatisfactory conditions have been corrected.

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.
- G. Install firestops or smoke seals with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.
- H. Install fire-resistant filler in openings where indicated.
 - 1. Dam bottom of vertical openings and one side of horizontal openings with temporary containment forms or, where required to achieve fire-resistance ratings, provide permanent mineral composition board forms.
 - 2. On horizontal penetrations, provide partial face containment forms where required for material displacement.
 - 3. Allow installed fillers to cure, and remove temporary forms; trim ragged edges with sharp knife; inspect and fill voids with additional filler to form uniform thickness of filler.

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.
- E. Spillage: Do not allow sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- F. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

- G. Tool or trowel exposed surfaces. Remove excess firestop or smoke seal material promptly as Work progresses and upon completion.
- H. Apply firestop or smoke seal material at penetrations of insulated piping after the insulation is installed.
 - 1. The material used shall have been tested for compatibility and rating in conjunction with the use of the insulation material being used.
 - 2. Calcium silicate, or other pipe insulation, may be substituted for fiberglass pipe insulation through the sleeve, if the insulation is part of an assembly which meets the requirements specified for firestopping or smoke sealing.
- I. Firestopping or smoke sealing materials for filling voids in floors having openings of 4 inches or greater, shall be installed to support the same load as the floor system, unless the area is protected by a permanent barrier preventing loading or traffic on the firestopped or smoke sealed area.

3.5 FIELD QUALITY CONTROL

- A. Do not cover up installations that will become concealed behind other construction until Owner's Representative 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 70 00.
- B. Clean adjacent surfaces of firestopping materials.

3.7 CURING AND PROTECTION OF FINISHED WORK

- A. Cure firestopping and smoke seal materials in compliance with manufacturer's instructions and recommendations.
- B. Installer shall advise Contractor of procedures required for protection of firestopping and smoke seals during remaining construction period.
- C. Protect finished Work under provisions of Section 01 87 00.
- D. Protect adjacent surfaces from damage by material installation.

3.8 SCHEDULE

Location	UL No.	F-Rating
Stud wall, metallic pipe, and conduit.	[]	[] hour
Stud wall, non-metallic pipe, and conduit.	[]	[] hour
Concrete and masonry wall, metallic pipe, and conduit.	[]	[] hour
Concrete and masonry wall, non-metallic pipe, and conduit.	[]	[] hour
Floors, metallic pipe, and conduit.	[]	[] hour
Floors, non-metallic pipe, and conduit.	[]	[] hour
Floor/ceiling assembly, metallic pipe, and conduit.	[]	[] hour
Floor/ceiling assembly, non-metallic pipe, and conduit.	[]	[] hour

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

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 toilet 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 toilet 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 D217 - Cone Penetration of Lubricating Grease.
- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, solvent Release Type.

- H. SWRI - (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit Product Data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.
- C. Submit two 4-inch long Samples 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 WARRANTY

- A. Provide sealant manufacturer's 5-year warranty against defects in materials.
- 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers and products are listed for each sealant type.

- B. Substitutions: Under provisions of Section 01 62 00.

2.2 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. Bostik Construction Products Division, "Chem-Calk 600".
 3. Pecora Corporation, "AC-20".
- 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 "Bitul Sealant".
 2. Bostik Construction Products Division, "Chem-Calk 300".
 3. Pecora Corporation, "BC-158".
- C. Type C - Silicone Sealant: One-part nonacid-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
1. Dow Corning Corp., "Dow Corning 790".
 2. General Electric Co., "Silpruf".
 3. Tremco, Inc., "Spectrum 1".
 4. Pecora Corp., "864" or "890".
- D. Type D - Neutral-Curing Silicone Sealant: One part medium modulus neutral-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
1. Dow Corning Corp., "Dow Corning 795".
 2. General Electric Co., "Ultraglaze 4000".
 3. Tremco, Inc., "Spectrum 3".
 4. Pecora Corp., "895".
- E. Type E - One-Part Mildew-Resistant Silicone Sealant: Complying with ASTM C920, Type S, Grade NS, Class 25.
1. Dow Corning Corp., "Dow Corning 786".
 2. General Electric Co., "Sanitary 1700".

3. Rhone-Poulenc Inc., "Rhodorsil 6 B White".
 4. Tremco, Inc., "Proglaze White".
 5. Pecora Corp., "863" or "898" White.
- F. Type F - Multi-Part Pourable Sealant: Complying with ASTM C920, Type M, Grade P, Class 25. Shore A hardness +40.
1. Tremco, Inc., "HPL".
 2. Mameco International, Inc., "Vulkem 255".
 3. Pecora Corp., "Dynatred" or "Urexpan NR-200".
 4. Sika Corporation, "Sikaflex 2C NS/SL".
 5. W.R. Meadows, "Pourthane".
- G. Type G - Acoustical Sealant: Nondrying, nonhardening permanently flexible conforming to ASTM D217.
1. Pecora Corp., "BA-98 Acoustical Sealant".
 2. Tremco, Inc., "Tremco Acoustical Sealant".
 3. United States Gypsum Co., "Sheetrock Acoustical Sealant".
- H. Sound and Fire Protective Rated Moldable Putty Pads as wall opening protective materials when code required in fire-rated walls.
1. Tremco, Inc., TREMstop "MP Putty Pads".
 2. 3M Inc., "3M Fire Barrier Moldable Putty Pads MPP+."
 3. Hilti Co., "CFS-P PA Fire Putty Pad".

2.3 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.

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 70 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.

3.6 SCHEDULE

Type	Location	Color
Type A - Acrylic Latex Cure	All interior joints not otherwise scheduled	To match adjacent surfaces
Type B - Butyl	Under thresholds	Black
Type C - One-Part Nonacid Curing Silicone	Exterior door, entrance & window frames. [Exterior & Interior vertical joints in concrete & masonry] [metal flashing]	[Black] {Bronze} [Aluminum] [Stone] [Grey] [] [to match adjacent material]
Type D - Neutral-Curing Silicone	Joints within [glazed curtain wall system] [skylight framing system] [aluminum entrance system] glass and glazing	[Translucent] [White] [Black] [Aluminum] [Bronze]
Type E - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures	[White] [Translucent] [Almond]
Type F - Multi-part Pourable Urethane	Exterior & interior joints in horizontal surfaces of concrete; between metal & concrete masonry and mortar	[Black] [Limestone] [Stone] [To match adjacent material]
Type G - Acoustical Sealant	In sound rated walls between stud track/runner and adjacent construction. Between outlet boxes and gypsum board.	[White] [Transluscent]
Type H - Sound and Fire Protective Rated Moldable Putty Pads	At fire-rated wall openings when code required, such as electric boxes. In sound rated walls at electric boxes.	Red

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Steelcraft (S).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 38 percent.
- D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying

with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.

1. Design: Flush panel.
 2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.
 - a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.374 and R-Value 2.53, including insulated door, Mercury thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.378 and R-Value 2.5, including insulated door, kerf type frame, and threshold.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Steel-Stiffened - 747 Series.
2. Curries Company (CU) - Energy Efficient - 797 Mercury Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) – M Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.

- 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

SECTION 08 14 16 FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wood doors, fire-rated and non-rated.
- B. Metal vision frames.
- C. Door louvers.

1.2 RELATED SECTIONS

- A. Section 08 11 13, Hollow Metal Frames.

1.3 REFERENCES

- A. WDMA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).
- B. NFPA 80 - Fire Doors and Windows.
- C. CBC - California Building Code.
- D. UL 10C - Fire Tests of Door Assemblies.
- E. WI - Woodwork Institute: Manual of Millwork.

1.4 QUALITY ASSURANCE

- A. Conform to requirements of WI Manual of Millwork, Section 12 and 13, Premium Grade except where otherwise indicated.
- B. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.
- C. After completion issue a WI Certified Compliance Certificate for Installation.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC for fire-rated doors.
- B. Fire Door Construction: Conform to UL 10C.
- C. Installed Doors: Conform to NFPA 80 for fire-rated class indicated on Drawings.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings shall bear the WI Certified Compliance Label on the first page of each set. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.
- C. Submit two Samples 12 inches x 12 inches in size illustrating each species and finish specified.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of Section 01 87 00.
- B. Package, deliver, and store doors in accordance with WI requirements as set forth in Technical Bulletin 419-R.

1.8 WARRANTY

- A. Provide manufacturer's standard lifetime warranty under provisions of Section 01 70 00 for solid core doors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, FLUSH FACED DOORS

- A. Eggers Industries, Inc.
- B. Marshfield Door Systems, Inc.
- C. Algoma Hardwoods, Inc.
- D. Metal Vision Frames: Anemostat or equal.
- E. Substitutions: Under provisions of Section 01 25 00.

2.2 DOOR CONSTRUCTION

- A. Solid Non-rated Core: Solid wood block, framed block glued, or solid particleboard.
- B. Solid, Special Function Core: Labeled fire performance type.
- C. Construction: 5-ply, with face veneer applied vertically over wood veneer cross banding.
- D. Flush Interior Door Veneer: Birch for paint grade and [] species to match adjacent wood or simulated wood finishes; plain sliced with book matched grain, for transparent clear or stain finish to match existing adjacent doors. Satin sheen. Color as selected by Architect to match other doors on site.

2.3 METAL VISION FRAMES

- A. 20 Ga. Cold rolled steel

2.4 ADHESIVES

- A. Exterior and Interior Doors: WI Type I.

2.5 FABRICATION

- A. Fabricate non-rated wood doors to requirements of WI Manual of Millwork, Section 12 and 13, in the WI Grade specified.
- B. Fabricate fire rated doors per 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, mid-height push bar, and at top of door for closer.
- E. For fire-rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with WI Manual of Millwork Sections 12 and 13 and WI Technical Bulletin 420-R.
- B. Conform to WI requirements for fit tolerances.
- C. Coordinate installation of glass and glazing.
- D. Install door louvers.
- E. Adjust doors for smooth and balanced movements.
- F. Install fire doors in accordance with NFPA 80.

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 | 3/8 inch |
| 4. | At door bottom and surface of nominal floor covering per NFPA 80 and at doors requiring an undercut as indicated on Drawings. | 5/8 inch |

END OF SECTION

SECTION 08 31 00 ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire-resistive rated and non-rated access doors and frames.

1.2 QUALITY ASSURANCE

- A. Manufacture fire-rated access doors and frames to conform to UL requirements.
- B. Provide labels indicating fire rating.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data and Shop Drawings: Include sizes, types, finishes, scheduled locations, and details of adjoining Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Milcor Commercial Products Group, (800)624-8642.
- B. Nystrom Incorporated, (800) 317-8770.
- C. Karp Associates, Inc., (800)888-4212.
- D. Substitutions: Under provisions of Section 01 62 00.

2.2 ACCESS UNITS

- A. Fire-Rated Units: Equivalent to Milcor Fire-Rated with sandwich type door panel with 1-1/2 hour B-label fire rating.
- B. Non-Rated Units: Equivalent to Milcor Style M.

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, cylinder lock with latch, two keys for each unit.
- E. Anchors: Provide masonry anchors where required for wall construction.

2.4 FINISH

- A. Prime coat units with baked on electrostatic primer in dry areas, stainless steel in restrooms and as noted.
- B. Site paint primed metal surfaces as specified in Section 09 91 00.

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 and level.
- B. Position to provide convenient access to concealed Work requiring access.
- C. Secure rigidly in place in accordance with manufacturer's instructions.
- D. Completely seal around all stainless steel units in wet areas to wall using grey sealant or color to match the wall finish.

END OF SECTION

SECTION 08 41 13

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Aluminum doors, frames and glazed storefront lights.
- B. Anchors, brackets, and attachments.
- C. Perimeter sealant.
- D. Sill-pans under storefront units.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- 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 701.2 - Voluntary Specification for Pile Weatherstripping.
- G. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
- H. NAAMM - Metal Finishes Manual.
- I. CBC - California Building Code.

1.3 PERFORMANCE

- A. System to provide for expansion and contraction within system components caused by a cycling temperature range of 120 F degrees without causing detrimental effects to system or components.

- B. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with CBC.
- C. Limit mullion deflection to 1/200, or flexure limit of glass with full recovery of glazing materials, whichever is less.
- D. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.
- E. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft as measured in accordance with ASTM E283.
- F. 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.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Shop Drawings: Include system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; sub sill-pans under storefront units, door hardware requirements; and affected related Work.
- C. Product Data: Manufacturer's brochures and manufacturer's installation instructions.
- D. Submit two Samples of each color, 12 inches x 12 inches in size, from manufacturer's complete line of colors, illustrating prefinished aluminum surfaces.
- E. For storefronts over 10' in height, submit drawing and stamped structural calculations to verify structural capabilities and obtain DSA approval.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AMA SFM-1.

1.6 MOCK-UP

- A. Prepare mock-up under provisions of Section 01 30 00.
- B. Provide full size section of window assembly including head, jamb, sill, mullion and operable window components
- C. Units will be examined to ascertain quality and conformity to the contract documents and industry standards.
- D. Mock-ups will establish a minimum standard of quality for this Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Convene a preinstallation conference approximately two (2) weeks before scheduled commencement of storefront system installation and associated work.
- B. Require attendance of installer of each component of associated work, installers of substrate construction to receive window system, and other work in and around window installation which must precede or follow installation work (including cement plaster, fiber cement siding, and finish carpentry work if any), Architect, Owner, window system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) the IOR, Owner's insurers, testing agencies and governing authorities.
- C. Objectives of conference to include:
 - 1. Review foreseeable methods and procedures related to window installation work, including set up and mobilization areas for stored material and work area.
 - 2. Tour representative areas of the Work, inspect and discuss condition of substrate, curbs, rough openings and other preparatory work performed by others.
 - 3. Review window system requirements (drawings, specifications and other contract documents).
 - 4. Review required submittals both completed and yet to be completed.
 - 5. Review and finalize construction schedule related to the window installation work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 6. Review required inspection, testing, certifying and material usage accounting procedures.
 - 7. Record discussion of conference including decisions and agreements (or disagreements) reached. Furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.
 - 8. Review notification procedures for inclement weather or non-working days.
- D. The intent of the conference is to resolve issues affecting the installation and performance of the window installation work. Do not proceed with the installation work until such issues are resolved the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of Work on the part of the Owner or Engineer of Record.

1.8 WARRANTY

- A. The window manufacturer shall furnish a written warranty against defects in workmanship and materials for a period of ten (10) years from the date of Substantial Completion. Warranty shall stipulate that service to windows shall be performed on job site and not at a point of manufacture. Warranty shall cover all portions and components of the system, including the laminated glass.
- B. Manufacturer shall designate the factory certified installer as responsible to be on call for a period of five (5) years following the date of Project Closeout. During such time, all calls shall be responded to within eight (8) hours of notification by the District. On call shall include any repairs required for the system and caulking, as well as training and assistance to District staff as needed.
- C. Following the five-year period and for the remainder of the ten- year warranty period, the manufacturer shall be on call to correct all defects in manufacture. If such corrections involve need for the designated factory-certified installer, then installer shall be included as well.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle system components under provisions of Section 01 60 00.
- B. Provide strippable coating to protect prefinished aluminum surfaces.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Kawneer Company, Inc., (714) 523-4850.
- B. Arcadia, (213) 269-7300.
- C. EFCO Corporation, (800) 221-4169.
- D. Substitutions: Under provisions of Section 01 63 00.

2.2 BASIS OF DESIGN – SEE DRAWINGS FOR LOCATIONS

- A. Kawneer 500 Tuffline entrances, with 6 inch cross bar; Kawneer TRIFAB VersaGlaze 450 storefront framing system.
- B. Arcadia WS512HD Series heavy duty wide stile entrances; AFG451T Series storefront framing system.

2.3 MATERIALS

- A. Extruded Aluminum: ASTM B221; Alloy G.S. 10A-T5.
- B. Brackets and Reinforcements: High strength aluminum.

- C. Fasteners: Stainless steel, aluminum.
- D. Compression Weatherstripping: Replaceable gaskets of molded neoprene complying with ASTM D2000, or molded PVC complying with ASTM D 2287.
- E. Sliding Weatherstripping: Replaceable wool, polypropylene or nylon woven pile; nylon fabric or aluminum strip backing; complying with AAMA 701.2.

2.4 FABRICATED COMPONENTS

- A. Frames: 2 inch x 4 inch profile, flush glazing stops.
- B. Wide Stile Doors: 2 inches thick, 5 inch wide top and mid-rail, 5 inch wide vertical stiles, 10 inch wide bottom rail (nominal dimensions); beveled glazing strips. All stiles and rails welded.
- C. Reinforced Mullion: Extruded aluminum cladding with internal reinforcement of steel shaped structural section as required by manufacturer.
- D. Spandrel Panel: Aluminum composite material panel (Reynobond ACM) with polyethylene (PE) core and Colorweld 300 Series 4 finish to match storefront system finish.
- E. Provide sill-pans per drawings under glazed units on curbs, as specified in Section 07 62 00.

2.5 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: As specified in Section 08 80 00 and as indicated on Drawings.

2.6 HARDWARE

- A. Door Hardware: As specified in Section 08 71 00.

2.7 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.

2.8 FINISHES

- A. Anodized Finish: NAAMM AA-M12-C22, Class I, Type III clear anodic coating.
- B. Apply bituminous paint to separate dissimilar metals and metal surfaces in contact with cementitious or dissimilar materials.

2.9 SEALANT MATERIALS

- A. Sealant and Backing Materials: As specified in Section 07 92 00.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify wall openings and adjoining materials are ready to receive Work of this Section.
- B. Confirm that site conditions and substrates are ready for work covered under this section to commence. If not, Contractor is to make suitable repairs or adjustments to the work.
- C. 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 90 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.
- K. Extra stock: Hardware (all labeled), weather stripping, glazing accessories as verified by Owner.

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 maximum.

3.4 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.
- B. 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.
- C. 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

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Extruded aluminum windows with fixed and operating sash.
- B. Glass and glazing.
- C. Operating hardware.
- D. Perimeter sealant.
- E. Extra components for repair.

1.2 REFERENCES

- A. AAMA 101 - Voluntary Specification s for Aluminum Prime Windows and Sliding Glass Door.
- B. ASTM B137 - Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum.
- C. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- D. ASTM B680 - Standard Test Method for Seal Quality of Anodic Coatings on Aluminum by Acid Dissolution.
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- F. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
- G. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- H. ASTM E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- I. ASTM E344 - Terminology Relating to Thermometry and Hydrometry.
- J. ASTM E413 - Classification for Rating Sound Insulation.
- K. ASTM E547 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.

- L. ASTM E987 - Standard Test Methods for Deglazing Force of Fenestration Products.
- M. CCR - California Code of Regulations, Title 24, Part 6, 116.
- N. CEC - California Energy Commission.
- O. FS-TT-S-00230C - Caulking.
- P. NFRC - National Fenestration Rating Council.
- Q. NAAMM - National Association of Architectural Metal Manufacturers.
- R. SIGMA - Sealed Insulating Glass Manufacturers Association.

1.3 PERFORMANCE REQUIREMENTS

- A. Window design shall be of multiple equal light configuration unless noted otherwise, consisting of a double hung window and a fixed unit continuously interlocked on to the inner and outer edges of the adjoining frames and shall incorporate a port for weather-sealing at the exterior. Windows shall be double hung configuration with bottom sash operable. All glazed units shall be easily removable for cleaning and glass repair. Where indicated or where encountered, vents, pipes, fans, or air conditioners are located in existing sash, that sash shall be glazed with a solid (base) panel made of hardboard core with both sides covered with aluminum with clear anodized finish allowing the existing structures to be mounted through or to the panel. If the object falls in the middle sash or lower sash, the overall unit shall be fixed. In upstairs classrooms and unsupervised areas the bottom sash shall have aluminum restrictor clips mounted at the top of the sash to allow the window to be open to a maximum of 6 inches.
- B. Qualification: Fabrication shall be by a manufacturer who can furnish evidence to the District that they are, and have been for not less than (10) consecutive years, regularly engaged in the manufacture of aluminum replacement windows units for the type and quality specified for California public schools, together with a current list of completed school projects done in the local area.
- C. Identification: The sill of each window shall have a permanently affixed metal label identifying the manufacturer.
- D. 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.
- E. Provide current certified AAMA test report that reflects the window configuration and type specified.
- F. 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.

- G. Thermal Performance: Overall U-value of 0.72 as rated in accordance with the National Fenestration Rating councils' (NFRC) Interim U-value Rating Procedure or in accordance with default table method approved by the California Energy Commission (CEC). Provide certified test results.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Show actual conditions at existing openings. Include wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; affected related Work including power operators; installation requirements. Incomplete Shop Drawings will be rejected for resubmittal.
- C. Submit Product Data for each window, including manufacturer's installation instructions.
- D. Submit one full-size mock-up illustrating window frame sections, corner section, mullion section, and panning, including head closure.
- E. Submit two Samples of operating hardware; submit power operator data.
- F. Submit manufacturer's certification 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 air infiltration requirements of CCR, Title 24, Part 6, 116 have been met.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect window units under provisions of Section 01 87 00.
- B. Provide wrapping or strippable coating to protect prefinished aluminum surfaces.

1.7 WARRANTY

- A. The window manufacturer shall furnish a written warranty against defects in workmanship and materials for a period of ten (10) years from the date of Substantial Completion. Warranty shall stipulate that service to windows shall be performed on jobsite and not at a point of manufacture. Warranty shall cover all portions and components of the system, including the insulating glass.

1.8 MANUFACTURER AND INSTALLER FOLLOW-UP

- A. Manufacturer shall designate the factory certified installer as responsible to be on call for a period of five (5) years following the date of Project Closeout. During such time, all calls shall be responded to within eight (8) hours of notification by the District. On call shall include any repairs required for the system and caulking, as well as training and assistance to District staff as needed.
- B. Following the five-year period and for the remainder of the ten- year warranty period, the manufacturer shall be on call to correct all defects in manufacture. If such corrections involve need for the designated factory-certified installer, then installer shall be included as well.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Kawneer, Arcadia, EFCO, Mon-Ray.
- B. Substitutions if approved per 01 25 00.

2.2 BASIS OF DESIGN

- A. Basis of Design for Building 400: Arcadia T200 STC Series, 2" frame, thermally broken, sound control series, dual color finish.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Performance Requirements:
 - 1. Windows shall conform to ANSI/AAMA 101 Section 2.2.3 Vertical Operating Windows. Windows shall meet the designation DH-C60 when a 4-1/2 foot x 7-1/2 foot, (34 Sq. Ft.) minimum size window is tested. Operating force tests and air leakage tests are to be performed before water resistance testing.
 - 2. Air Leakage: With the sash in the closed and locked position, window shall be tested in accordance with ASTM E283, and meet the following performance requirements.
 - a. Air leakage for windows with less than 18 lineal feet of operable crack perimeter shall not exceed 0.15 CFM at 1.56 PSF or 0.35 CFM at 6.24 PSF, when a positive and negative pressure drop is applied to the window.
 - 3. Water Resistance: The window shall be tested in accordance with ASTM E331. A water flow of five gallons per hour, per square foot of window area, is applied to exterior face of the window for 15 minutes. The positive static pressure will be measured at the exterior side of the window. No water shall pass the interior face of the window frame, nor penetrate into the area that

would represent wall construction surrounding an installed window. The minimum pressure is 6.24 PSF (50 mph).

4. Uniform Structural Load: The window shall be tested with the sash closed and locked in accordance with ASTM E330. A positive and negative load of 90 PSF (187 mph) will be applied and maintained for a period of 10 seconds, with no permanent deformation of frame and sash in excess of 0.4% of its span. At the conclusion of these tests, there will be no glass breakage, permanent damage of fasteners, hardware parts nor other damage causing the window to be inoperable.
5. Sound Transmission Loss: The window when tested in accordance with ASTM E90 and ASTM E413 will have a calculated STC not less than 32.
6. Operating Force: Operating sash once started in motion will not require more than 35 pounds operating force to keep the sash in motion, in either direction.
7. Deglazing Test: Sash when tested in accordance with ASTM E987 will have no disengagement of the sash rails from the glass when a load of 70 pounds is applied to the horizontal rails and 50 pounds to the vertical rails.
8. Aluminum Anodic Finish and Hardness Test: Submit three 12 inch long pieces of anodically finished exterior sill, meeting rail and mullion cover. Each Sample will be tested for coating thickness, coating weight, stain resistance and hardness. The performance shall meet these minimums:
 - a. ASTM E244 (Anodized Coating Thickness): 0.7 mils, Architectural Class 1.
 - b. ASTM B137 (Anodized Coating Density) 38 grams per cubic inch.
 - c. ASTM B680-89 (Anodic Seal Integrity): No observable stain.
 - d. Rockwell Tester (Hardness): Gauge reading of 12 on Webster dial gauge.
9. Certified test reports for windows will be required.

2.4 MATERIALS

A. Extruded Aluminum:

1. ASTM B221, 6063 Alloy, T5 or T6 temper.

2.5 FABRICATED COMPONENTS

- ### A. Frame:
- Frame corners to be butt and coped type, with permanent gaskets at corners, secured with aluminum of three # 8 x 5/8 inch non-magnetic stainless steel screws at sill corners, and a minimum of at least two # 8 x 5/8 inch non-magnetic stainless steel screws at head corners. All fasteners shall be anchored into integral extruded screw ports. Frame shall be double weather-stripped with four extruded weather-strip ports at jambs and head sections. Frame sections at exterior shall have a fully extruded port to receive

necessary trim pieces. All frame members shall be fully extruded aluminum. The use of vinyl weather-strip, frame liners, etc. will not be acceptable. Sealant only corners will not be acceptable. Mitered frame corners will not be acceptable.

- B. Sash: All sash corners shall be butt and cope type. Mitered sash corners will not be acceptable. All sash corners shall be secured with #6 x 1 inch thread cutting non magnetic stainless steel screws to insure tight corners when reassembling after consecutive glass repairs have been made. Corner joints shall be factory processed with a sealant hole that will allow filling of the corners with sealant to create a water tight seal. Meeting rails shall interlock when in closed position and be double weather-stripped. All sash shall have a fully extruded lift rail a minimum of 3/16 inch thick running the approximate width of the sash. The lift rail shall be part of the sash rail and not a separate piece. All sash corners, lift rails and any sharp edges shall be de-burred and made smooth. All horizontal sash rails shall be tubular, and furnished with required hardware. All sash shall be factory glazed with specified glazing material, held in place by a virgin vinyl wrap around marine glazing in one continuous piece.
- C. Screens: (Not Used)
- D. Sill: All frame sill members shall be tubular and have a continuous slope to the exterior of at least 5 degrees. The sill weep system shall prevent the passage of air, dirt and insects to the interior and provide ample opening, relative to the window size, to prevent the accumulation of water. Weep flaps to be gravity operated to open and exhaust water, yet close to prevent air infiltration.
- E. Base Panel: Where indicated, to fill space between the window sash and the bottom of the rough opening, an aluminum faced hardboard shall be used. Panel shall be factory laminated of 2.063 inch aluminum face sheets over a 3/16 inch thick hardboard. Edges of hardboard shall be primed or otherwise treated to prevent delamination from moisture.
- F. Head Panel: Where indicated, to fill space between the top of the rough opening and top of the window sash, an aluminum faced insulated sandwich panel shall be used. Panel shall be factory laminated of .040 inch aluminum sheet each face over 1/8 inch hardboard adhered to isocyanurate foam filler.
- G. Base and Head Panel Surrounds: Frame and trim shall be the same as, and interlocking and compatible with, the rest of the window and detailed so that when fully constructed the windows and panels form one unit to fill the complete opening.
- H. Stackability: Where indicated, some windows may exceed four panes in height. Frame and sash assemblies shall be designed to permit interconnectability of all additional components of the system, including base and head panels and sash extension.
- I. General: The entire window unit including head and base panels shall be constructed in a manner that will allow easy replacement of any hardware or weather stripping. The window unit shall be double weather stripped with a seal at all sash perimeters. All weather stripping in the sash shall be concealed to prevent accumulation of foreign matter or matting through cleaning, operating or handling,

which would reduce the effectiveness or life of the weather stripping. Weather stripping shall be secured to prevent movement or loss when removing sash for cleaning or glass repair.

2.6 MATERIALS:

- A. All frame, sash and screen members to be extruded 6063T-6 prime billet aluminum with a nominal main wall thickness not less than .062 inch. Aluminum shall pass gauge reading of 12 on Webster dial gauge when tested for hardness.

2.7 WEATHER STRIPPING:

- A. Windows shall be double weather-stripped at sill, meeting rail and jambs with woven pile seal and rigid vinyl. All weather stripping to be silicone treated, UV stabilized polypropylene pile with an integral polypropylene fin-type seal. This is to be bonded to a non-shrinking backing.

2.8 FINISH:

- A. Finish all areas of aluminum windows and components with electrolytically deposited color thickness equal to 215R1 Alcoa 0.7 mil thickness. Finish shall meet ASTM E244 for 0.7 mils Architectural Class 1, ASTM B137 (Anodic Coating density) 38g/in³., ASTM B680 (Anodic Seal Integrity) no observable stain. Type III hard-coat.

2.9 GLASS AND GLAZING MATERIALS:

- A. Glass:
 - 1. Insulating Glass Units: Vitro 1" insulating glass unit, with 6mm Solargray / 1/2" air space / 6 mm Solarban 70XL.
- B. Glazing Method:
 - 1. Frame assemblies shall be sized to accept the above sizes of glass and still meet the nominal dimensions shown. Assemblies shall be fully factory glazed, but shall be constructed to permit easy and quick in-shop reglazing by the District's forces.
 - 2. Assemblies shall be factory glazed with 1 inch insulating glass, "G" or glazing grade. (See Architectural Drawings for specific locations.) White Poly masking protective paper clearly identifying manufacturer's name shall be left applied for shipping. Brown masking paper will not be accepted. Internally seal any glazing channels voids at glass corners. Fixed glazing panels shall rest on two resilient setting blocks located at quarter points of the horizontal span. Use 100% solids, pre-shimmed polyisobutylene-butyl pre-formed glazing tape applied to the glazing stop lip. Toe bead with a class "A" caulking meeting Federal Specification TT-S-00230C. Glazing stops to be .062 inch extruded 6063T-6 tempered aluminum. Stops shall have a "poron" resilient sponge, with a self-adhering surface, applied to the outer edge of the snap in stop. Stops are to snap

into an extruded channel and lock into place without any special tools needed for installation or removal.

2.10 EXTERIOR PANNING TRIM:

- A. All exterior panning shall be extruded 6063T-6 aluminum with a minimum wall thickness of .062 inch with configuration as detailed. When installed the panning shall cover all existing exterior window framing, mullions, and trim. Aluminum sections shall be one piece, designed to interlock into window frame for the full length of jamb, head, and sill sections, in a manner that will allow back sealing of the entire perimeter to provide a completely weather tight connection. Where the head and sill butts up to the jambs a stainless steel alignment clip shall be used and back sealed. Exposed screws and rivets will not be accepted on exterior panning and covers. Where existing windows protrude away from the building panning shall cover and wrap back to the stucco, brick or building fascia in a manner that covers all wood or metal. Angle panning shall be extruded 6063T-6 aluminum which will interlock onto the panning and have a flange to allow caulking of the seam. Mitered panning corners, or receptor type panning requiring an exposed sealant joint at the exterior, between the window frame and panning joint will not be accepted.

2.11 INTERIOR TRIM:

- A. All interior trim shall be extruded 6063T-6 aluminum with a minimum wall thickness of .50 inch. Mounting clips and fasteners for trim shall be concealed so no exposed screws or rivets are visible.

2.12 MULLION AND TRANSOMS:

- A. Where two or more frames are joined together, horizontally or vertically, the connector design shall be continuously interlocked on to the inner and outer edges of the frame and shall incorporate a port for weather-sealing at the exterior. There shall be no exposed screws on either the interior or the exterior. The mullions and transoms must be capable of withstanding the project design wind load on the total area without deflecting more than 1/175th of the span.

2.13 MANUAL OPERATION

- A. All vertical sliding sash shall operate on spring loaded nylon cushion blocks, incorporating a non-magnetic stainless steel, nylon tipped pinlocks measuring 2-1/8 inch x 7/32 inch and 2-5/8 inch x 7/32 inch. The pinlocks shall engage in predetermined ventilating positions processed into the frame, and to lock window automatically when in the closed position. The pinlocks will be operated by nylon handles measuring 2 inch x 11/16 inch located directly below the lift rail. All springs, screws, hardware components that comprise the pinlock assembly shall be non-magnetic stainless steel. Counterbalance shall be excluded on all sash having less than 25 pounds lift load. Where balances are required, windows shall be processed to incorporate both of the above systems. All operating surfaces to be protected from metal to metal sliding contact by woven pile, vinyl and nylon glides. All sash shall be side load, and easily removable from the inside for cleaning or

repairs. Any hardware material other than non-magnetic stainless steel will not be acceptable.

2.14 ACCESSIBLE POWER OPERATION

- A. LinkAYL LK-LCD300 24V single chain opener, with LK LK-CP611 single channel control panel, LK-MS541 manual wall switch and 24V switching power supply (www.LinkAYL.com).
- B. Location: Building 400, as indicated on drawings.

2.15 SEALANT MATERIALS

- A. Sealant and Backing Material: As specified in Section 07 92 00.

2.16 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.

2.17 FINISHES

- A. Dual Color Finish inside and outside of frame: Clear Anodized Class I, Type III, NAAMM AA-MI2-C22-A41; 70% Kynar, from manufacturer's full range of colors
- B. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

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 and 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.

3.4 MAINTENANCE INSTRUCTIONS

- A. Provide training to District personnel on window replacement and re-glazing

3.5 EXTRA STOCK

- A. Provide one (1) additional glazed fixed sash unit in each of the three sizes, for each project.
- B. Provide list of additional components such as sealant, packing material and weather stripping, glazing tape and setting blocks available from factory along with manufacturer's published prices.

END OF SECTION

SECTION 08 62 23 TUBULAR SKYLIGHTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Tubular daylighting device, consisting of roof dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.
- B. Accessories.

1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: flashing of skylight base.
- B. Section 07 01 52 – Roofing Repair: flashing of skylight base into existing roofs.
- C. Section 07 52 00 - Membrane Roofing: flashing of skylight base.
- D. Section 07 61 00 – Sheet Metal Roofing: flashing of skylight base.
- E. Section 07 62 00 – Sheet Metal Flashing and Trim: metal flashing.

1.3 REFERENCES

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008a.
- B. ASTM A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; 2006.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; 2007.
- D. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.
- E. ASTM E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System; 2006.
- F. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors; 2002.
- G. ASTM E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000.
- H. ASTM D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position; 2006.
- I. ASTM D-1929 - Test Method for Ignition Properties of Plastics; 1996 (2001).
- J. UL 181 - Factory Made Air Ducts and Air Connectors
- K. UL 790 - Standard for Tests for Fire Resistance of Roof Covering Materials; 2004.

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L. ICBO/ICC AC-16 - Acceptance Criteria for Plastic Skylights; April 2011.

1.4 PERFORMANCE REQUIREMENTS

- A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:
1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
 2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.
 3. Uniform Load Test:
 - a. No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).
 - b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.
 4. Fire Testing:
 - a. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the 2006 International Building Code.
 - b. Self-Ignition Temperature - Greater than 650 degrees F Per: U.B.C. Standard 26-6. See ASTM D-1929.
 - c. Smoke Density - Rating no greater than 450 Per U.B.C. 8-1 (See ASTM Standard E 84) in way intended for use. Classification C.
 - d. Rate of Burn and/or Extent - Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2: U.B.C. Standard 26-7. See ASTM D 635.
 - e. Rate of Burn and/or Extent - Maximum Burn Extent: 1 inch (25 mm) Classification CC-1: U.B.C. Standard 26-7. See ASTM D 635.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- 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 shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.
 - D. Verification Samples: As requested by Architect.
 - E. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Store products in manufacturer's unopened packaging until ready for installation.
 - B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- 1.8 PROJECT CONDITIONS
- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- 1.9 WARRANTY
- A. Daylighting Device: Manufacturer's standard warranty for 10 years.
 - B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Solatube International, Inc., which is located at: 2210 Oak Ridge Way ; Vista, CA 92081; Toll Free Tel: 888-765-2882; Tel: 760-477-1120; Fax: 760-597-4488 ; Email: request info; Web: www.solatube.com
- B. Substitutions: Not permitted.

2.2 TUBULAR DAYLIGHTING DEVICES

- A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16.

- B. SolaMaster Series: Solatube Model 750 DS-C Penetrating Ceiling, 21 inch (530 mm) Daylighting System:
1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
 - a. Outer Dome Glazing: Type DA, 0.125 inch (3.2 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibited, impact modified acrylic blend.
 2. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
 3. Roof Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
 - a. Base Style: Type FCM, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm x 685 mm) to cover curb as specified in Section 07600.
 - b. Dome Edge Protection Band: Type PB, For fire rated roofs. Galvanized steel. Nominal thickness of 0.039 inches (1 mm).
 4. Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact PVC; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
 5. Dome Seal: Adhesive backed weatherstrip 0.63 inch (16 mm) tall by 0.28 inch (7 mm).
 6. Reflective Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm).
 - a. General:
 1. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Specular reflectance for visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum reflectance (400 nm to 2500 nm) less than 93 percent.
 2. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
 - b. Top Tube Angle Adapter and Bottom Top Tube Angle Adapter Kit, Type AK:
 1. Reflective 30 degree adjustable top and bottom angle adapters (one each), 16 inches (406 mm) long.
 - c. Extension Tube:
 1. Reflective extension tube, Type EXX, Notched for Open Ceiling diffuser attachment, 24 inches (610 mm) long.

- d. Reflective 90 degree Adjustable tube:
 - 1. Extension Tube Angle Adapter: Provide manufacturer's standard adapters for applications requiring:
 - a. Type A1 one 0 to 90 degree extension tube angle adapter.
- 7. Diffuser Assemblies for Tubes Penetrating Ceilings: Solatube Model 750 DS-C. Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube; 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.
 - a. Round to square transition box made of opaque polymeric material, classified as CC2, Class C, 0.110 inch (2.8 mm) thick.
 - b. Lens: Type L1 OptiView Fresnel lens design to maximize light output and diffusion with extruded aluminum frame. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.
- 8. Accessories:
 - a. Security Bar: Type B Security Bar 0.375 inch (95 mm) stainless steel bar across flashing diameter opening.
 - b. Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required.
 - c. Security Kit: Type SK Dome Security Kit, rivets with nylon spacers to replace dome screws.

2.3 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.
- C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
 - 4. Exterior gates.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Section 05 50 00, Metal Fabrications.
 - 2. Section 08 11 13, Hollow Metal Doors and Frames.
 - 3. Section 08 14 16, Flush Wood Doors.
 - 4. Section 08 41 13, Aluminum Entrances and Storefronts.
 - 5. Section 32 31 13, Chain Link Fences and Gates.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and

adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
 - C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
 - D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 3. Five years for exit hardware.
 - 4. Twenty five years for manual surface door closer bodies.
- 1.8 MAINTENANCE SERVICE
- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:
 - a. Hager Companies (HA).
 - b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Manufacturers:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - b. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 3. Manufacturers:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - b. Trimco (TC).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Match existing.

- D. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.
 - 1. Manufacturers:
 - a. Schlage Lock (SC) - Primus Everest.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to Owner's existing system.
- F. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Manufacturers:
 - a. Sargent Manufacturing (SA) – 8200 Series.
 - b. Schlage (SC) – L9000 Series.
- B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.
 - 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 - 2. Locks are to be non-handed and fully field reversible.
 - 3. Manufacturers:
 - a. Sargent Manufacturing (SA) – 10 Line.
 - b. Schlage (SC) – ND Series.

2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Rim Exit Devices: Exit device rails shall release with less than 5 pounds of pressure per the California Building Code.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Sargent Manufacturing (SA) - 80 Series.
 - b. Von Duprin (VD) - 98 Series.

2.8 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper

installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

- 1. Manufacturers:

- a. LCN Closers (LC) - 4040 Series.
- b. Norton Door Controls (NO) - 7500 Series.

2.9 ARCHITECTURAL TRIM

- A. Door Protective Trim

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Manufacturers:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - b. Trimco (TC).

2.10 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

- a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- b. Trimco (TC).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Rixson Door Controls (RF).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.11 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.12 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. PE - Pemko
 - 3. RO - Rockwood
 - 4. SA - Sargent
 - 5. SC - Schlage
 - 6. RF - Rixson
 - 7. NO - Norton

HARDWARE SETS

Set: 1.0

Description: Inc2: Not Used | Inc3: 616A, 618, 618C

2 Continuous Hinge	CFM SLF-HD1		PE
1 Removable Mullion	980A	US28	SA
2 Rim Exit Device	LC LD 5CH 49 8816 ETL	US32D	SA
2 Cylinder (mortise)	20-701 50-210	626	SC
2 Cylinder (rim)	20-710 50-210	626	SC
2 Surface Closer	CPS7500 (7788 6891 as required)	689	NO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	by door mfg.		
2 Sweep	57AV		PE

Set: 2.0

Doors: Inc 2: 210, 210B, 212, 212B | Inc3: 616D

1 Continuous Hinge	CFM SLF-HD1		PE
1 Rim Exit Device	LC LD 5CH 49 8816 ETL	US32D	SA
1 Cylinder (mortise)	20-701 50-210	626	SC
1 Cylinder (rim)	20-710 50-210	626	SC
1 Surface Closer	CPS7500 (7788 6891 as required)	689	NO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	by door mfg.		
1 Sweep	57AV		PE

Set: 3.0

Doors: Inc 2: 101, 102, 103, 104, 106, 107, 108, 150, 151, 201, 202, 203, 204, 205A, 206A, 206B, 207, 208, 209, A100, A100A | Inc3: Not Used

1 Continuous Hinge	CFM SLF-HD1		PE
1 Classroom Security Lock	LC 28 10G38 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	CPS7500 (7788 6891 as required)	689	NO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	by door mfg.		
1 Sweep	57AV		PE

Set: 4.0

Doors: Inc2: 150A, 210A, 212A | Inc 3: Not Used

3 Hinge	TA2314 x NRP	US32D	MK
1 Storeroom Lock	LC 28 10G04 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	CPS7500	689	NO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	294AV		PE
1 Sweep	57AV		PE

Set: 4.1

Doors: Inc2: 151A | Inc 3: Not Used

6 Hinge	TA2314 x NRP	US32D	MK
2 Flush Bolt	555 (12"-24" as required)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	LC 28 10G04 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
2 Surface Closer	CPS7500	689	NO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	294AV		PE
2 Sweep	57AV		PE

Set: 5.0

Doors: Inc 2: A1.03.1, A104, A105, A106 | Inc 3: Not Used

3 Hinge	TA2314 x NRP	US32D	MK
1 Office Lock	LC 28 10G05 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	294AV		PE
1 Sweep	57AV		PE

Set: 6.0

Doors: Inc2: 154, 206C, A112, A117 | Inc3: Not Used

3 Hinge	T4A3386 x NRP	US32D	MK
1 Classroom Security Lock	LC 28 10G38 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Threshold	2009APK (or per details)		PE
1 Gasketing	294AV		PE
1 Sweep	57AV		PE

Set: 7.0

Doors: Inc 2: Not Used | Inc 3: Not Used

1 Classroom Security Lock	LC 28 10G38 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Threshold	2009APK (or per details)		PE
1 Gasketing	294AV		PE
1 Sweep	57AV		PE
1 Balance of Hardware	existing.		

Set: 8.0

Doors: Inc 2: Not Used | Inc 3: Not Used

1 Threshold	2009APK (or per details)		PE
1 Gasketing	294AV		PE
1 Sweep	57AV		PE
1 Balance of Hardware	existing.		

Set: 9.0

Doors: Inc 2: 206D, A114 | Inc 3: Not Used

3 Hinge	TA2714	US26D	MK
1 Exit Device	12 LC 5CH-8804 ETL	US32D	SA
1 Cylinder (rim)	20-710 50-210	626	SC
1 Surface Closer	7500	689	NO
1 Stop	400/403/441H (as required)	US26D	RO
1 Gasketing	S44BL		PE

Set: 10.0

Description: Inc 2: Not Used | Inc 3: 606C

6 Hinge	T4A3786	US26D	MK
1 Removable Mullion	980A	US28	SA
2 Rim Exit Device	LC LD 5CH 49 8816 ETL	US32D	SA
2 Cylinder (mortise)	20-701 50-210	626	SC
2 Cylinder (rim)	20-710 50-210	626	SC
2 Surface Closer	PR 7500	689	NO
2 Kick Plate	K1050 10"	US32D	RO
2 Stop	400/403/441H (as required)	US26D	RO
2 Silencer	608		RO

Set: 10.1

Doors: Inc 2: Not Used | Inc 3: 616

1 Rim Exit Device	LC LD 5CH 49 8816 ETL	US32D	SA
1 Cylinder (mortise)	20-701 50-210	626	SC
1 Cylinder (rim)	20-710 50-210	626	SC
1 Balance of Hardware	existing.		

Notes: Verification of specified hardware required for existing doors. Modifications of existing doors and frames may be required.

Set: 10.2

Doors: Inc 2: Not Used | Inc 3: Not Used

1 Rim Exit Device	12 LC 5CH 49 8816 ETL	US32D	SA
1 Cylinder (mortise)	20-701 50-210	626	SC
1 Cylinder (rim)	20-710 50-210	626	SC
1 Balance of Hardware	existing.		

Notes: Verification of specified hardware required for existing doors. Modifications of existing doors and frames may be required.

Set: 11.0

Doors: Inc 2: A122 | Inc3: Not Used

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	LC 28 10G04 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Stop	400/403/441H (as required)	US26D	RO
3 Silencer	608		RO

Set: 12.0

Doors: Inc 2: Not Used | Inc 3: Not Used

2 Hinge	TA2714	US26D	MK
1 Storeroom Lock	LC 28 10G04 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Surf Overhead Stop	10-X36	630	RF
3 Silencer	608		RO

Set: 13.0

Doors: Inc 2: A110 | Inc3: 608

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	LC 28 10G04 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	7500	689	NO
1 Stop	400/403/441H (as required)	US26D	RO
1 Gasketing	S44BL		PE

Set: 14.0

Doors: Inc 2: Not Used | Inc 3: 602A, 607

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	LC 28 10G04 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	CPS7500	689	NO
1 Gasketing	S44BL		PE

Set: 15.0

Doors: Inc 2: 152A, 152B, 153A, A102, A103, A104A, A105A, A106A, A119, A120, A121 | Inc 3: 603C, 604A

3 Hinge	TA2714	US26D	MK
1 Office Lock	LC 28 10G05 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Stop	400/403/441H (as required)	US26D	RO
3 Silencer	608		RO

Set: 16.0

Doors: Inc 2: 151B, 205C | Inc3: Not Used

6 Hinge	TA2714	US26D	MK
2 Flush Bolt	555 (12"-24" as required)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Classroom Lock	LC 28 10G37 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
2 Surf Overhead Stop	10-X36	630	RF
2 Silencer	608		RO

Set: 17.0

Description: Inc 2: Not Used | Inc 3: 610

3 Hinge	TA2714	US26D	MK
1 Classroom Lock	LC 28 10G37 LL	US26D	SA
1 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Gasketing	S773BL		PE
1 Door Bottom	4131CPKL		PE

Set: 18.0

Doors: Inc 2: 206E, 206F, 206G, A117A, A117B | Inc 3: Not Used

3 Hinge	T4A3786	US26D	MK
1 Classroom Security Lock	LC 28 10G38 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	PR 7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Stop	400/403/441H (as required)	US26D	RO
3 Silencer	608		RO

Set: 19.0

Doors: Inc 2: Not Used | Inc 3: Not Used

3 Hinge	T4A3786	US26D	MK
1 Classroom Security Lock	LC 28 10G38 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Surface Closer	PR 7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Stop	400/403/441H (as required)	US26D	RO
1 Gasketing	S44BL		PE

Set: 20.0

Doors: Inc 2: Not Used | Inc 3: 612

1 Classroom Security Lock	LC 28 10G38 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Balance of Hardware	existing.		

Notes: Verification of specified hardware required for existing doors. Modifications of existing doors and frames may be required.

Set: 20.1

Doors: Inc 2: Not Used | Inc 3: Not Used

1 Classroom Security Intruder Lock	LC 8238 LNL	US26D	SA
2 Cylinder (mortise)	20-701 50-210	626	SC
1 Balance of Hardware	existing.		

Notes: Verification of specified hardware required for existing doors. Modifications of existing doors and frames may be required.

Set: 20.2

Doors: Inc 2: Not Used | Inc 3: 620

1 Office Lock	LC 28 10G05 LL	US26D	SA
2 Cylinder (KIL)	20-719 50-210	626	SC
1 Balance of Hardware	existing.		

Notes: Verification of specified hardware required for existing doors. Modifications of existing doors and frames may be required.

Set: 21.0

Doors: Inc 2: A103A | Inc 3: Not Used

3 Hinge	TA2714	US26D	MK
1 Privacy Lock	28 10U65 LL	US26D	SA
1 Stop	400/403/441H (as required)	US26D	RO
3 Silencer	608		RO

Set: 22.0

Doors: Inc 2: A115, A116 | Inc 3: Not Used

3 Hinge	TA2714	US26D	MK
1 Privacy Lock	LB 49 8266 LNL	US26D	SA
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Gasketing	S773BL		PE
1 Door Bottom	4131CPKL		PE

Set: 23.0

Doors: Inc 2: A107, A111 | Not Used

3 Hinge	TA2714	US26D	MK
1 Passage Latch	28 10U15 LL	US26D	SA
1 Stop	400/403/441H (as required)	US26D	RO
3 Silencer	608		RO

Set: 24.0

Doors: Inc 2: A108 | Inc 3: Not Used

3 Hinge	TA2714	US26D	MK
1 Passage Latch	28 10U15 LL	US26D	SA
1 Stop	400/403/441H (as required)	US26D	RO
1 Gasketing	S773BL		PE
1 Door Bottom	4131CPKL		PE

Set: 25.0

Doors: Inc 2: A109, A109A, A113 | Inc 3: Not Used

3 Hinge	TA2714	US26D	MK
1 Passage Latch	28 10U15 LL	US26D	SA
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Stop	400/403/441H (as required)	US26D	RO
3 Silencer	608		RO

Set: 26.0

Doors: Inc 2: Not Used | Inc 3: Not Used

3 Hinge	T4A3786	US26D	MK
1 Passage Latch	28 10U15 LL	US26D	SA
1 Surface Closer	PR 7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
1 Stop	400/403/441H (as required)	US26D	RO
1 Gasketing	S44BL		PE

Set: 27.0

Doors: Inc 2: Not Used | Inc 3: 605, 611

3 Hinge	T4A3786	US26D	MK
1 Push Plate	70F	US32D	RO
1 Pull Plate	BF 111x70C	US32D	RO
1 Surface Closer	CPS7500	689	NO
1 Kick Plate	K1050 10"	US32D	RO
3 Silencer	608		RO

Set: 28.0

Doors: 101A, 102A, 103A, 104A, 106A, 107A, 108A, 153, 201A, 202A, 203A, 204A, 207A, 208A, 209A, 600, 601, 601A, 602, 603A, 604, 606A, 606B, 609, 617A, 617B, 618D, 621, 622, 622C, 624, 624A, 627, 628, 630A, 631, 632, 632A, 633, 633A

1 Hardware	existing or by door mfg.
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Set: 29.0 (Inc 1)

Exterior Gates: Inc 1: G1, G2, G3, G4, G5, G12 | Inc 2: Not Used | Inc 3: Not Used

2 Cane Bolt	12"	US26D	
1 Padlock	KS43D2300 50-001		SC
1 Rim Exit Device, Storeroom	LC 8804 ETL 644	US32D	SA
1 Cylinder (rim)	20-710 50-210	626	SC
1 Latch Protector	325	US26D	RO
1 balance of hardware	provided by gate manufacturer		

Set: 30.0 (Inc 1)

Exterior Gates: Inc 1: G7, G8, G9, G10, G11 Inc2: Not Used | Inc 3: Not Used

1 Rim Exit Device, Storeroom	LC 8804 ETL 644	US32D	SA
1 Cylinder (rim)	20-710 50-210	626	SC
1 Surface Closer	7500	689	NO
1 Latch Protector	325	US26D	RO
1 balance of hardware	provided by gate manufacturer		

Set: 31.0 (Inc 1 & Inc 3)

Exterior Gates: Inc1: G6 | Inc3: G13

1 Padlock	KS43D2300 50-001		SC
1 balance of hardware	provided by gate manufacturer		

END OF SECTION

SECTION 08 80 00 GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Glass and glazing for hollow metal work, windows, glazed walls and doors.
- B. Mirror glass.

1.2 SECTION EXCLUDES

- A. Factory glazing of aluminum windows.

1.3 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. GANA - Glazing Manual and Sealant Manual.
- G. UL - Underwriters' Laboratories, Inc., Building Materials Directory.

1.4 QUALITY ASSURANCE

- A. Conform to Glass Association of North America (GANA) Glazing Manual and Sealant Manual for glazing installation methods.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements for glass. Provide data on glazing sealant. Identify colors available.
- C. Submit two 12-inch-square Samples, illustrating each glass coloration.
- D. Submit 12-inch long bead of glazing sealant in color selected.

- E. Submit sealed glass unit manufacturer's certificate indicating units meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store and protect products under provisions of Section 01 87 00.

1.7 WARRANTY

- A. Provide manufacturer's warranty against defects in material, including loss of hermetic seal insulating units, for a period of 10 years after date of Substantial Completion.
- B. Include coverage for reflective coating on mirrors and replacement of same.
- C. Include coverage for delamination of laminated glass and replacement of same.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Insulating, Tempered, Laminated and Spandrel Glass:
 - 1. Vitro: basis of design
 - 2. Pilkington
 - 3. Guardian Glass
 - 4. Oldcastle
 - 5. Viracon, Inc.
- B. Mirror Glass:
 - 1. C.R. Laurence Co., Inc.
 - 2. Avalon Mirror.
- C. Polycarbonate Mirror Glass:
 - 1. Plaskolite, Inc. "MirrorPlast".
 - 2. K-Mac Plastics.
 - 3. A&C Plastics, Inc.
- D. Substitutions: Under provisions of Section 01 25 00.

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, mesh and pattern.
- B. Laminated Glass Standard: Comply with ASTM C1172 requirements including reference to type, class, quality and if applicable, form, finish and pattern.
- C. 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.
- D. Visual Light Transmission and Heat Gain: Conform to requirements indicated.
- E. Sizes: Fabricate glass to sizes required for glazing openings, with edge clearances and tolerances complying with recommendations of glass manufacturer and GANA.
- F. Provide thicknesses indicated or, if not indicated, as recommended by glass manufacturer for application indicated.

2.3 PRIMARY GLASS PRODUCTS

- A. Insulating Glass Units: Vitro 1" insulating glass unit, with 6mm Solargray / 1/2" air space / 6 mm Solarban 70XL.
- B. Spandrel Glass: Vitro 1" fire-fused ceramic frit heat-strengthened insulating glass unit; frit on #4 surface.
- C. Clear Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select). Low E coating on No. 2 surface of exterior glass.
- D. 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.
- E. Polycarbonate Mirror: High-Impact strength, FDA compliant, flame-resistant, with UV stability. 1/4 inch thick sheet with reflective coating on one side, protected by 1.0 mil thick gray backcoat.

2.4 TEMPERED GLASS PRODUCTS

- A. Manufacturing Process: Horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed.
- B. Clear Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type 1 (transparent glass, flat) Class 1 (clear), Quality q3 (glazing select); conforming to ANSI Z97.1.
- C. Clear Tempered Float Glass - Low E: ASTM C1048, Kind FT (fully tempered), Condition C (coated) with low E coating on No. 2 surface, Type 1 (transparent glass, flat) Class 1 (clear), Quality q3 (glazing select); conforming to ANSI Z97.1.

2.5 LAMINATED GLASS PRODUCTS

- A. Laminated Glass: Two panes 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. Unit shall have the following characteristics:
 - 1. Overall Laminated Glass Thickness: Approximately 5/16 inch.
 - 2. Visual Light Transmission (VLT): The VLT of the entire laminated assembly shall be equal to or better than 75%.
 - 3. Solar Heat Gain Coefficient: The SHGC of the entire laminated assembly shall equal to or less than 0.60.
- B. Obscure Laminated Glass:
 - 1. Glass: Class 1 clear for both panes. Low E coating on Number 2 surface.
 - 2. Glass Thickness (each pane): 1/8 inch.
 - 3. Color of Plastic Interlayer: Obscure (white).
- C. Clear Laminated Glass:
 - 1. Glass: Class 1 clear for both panes. Low E coating number 2 surface.
 - 2. Glass Thickness (Each Pane): 1/8/ inch.
 - 3. Color of Plastic Interlayer: Clear.
- D. Plastic Interlayer: Polyvinyl Butyral as manufactured by:
 - 1. "Saflex"; Monsanto Co.
 - 2. "Butacite"; E.S. DuPont DeNemours & Co., Inc.

2.6 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.
 - 2. "Norseal Butyl"; Norton Performance Products.
 - 3. "BC 158"; Pecora Corp.
 - 4. "757 Butyl Sealant"; Protective Treatments, Inc.
- C. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25:

1. "Chem-Calk 1200"; Bostik Construction Products Div.
 2. "Dow Corning 999"; Dow Corning Corp.
 3. "SCS 1200"; General Electric Corp.
 4. "863"; Pecora Corp.
 5. "Rhodorsil 3B"; Rhone-Poulenc Inc.
 6. "Omniglaze"; Sonneborn Building Products Div.; Rexnord Chemical Products Inc.
 7. "Proglaze"; Tremco.
- D. Preformed Butyl-Polyisobutylene Glazing Tape With Spacer Rod:
1. "Chem-Tape 60"; Bostik Construction Products Div.
 2. "Shim-Seal"; Pecora Corp.
 3. "PTTI 303 Shim Tape"; Protective Treatments, Inc.
 4. "Pre-shimmed Tremco 440 Tape"; Tremco Inc.

2.7 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. Color to be selected by Architect from manufacturer's full range of colors.
- D. Glazing Clips: Manufacturer's standard type.
- E. Mirror Attachment Accessories: Mirror adhesive, chemically compatible with mirror coating and wall substrate.

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 AT ALUMINUM STOREFRONT SYSTEM)

- 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 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.

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.

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.

3.6 INSTALLATION - MIRRORS

- A. Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.7 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 08 91 00

LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Louvers and frames.
- B. Insect and bird screening.

1.2 REFERENCES

- A. AMCA 500 - (Air Movement Council Association) Test Method for Louvers, Dampers, and Shutters.
- B. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- 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.

1.3 SYSTEM PERFORMANCE

- A. Fabricate louver to permit percent free area required by mechanical drawings.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of AMCA certified louvers with five years experience.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate layout, elevations, dimensions, and tolerances; head, jamb, and sill details; blade configuration; screening; and frames.
- C. Provide Product Data on preassembled louvers describing design characteristics, maximum recommended air velocity, free area, materials, and finishes.
- D. Submit two 6-inch square Samples illustrating finish and color of exterior and interior prefinish.
- E. Submit manufacturer's installation instructions.

1.6 COORDINATION

- A. Coordinate Work of this Section with installation of flashings under Section 07 62 00 and furnace enclosures under Section 23 30 00.
- B. Coordinate Work of this Section with mechanical ductwork.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Airline Products Co.
- B. The C/S Group.
- C. The Airolite Co. (as a standard of quality).
- D. Industrial Louvers, Inc.
- E. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

- A. Aluminum: ASTM B221, 6063 alloy, T5 or T52 temper; extruded shape.
- B. Steel Sheet: ASTM A653, Commercial Steel, Type A, galvanized to G90 zinc coating in accordance with ASTM A924.
- C. Fasteners and Anchors: Stainless steel type.

2.3 ACCESSORIES

- A. Bird Screen: Interwoven wire mesh of [steel,] [aluminum,] 0.063 inch diameter wire, 1/2 inch open weave, [diagonal] [square] design.
- B. Insect Screen: 18 x 16 size [aluminum] [steel] mesh, set in [aluminum] [steel] frame.
- C. Primer: Zinc chromate, alkyd type.
- D. Flashings: Of same material as louver frame.

2.4 FABRICATION

- A. Fixed Louvers: [_____], Model [_____].
- B. Louver Size: 4 inches deep, face measurements as indicated.

- C. Louver Blade: Sloped at 45 degrees; Inverted 'Y' shape; minimum material thickness of 16 gauge.
- D. Louver Frame: Channel shape, welded corner joints, material thickness of 16 gauge.
- E. Mullions: Concealed, of material to match frame, profiled to suit louver frame.
- F. Head, Jamb and Sill Flashings: Roll-formed to required shape, one piece per location.
- G. Screens: Permanently installed screen mesh in shaped frame with reinforced corner construction; screw to louver frame.
- H. Blank Out Sheeting: If required, same material as louver and frame.

2.5 FINISHES

- A. Steel Surfaces: Shop coat of primer for site painting under provisions of Section 09 91 00.
- B. Steel Surfaces: Factory "Kynar 500" or "Hylar 5000" fluorocarbon 3-coat coating system, color as selected by Architect.
- C. Aluminum Surfaces: AA-M12C22A42 clear anodized:

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that prepared openings and flashings are ready to receive Work, and opening dimensions are as indicated on Drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Secure louvers in opening framing with concealed fasteners, removable for maintenance purposes.
- D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Install bird screening to exterior of louver under metal protection grille.

- F. Install insect screens to intake louvers. Install bird screens to exhaust louvers.

3.3 CLEANING

- A. Clean surfaces and components.

END OF SECTION

SECTION 09 24 00 CEMENT PLASTERING

PART 1- GENERAL

1.1 SECTION INCLUDES

- A. Metal furring and lathing and suspended ceiling framing.
- B. Portland cement plaster system.
- C. Machine applied surface finish.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

- A. ASTM C150 - Portland Cement.
- B. ASTM C206 - Finishing Hydrated Lime.
- C. ASTM C207 - Hydrated Lime for Masonry Purposes.
- 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 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.
- I. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
- J. ASTM C1063 - Installation of Lathing and Furring for Portland Cement Based Plaster.
- K. NAAMM Standard ML/SFA 920 - Guide Specifications for Metal Lathing and Furring.
- L. TSIB (Technical Services & Information Bureau) – 2012 Plaster Assembly Manual.

- M. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25.
- N. ICC-ES: ICC—Evaluation Services Reports.
- O. CBC – California Building Code, Chapter 25.

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 Northern California Plastering Institute, Inc., and arrange for inspection of lathing and accessories installation. Provide to Architect a written report of the results of the inspection.
- C. Lath and related accessories shall provide proper, secure base and reinforcement for plaster systems. Plaster base coats shall provide suitable base for finish coat.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, Chapter 7, for fire rated assemblies as indicated on Drawings.
- B. Conform to CCR, Title 24, Part 2, Chapter 25A for materials and their installation.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Provide Product Data on plaster materials, characteristics and limitations of products specified.
- C. Submit Samples of texture for plaster finish, building paper, flashing membrane, lath, accessories, trim, and fasteners.

1.6 MOCK-UP

- A. Prepare field mock-up of an area at least 9 feet high by 6 feet wide. Mock-up shall include finish treatment at all openings, joints and other elements of the architecture, in accordance with the selected patterns.
- B. Mock-up, once approved, may be integrated into the Work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 01 87 00.
- B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

- C. Keep plaster and other cementitious materials dry until ready for use. Keep materials off ground, under watertight covers, and away from damp surfaces.
- D. Protect metal products from rusting.
- E. Remove from site any damaged or deteriorated materials.
- F. Stack preformed material to prevent twisting, bending, abrasion, staining, or corrosion and to provide ventilation.
- G. Prevent contact with materials during storage which may cause damage, discoloration, staining, or drainage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply plaster when substrate or ambient air temperature is less than 40 degrees Fahrenheit nor more than 77 degrees Fahrenheit.
- B. Maintain minimum ambient temperature of 40 degrees Fahrenheit during and after installation of plaster.
- C. Protect plaster from uneven and excessive evaporation during dry weather and from strong blasts of dry air.
- D. Do not subject newly applied plaster to hot, dry winds.
- E. Do not install exterior plaster when prevailing temperature is less than 40 degrees Fahrenheit.
- F. When ambient air temperature exceeds 77 degrees Fahrenheit, follow procedures for maintaining moisture content in new plaster.
- G. Provide protection against accelerated dehydration caused by wind. Protect cement plaster from uneven and excessive evaporation during hot and/or windy weather.
- H. Fine spray plaster twice daily for up to 48 hours minimum.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Lathing Materials:
 - 1. Western Metal Lath Division.
 - 2. Amico-West.
 - 3. CEMCO.

B. Accessories:

1. Fry Reglet Corp.
2. Keene Metal Products Division.
3. M.M. Systems Corporation.
4. CEMCO.
5. Amico-West.
6. Superior Metal Trim.
7. Stockton Products.
8. Western.

C. Substitutions: Under provisions of Section 01 25 00.

2.2 PLASTER BASE COAT MATERIALS

- A. Cement: ASTM C150, Normal - Type I, Portland or ASTM C91, masonry.
- B. Lime: ASTM C206, Type S for use with Portland cement or ASTM C207, Type S, for use with masonry cement.
- 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. Plaster Mix Reinforcement: Glass fibers, 1/2 inch nominal length, alkali resistant.
- F. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete, concrete masonry surfaces and existing plaster surfaces. Larsen Products Corp. "Weld-Crete". Substitutions under provisions of Section 01 62 00.
- G. Sand: ASTM C144.

2.3 PLASTER FINISH COAT MATERIALS

- A. Cement: As specified for plaster base coat, grey color.
- B. Lime: As specified for plaster base coat.
- C. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.
- D. Finish: Site paint under provisions of Section 09 91 00.

- E. Acrylic Finish Coat For Exterior Applications: Provide BMI 150 Stucco Coat (100% acrylic) or equal.
- F. Protect with BMI Stretchcoat (elastomeric) or equal. Further, provide graffiti protection coating as specified in Section 09 96 53.

2.4 FURRING AND LATHING

- A. Metal Lath for Vertical Surfaces: ASTM C847, 3.4 lb/sq. yd. expanded metal, galvanized, self-furring type with continuous groove.
- B. Metal Lath for Horizontal Surfaces: ASTM C847, 3.4 lb./sq. yd expanded metal, galvanized, 3/8 inch rib lath with factory applied Kraft paper backing.
- C. Wire Lath for Vertical/Horizontal Patchwork: 1-1/2 x 17 gage woven galvanized wire.
- D. Underlayment: Two layers of WRB Type D building paper conforming to CBC Standard No. 14-1.

2.5 ACCESSORIES

- A. Corner Mesh: Formed steel, minimum .0179 inch thick; expanded flanges shaped to permit complete embedding in plaster; minimum 2 inches wide; galvanized finish.
- B. Corner Reinforcement: Equivalent to Western Metal, .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 inch wide x 18 inch long.
- D. Vent Screed: Equivalent to Superior SRS, minimum .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 .0239 inch thick; thickness governed by plaster thickness; maximum possible lengths; expanded metal flanges, 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 Superior SWS, minimum .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 Superior No. 5 or No. 10 drip mould as indicated on drawings, minimum .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 Superior SWD, minimum .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. Interior Corner Joints: Equivalent to Western No. 30, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.
- L. 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.
- M. Screws: ASTM C954 or ASTM C1002, self drilling.
- N. Penetration Flashing: Type 1, Grade A conforming to CBC Standard 14-1, 9-inch wide x length required.
- O. Polyethylene Sheet: Clear, 6 mil thick, with self-adhesive tape.
- P. Wire: ASTM A641, Class 1 coating (galvanized), soft temper.
- Q. Powder Activated Fastener: 0.145 inch diameter SDM flat head nail with washer as manufactured by Hilti, Inc., ICBO Report No. 2388.
- R. Continuous Stucco Soffit Vent: Equivalent to Fry Reglet WPM-75-V-300; extruded aluminum alloy 6063 T5; anodized aluminum finish.

2.6 SUSPENDED METAL CEILING FRAMING

- A. Runner Channels: 1-1/2 inch high cold rolled steel, .475 lb./ft., galvanized or coated with rust inhibitive paint; length as required.
- B. Furring Channels: 3/4 inch high cold rolled steel, .30 lb./ft., galvanized or coated with rust-inhibitive paint.
- C. Hanger Wires: ASTM A641, No. 8 gauge galvanized soft temper wire.
- D. Tie Wire: ASTM A641, No. 18 gauge galvanized soft temper wire.
- E. Compression struts as indicated on Drawings.

2.7 CEMENT PLASTER MIXES

- A. Mix and proportion cement plaster in accordance with ASTM C926 and the Plaster Assembly Manual, by TSIB.

- B. Base Coat and Brown Coat: One part cement, minimum 3-1/2 and maximum 4 parts aggregate, and 0-3/4 parts hydrated lime, and alkali resistant glass fibers at a rate of 1 lb. per sack of cement.
- C. Job Mixed Finish Coat: One part cement, three parts aggregate, and one part lime.
- 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 re-temper mixes after initial set has occurred.

2.8 CEMENT PLASTER FINISHES

- A. Unless noted otherwise, all interior plaster surfaces shall be smooth finish.
- B. All exterior plaster surfaces below 9 feet shall be smooth finish. Finishes above 9 feet may be lightly textured in accordance with those patterns indicated in the Plaster Assembly Manual and as approved by the Architect.
- C. Plaster surface finishes must be capable of receiving roller-applied paint (medium texture) without leaving pinholes or voids.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Confirm that site conditions and substrates are ready for work covered under this section to commence. If not, Contractor to make suitable repairs or adjustments to the work.
- B. Grounds and Blocking: Verify items within walls for other Sections of Work have been installed.
- C. Mechanical and Electrical: Verify services within walls have been tested and approved.
- D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - LATHING MATERIALS

- A. Install metal lathing in accordance with ML/SFA 920, ASTM C1063 and as specified herein.
- B. On vertical surfaces apply two plies of WRB underlayment over substrate; weatherlap horizontal edges 4 inches, vertical edges 6 inches. Fasten in place.

- C. Install penetration flashing around all openings and penetrations in exterior walls, soffits and ceilings in compliance with CCR, Title 24, Part 2, Section 1402A, including sealant and in conformance with recommendations contained in Plaster and Lathing Systems Manual and ML/SFA 920.
- D. Apply self-furring reinforcement with self-furring ribs perpendicular to supports for horizontal surfaces.
- E. Apply metal lath taut, with long dimension perpendicular to supports for vertical surfaces.
- F. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.
- G. Lap sides of expanded metal lath minimum 1-1/2 inches. Nest outside ribs of rib lath together.
- 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 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. Maximum spacing 6 inches on center.
- J. 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.
- K. 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 on center and not more than 3 inches from the edge of each sheet. Such staples may be placed over the ribs of 3/8 rib lath or over the back wire of other approved lath at 27 inches on center omitting the 10d nails.
- L. Continuously reinforce internal angles with corner mesh, except where corner joint No. 30 is shown. Fasten at perimeter edges only.
- M. Place beaded external angle with mesh at corners. Fasten at outer edges only.
- N. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- O. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.

- P. Place window/door drip screed at head of all windows and door openings in exterior walls.
- Q. 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. WRB underlayment and lath shall cover and terminate on the attachment flange of the screed.
- R. Place drip screed at base of all vertical plaster applications which do not terminate at framed wall openings or at foundation line.
- S. Place vent screed in soffit areas as indicated.
- T. 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.
- U. Install accessories to lines and levels.

3.3 INSTALLATION - SUSPENDED METAL CEILING FRAMING

- A. Install in accordance with ASTM C1063.
- B. Coordinate location of hangers with other Work.
- C. Install ceiling framing independent of walls and columns.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum of 24 inches past end of openings.

3.4 CONTROL AND EXPANSION JOINTS

- A. Locate interior control and expansion joints as indicated on the Drawings, but not to exceed 20 feet on center, horizontally or vertically.
- B. Locate exterior control and expansion joints as indicated on Drawings.
- C. Establish control and expansion joints with specified joint device.
- D. Install expansion joint in such a way as to assist with air seal continuity.
- E. Coordinate joint placement with other related Work.

3.5 PLASTERING

- A. Apply plaster in accordance with ASTM C926 and the Plaster Assembly 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: Apply bonding agent to substrate. Wet surface if required. At concrete, masonry, and existing plaster surfaces, apply 3/8 inch thick leveling coat and then 1/8 inch finish coat.
- D. No flat horizontal surfaces in restrooms. Restrooms are designed to be hosed down daily. Plaster at base of windows, tops of stub walls and other flat surfaces shall be gently sloped so as not to allow any standing water.
- E. Coved corners and beveled edges in restrooms: All inside corners and intersections of walls and ceilings shall receive a 1/2 inch cove. All beveled edges around windows, doors, and other projections shall receive a 1/2 inch beveled edge.
- F. Moist cure scratch and brown coats. Do not apply brown coat sooner than 48 hours following scratch coat.
- G. After curing, dampen base coat prior to applying finish coat. Do not apply finish coat sooner than 7 days following brown coat.
- H. Apply finish plaster in two coats evenly and uniformly. Machine or trowel or finish spray as indicated. Apply as recommended based on finish texture selected. Apply first coat to provide texture pattern; second coat to obtain uniformity in color and texture.
- I. Moist cure finish coat for minimum period of 48 hours only when strong dry wind conditions exist.

3.6 FINISH COAT TEXTURE

- A. Medium Sand Float as defined by photographs and application procedures in the Plaster Assembly Manual, recent edition, and as indicated.

3.7 TOLERANCES

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

3.8 CLEANING

- A. Remove protective masking.
- B. Remove any overspray from surrounding materials.
- C. Clean adjacent affected surfaces.

3.9 PLASTER APPLICATION SCHEDULE

- A. Exterior Vertical Surface of Existing Plaster Building Walls: Two coat plaster over bonding agent.

- B. Exterior Vertical Surface of Existing Plaster Building Walls Where Necessary: Three coat plaster over metal lath and underlayment.
- C. Exterior Vertical Surface of Framed Walls: Three coat plaster over metal lath and underlayment.
- D. Exterior Horizontal Framed Surfaces: Three coat plaster over metal lath.
- E. As indicated on Drawings.

END OF SECTION

SECTION 09 26 13 GYPSUM VENEER PLASTERING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Gypsum Plaster Base
 - 1. Regular
 - 2. Fire-Rated
 - 3. Fire-Rated, Abuse Resistant
- B. Gypsum Veneer Plaster

1.2 PERFORMANCE CRITERIA

- A. Wall Assembly Fire-Resistance Rating: Non-rated.

1.3 SUBMITTAL / MOCK-UP

- A. Per Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURER / PRODUCTS

- A. Basis of Design: Products of National Gypsum Company

2.2 GYPSUM PLASTER BASE

- A. Basis of Design: Gold Bond® BRAND Kal-Kore Plaster Base
 - 1. Panel Physical Characteristics
 - a. Core: Regular gypsum core lathing panel
 - b. Surface Paper: Absorptive paper on front and long edges
 - c. Long Edges: tapered
 - d. Overall Thickness: 1/2 inch
 - e. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board

2.3 FIRE-RESISTANCE RATED GYPSUM PLASTER BASE

- A. Basis of Design: Gold Bond Kal-Kore Fire-Shield Plaster Base
 - 1. Type X, Panel Physical Characteristics

- a. Core: Fire resistance rated gypsum core
- b. Surface Paper: Absorptive paper on front and long edges
- c. Long Edges: tapered
- d. Overall Thickness: 5/8 inch
- e. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board, Type X

B. Basis of Design: Gold Bond® BRAND Kal-Kore Fire-Shield C Plaster Base

1. Type C, Panel Physical Characteristics

- a. Core: Gypsum core lathing panel with additives to enhance the fire resistance
- b. Surface Paper: Absorptive paper on front and long edges
- c. Long Edges: tapered
- d. Overall Thickness: ½ inch
- e. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board, Type X

2.4 FIRE-RESISTANCE RATED, ABUSE-RESISTANT PLASTER BASE

A. Basis of Design: Gold Bond® BRAND Hi-Abuse Kal-Kore Fire-Shield Plaster Base

1. Type X, Panel Physical Characteristics

- a. Core: Gypsum core lathing panel with additives to enhance the fire and impact resistance
- b. Surface Paper: Absorptive paper on front and long edges with heavy liner paper bonded to the back side
- c. Long Edges: tapered
- d. Overall Thickness: 5/8 inch
- e. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board, Type X

2.5 BASE PLASTER

A. Basis of Design: Gold Bond® BRAND Kal-Kote Base Plaster

1. Physical Characteristics

- a. Complies with requirements of ASTM C 587 Standard Specification for Gypsum Veneer Plaster

2.6 FINISH PLASTER

A. Basis of Design: Gold Bond® BRAND Kal-Kote smooth finish Plaster

1. Physical Characteristics

- a. Complies with requirements of ASTM C 587 Standard Specification for Gypsum Veneer Plaster
- b. Finish: as selected by Architect

2.7 ONE COAT GYPSUM PLASTER

A. Basis of Design: Gold Bond® BRAND X-KALibur Veneer Plaster

1. Physical Characteristics

- a. Complies with requirements of ASTM C 587 Standard Specification for Gypsum Veneer Plaster
- b. Finish: as selected by Architect

2.8 AUXILIARY MATERIALS

A. Silica Sand: Complying with ASTM C 35 Specification for Inorganic Aggregates for Use in Gypsum Plaster

B. Water: Potable

2.9 ACCESSORIES

A. Joint Treatment

1. Joint Reinforcing Tape: 2-1/16 in. wide paper reinforcing tape (ProForm Brand Joint Tape)
2. Joint Reinforcing Tape: 2-1/2 in. wide coated fiberglass reinforcing tape (Kal-Mesh Tape)

B. Trim: per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION, PLASTER BASE

A. Install in accordance with manufacturer recommendations and in accordance with ASTM C 844 Specification for Application of Gypsum Base to Receive Veneer Plaster.

3.2 INSTALLATION, GYPSUM VENEER PLASTER

A. Install in accordance with manufacturer recommendations and in accordance with ASTM C 843 Specification for Application of Gypsum Veneer Plaster.

END OF SECTION

SECTION 09 28 13 CEMENTITIOUS BACKING BOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Membrane under backing board.
- B. Cementitious backing board.
- C. Preparation of surface to receive special coatings.

1.2 REFERENCES

- A. ANSI/TCA A108.11 - Interior Installation of Cementitious Backer Units.
- B. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- C. ANSI/TCA A118.9 - Test Methods and Specifications for Cementitious Backer Units.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data for materials specified.

1.4 MOCK-UP

- A. Provide mock-up of finish substrate in accordance with Section 09 67 01.

1.5 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A108.11 and A118.9 for backing board.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in applying the Work of this Section with minimum five years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain 50 degrees Fahrenheit during installation.

PART 2 - PRODUCTS

2.1 BACKING BOARD MATERIALS

- A. Backing Board: ANSI/TCA A118.9; high density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners; manufacturer shall be licensed by TCA. Material containing "Styrofoam" additive or a rippled or pinholed surface will be rejected.

2.2 MORTAR MATERIALS

- A. Portland Cement Mortar Materials: ANSI/TCA A118.1.
- B. Latex-Portland Cement Mortar: ANSI/TCA A118.4 and the following:
 - 1. Acrylic resin latex additive.
 - 2. Dry mortar mix supplied by latex manufacturer.

2.3 ACCESSORIES

- 1. Membrane: ASTM D226; No. 15 asphalt saturated roof felt. Provide on stud face for full height of wall.
- 2. RedGard Waterproofing and crack prevention membrane or approved equal. Provide over surface of cementitious backer board. Overlap 6 inches to adjacent gypsum wallboard where applicable.

2.4 JOINT FILLER MIX

- A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions and referenced standards.

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.

3.3 INSTALLATION

- A. Install vapor barrier over substrate; weatherlap horizontal edges 4 inches, lap vertical edges 6 inches, and tape all joints as recommended by manufacturer.
- B. Coordinate installation of backing board with application of finish surfaces. Install with the rough side exposed.
- C. Install backing board in accordance with manufacturer's instructions and ANSI/TCA A108.11. Tape joints and corners. Chamfer all exposed corners to create a 1/2 inch radius.
- D. Smooth finish with skim coat of dry-set mortar to conceal all joints, fasteners, and imperfections in the board surface, to a feather edge, to make the entire surface "paint ready".
- E. Obtain acceptance of special coatings applicator prior to final completion.

3.4 CLEANING

- A. Clean Work under provisions of Division 1.

END OF SECTION

SECTION 09 29 00 GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Gypsum board.
- B. Taped and sanded joint treatment.
- C. Surface primer.
- D. Texture finish.
- E. Level 5 finish, if indicated.
- F. Resilient furring channels.
- G. Metal channel ceiling framing.

1.2 RELATED SECTION

- A. See 12 35 00, Educational Casework, 2.3.A.10, for high-pressure laminate finish for impact-resistant interior panel.

1.3 REFERENCES

- A. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.
- B. ASTM C1396 - Gypsum Wallboard.
- C. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- D. ASTM C514 - Nails for the Application of Gypsum Wallboard.
- E. ASTM C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- F. ASTM C630 - Water Resistant Gypsum Backing Board.
- G. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- H. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- I. ASTM C754 - Installation of Steel Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.

- J. ASTM C840 - Application and Finishing of Gypsum Board.
- K. ASTM C919 - Use of Sealants in Acoustical Applications.
- L. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.
- M. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.
- N. ASTM E90 - Method for Laboratory Measurement of Airborne Sound transmission Loss of Building Partitions.
- O. GA 201 - Using Gypsum Board for Walls and Ceilings.
- P. GA 214 - Levels of Gypsum Board Finish.
- Q. GA 216 - Application and Finishing of Gypsum Board.
- R. GA 600 - Fire Resistance Design Manual.
- S. CBC - California Building Code.
- T. UL - Underwriters Laboratories.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in gypsum board systems, with five years documented experience.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC, Chapter 7, and UL and GA requirements for fire-rated assemblies.

1.6 ACOUSTICAL PERFORMANCE

- A. Acoustical attenuation for interior partitions, where indicated, shall be STC rating in accordance with ASTM E90.

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 square feet 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.

1.9 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Provide Product Data for all items specified.
- C. Submit 12 inch square Samples of each texture finish specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Georgia Pacific Corp.
- B. National Gypsum Company.
- C. United States Gypsum Co..
- D. Substitutions: Under provisions of Section 01 62 00.

2.2 FRAMING MATERIALS

- A. Metal Furring: ASTM C645, hat-shaped, 7/8 inch deep, .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 .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 .475 pounds per foot.
- 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 C36; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

- B. Fire-Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.
- C. Moisture-Resistant Gypsum Board: ASTM C630; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.
- D. Impact-Resistant Interior Panel: ASTM C1658, C1396 Section 7 and C1177; test standard ASTM C1629; 5/8 inch thick; tapered edges; coated fiberglass facings with embedded fiberglass core reinforcement.

2.4 ACCESSORIES

- A. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
 - 1. "Sheetrock Acoustical Sealant", manufactured by United States Gypsum Company.
 - 2. "BA-98 Acoustical Sealant", manufactured by Pecora Corporation.
 - 3. "Tremco Acoustical Sealant", manufactured by Tremco, Inc.
- B. Fire-Rated Sealant: As specified in Section 07 84 00.
- C. Corner Beads: Metal, hot dip galvanized.
- D. Edge Trim: GA 201 and GA 216; Type LC bead, unless otherwise indicated.
- E. Control Joints: Roll-formed zinc, USG No. 093, or approved equal.
- F. Spot Grout: ASTM C475, setting-type joint compound.
- G. Joint Materials: 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. Primer: Flat latex basecoat paint equivalent to "First Coat" manufactured by United States Gypsum Company.
- I. Spray Texture Finish: Equivalent to "USG Spray Texture Finish", orange peel texture, manufactured by United States Gypsum Company.
- J. Other Textures: To match existing.
- K. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.

- L. Adhesive for Application Over Hard Surfaces: Mastic glue as recommended by the gypsum board manufacturer for the specific substrate.

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 walls.
- B. Erect metal furring vertically at 16 inches on center. Secure in place on alternate channel flanges at maximum 24 inches on center.

3.3 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Space resilient furring channels horizontally at maximum 16 inches on center, 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. 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, 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 at 3 feet on center 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 feet on center 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 on center.
- 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.
- B. Install membrane over substrate; weatherlap horizontal edges 4 inches, vertical edges 6 inches.

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 CBC fire-rated assembly.

- H. Install firestop sealant at wall penetrations and terminations in accordance with required UL, CBC, or GA fire-rated assembly in accordance with Section 07 84 00.
- I. Treat cut edges and holes in moisture-resistant gypsum board with sealant.
- J. Place control joints as indicated on the Drawings.
- K. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- L. 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.
- D. On concave side of partition, start fastening panels at center of curve and work outward to panel ends.
- E. Allow wetted panels to dry before applying joint treatment.

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 space where panels abut other construction penetrations.
- C. Fasten with corrosion-resistant screws.

3.9 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 3 Treatment:

1. Not used.

G. Level 4 Treatment:

1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, angles, fasteners, and accessories.
2. All compound shall be smooth and free of tool marks and ridges.
3. Sand lightly between coats, taking care not to roughen face paper.
4. Use for all surfaces that are scheduled to receive a textured and painted finish, except areas of food service and preparation, or a surface applied wallcovering.
5. Where patching skip-trowel, knock-down or other finishes, match existing to the greatest extent possible.

H. 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 a thin skim coat of topping compound over entire surface.
3. All compounds shall be smooth and free of tool marks and ridges.

4. Sand lightly between coats.

3.10 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. Trowel-apply patch-to-match textures to match existing.
- D. Remove any overspray of texture finish from door frames, windows, and other adjoining construction.

3.11 TOLERANCES

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

3.12 SCHEDULE

- A. Existing Construction: Patch-to-match, or if exceeds 30% of existing wall, strip and replace to the nearest surface break and treat this area as new construction.

Room Type	Wallboard System	Finish Type	Notes
Typical Surfaces (Classrooms, corridors, office/work areas)	5/8", Type X	Match existing	
Wet Areas (Other than gang restrooms or see 09 24 00 if cement plaster.)	5/8", Type MR	Level 5 or coordinate with final surface	If tile, substrate is specified elsewhere.
High Abuse Areas (MPR / Cafeteria/Stage)	5/8" high impact fire-shield 2000	Level 5	
Gang Restrooms (See 09 30 13)	5/8", Type MR	Level 5 or coordinate with final surface	If tile, substrate is specified elsewhere
Fire-Rated Underlayment	5/8" Type X	Tape joints only	Use only in conjunction with a finish surface overlay system.

- B. New Construction: Note: New construction may be over wood or metal frame construction.

Room Type	Wallboard System	Finish Type	Notes
Typical Surfaces (Classrooms, corridors, office/work areas)	5/8", Type X	Level 5	All surfaces Accent surfaces only, such as Soffits.
Wet Areas	5/8", Type MR	Level 5 or coordinate with final surface	Coordinate finish with final surface treatment
Shaft Walls	Shaft wall system to suit	Finish outside per above, if exposed	
High Abuse Areas (MPR/Cafeteria / Stage)	5/8" High- Impact Fire- Shield 2000	Finish per above.	
Gang Restrooms (See 09 30 13)	5/8", Type MR	Level 5 or coordinate with final surface	If tile, substrate is specified elsewhere
Fire-Rated Underlayment	5/8" Type	Tape joints only	Use only in conjunction with a finish surface overlay system

END OF SECTION

SECTION 09 30 13 CERAMIC TILE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Glazed ceramic tile.
- B. Unglazed ceramic tile.
- C. Porcelain Tile Wall Panels.
- D. Cementitious backing board.
- E. Grout.
- F. Accessories.

1.2 REFERENCES

- A. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
- B. ANSI A118.6 - Ceramic Tile Grouts.
- C. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
- D. ANSI A137.1 - Specifications for Ceramic Tile.
- E. ASTM C1028 – Static Coefficient of Friction of Ceramic Tile.
- F. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.
- G. ASTM D2047 – Static Coefficient of Friction Test.
- H. TCNA (Tile Council of North America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit Product Data for all materials specified.
- C. Samples: Mount tile and apply grout on two 24 inch x 24 inch plywood panels, representative of pattern, color variations, and grout joint size variations.
- D. Submit manufacturer's installation instructions, maintenance data, and recommended cleaning and stain removal methods and cleaning materials.

1.4 QUALITY ASSURANCE

- A. Conform to ANSI A137.1 for tile material.
- B. Conform to ANSI Standards and TCNA Handbook for tile installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in applying the Work of this Section with minimum five years documented experience.
- C. Installer for thin porcelain tile panels to have a minimum of three documented years installation experience with this specific product.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain minimum 50 degrees Fahrenheit during installation of grout materials.

1.7 EXTRA STOCK

- A. Provide extra quantity of full size tile and trim shape units to District under provisions of Section 01 70 00.
- B. Provide quantity equal to 2 percent of units installed of each shape and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - TILE

- A. Basis of Design: Interceramic USA, Carrollton, TX.
- B. Substitutions: Under provisions of Section 01 25 00.

2.2 TILE MATERIAL

- A. Ceramic Wall Tile TW1-TW4: Interceramic Aquarelle
 - 1. Size: 10" x 20".
 - 2. Patterns / Colors: To be selected by Architect from manufacturer's full range of patterns.
 - 3. Tile Thickness: 8.15 mm.
- B. Ceramic Wall Tile TW5: Interceramic Construct

1. Patterns / Colors: To be selected by Architect from manufacturer's full range of patterns.
 2. Size: 12" x 24".
 3. Thickness: 11.2 mm.
- C. Ceramic Wall Tile TW6: Interceramic Construct Mosaic decorative accents, on mesh back sheet.
1. Patterns / Colors: To be selected by Architect from manufacturer's full range of patterns.
 2. Size: 12" x 12".
 3. Thickness: 11.2 mm.

2.3 GROUT MATERIALS

- A. Mapei Kerapoxy CQ epoxy grout.

2.4 ACCESSORIES

- A. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.
- B. Backing Board: ANSI/TCA A118.9; high density, cementitious, glass fiber reinforced, 1/2 inch thick minimum; 2 inch wide coated glass fiber tape for joints and corners; manufacturer shall be licensed by TCA.
- C. Sealant: Type specified in Section 07 90 00.

2.5 GROUT MIX

- A. Mix and proportion grout materials in accordance with manufacturer's instructions and referenced standards.
- B. Epoxy Grout – mix two-part epoxy grout resin and hardener.

2.6 SEALER

- A. Tile and Grout Sealer: "Aqua Mix Penetrating Sealer" manufactured by Aqua Mix, Inc., (562) 946-6877, or approved equal.

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 - GENERAL

- A. Install tile and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCNA Handbook.
- B. Install membrane over substrate; weatherlap horizontal edges 4 inches, lap vertical edges 6 inches.
- C. Lay tile to pattern indicated. If not indicated, request from Architect. Do not interrupt tile pattern around openings.
- D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align wall, base, and floor joints.
- E. 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.
- F. Form internal angles square and external angles bullnosed.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control joints free of mortar or grout. Apply sealant to joints.
- I. Allow tile to set for a minimum of 48 hours prior to grouting.
- J. Grout tile joints.
- K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 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. Shower areas in accordance with TCA B415-09
- B. Install backing board in accordance with manufacturer's instructions and ANSI/TCA A108.11. Tape joints and corners; cover with skim coat of dry-set mortar to a feather edge.

3.5 PORCELAIN TILE PANELS

- A. Apply mortar to both the substrate and the panel backs. Mortar to be applied to a minimum 95% coverage to both panel backs and substrate. Apply as per Technical Bulletin TB60, by Custom Building Products.
- B. Installation & Setting Materials: Consult Technical Bulletin No. 46 (TB46) by Custom Building Products, regarding materials and accessories.
- C. Limit lippage of panels to 1/16", as per TB60.
- D. Grouting Porcelain Panels: Strike grout joints clean of excess mortar which will reduce the effective depth of the grout.

3.6 CLEANING

- A. Clean Work per manufacturer's written recommendations.

3.8 SEALING

- A. Install sealer on all surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 51 00 ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical panels.
- C. Perimeter trim.

1.2 REFERENCES

- A. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- B. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- D. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- E. ASTM E580 - Application of Ceiling Suspension Systems from Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- F. ASTM E1264 - Classification of Acoustical Ceiling Products.
- G. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25A.
- H. DSA - Division of the State Architect.
- I. CBC - California Building Code.
- J. 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 CCR Title 24, Part 2, for suspension system requirements.
- B. Suspension system shall be acceptable to DSA and have current product acceptance number issued by DSA.
- C. Conform to applicable UL and CBC combustibility requirements for materials.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Provide Product Data on metal grid system components and acoustic units.
- C. Provide product acceptance approval verification issued by DSA for metal grid system.
- D. Submit two 6-inch squares Samples illustrating material and finish of acoustic units.
- E. Submit two 12-inch long Samples of suspension system main runner, cross runner, and edge trim.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees Fahrenheit, and humidity of 20 to 40 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 70 00.
- B. Provide quantity equal to 2 percent of units installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - SUSPENSION SYSTEM

- A. Armstrong Ceiling Systems. DSA Product Acceptance No. PA-041.

- B. Chicago Metallic Corporation. DSA Product Acceptance No. PA-026.
- C. USG Interior Systems, (DONN). DSA Product Acceptance No. PA-030.
- D. Substitutions: Under provisions of Section 01 62 00.

2.2 SUSPENSION SYSTEM MATERIALS

- A. Basis of Design: Chicago Metallic 4000 Tempura 9/16" grid system 2'x2'.
- B. Grid: ASTM C635, heavy duty, non-fire-rated; components die-cut and interlocking. 2 feet x 2 feet.
- C. Accessories: Stabilizer bars, clips, splices, and edge moldings required for suspended grid system.
- D. Grid Materials: Commercial quality cold-rolled steel with galvanized coating.
- E. Grid Finish: Off-White color, baked enamel.
- F. 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.
- G. Compression Strut: ASTM A513, telescoping design as detailed on Drawings, 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 or equivalent pre-manufactured compression post supplied by ceiling grid manufacturer.
- H. Hanger Wire: ASTM C641, Class 1 coating (galvanized), soft temper, No. 12 gage.

2.3 ACCEPTABLE MANUFACTURERS - ACOUSTIC UNITS

- A. Armstrong Ceiling Systems.
- B. BPB Celotex.
- C. Chicago Metallic Corporation.
- D. Rockfon North America.
- E. USG Interiors, Inc.
- F. Substitutions: Under provisions of Section 01 25 00.

2.4 ACOUSTIC UNIT MATERIALS

- A. Basis of Design: Rockfon North America "Sonar Activity" acoustic tiles.

- B. Acoustic Panels: ASTM E1264, conforming to the following:
1. Equivalent to "Sonar Activity" panel, or approved equal.
 - a. Size: 24 x 24 inches.
 - b. Thickness: 1-1/2 inches.
 - c. Composition: Stone wool (mineral wool), with factory-painted glass scrim surface.
 - d. Light Reflectance: .85.
 - e. NRC Range: .90.
 - f. Edge: angled tegular.
 - g. Surface Color: White.
 - h. Flame Spread :(0-25) Class A, UL 25 or under.
 - i. Smoke Density: Not to exceed 450 when tested in accordance with UL Standard 723-03.

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 Drawings 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. Provide cross-struts at four-foot centers for acoustic panels and at two-foot centers for metal panels.

- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest effected hangers and related carrying channels to span the extra distance.
- E. Compression struts shall be installed at each main runner not exceeding 12 feet on center 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 metal 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 grid system on room axis according to reflected ceiling plan. Trim edge panels precisely to fit using table saw. Reject cut pieces which are deformed or damaged during cutting.
- 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 reveal cut edge of perimeter tiles to match factory reveal 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 44 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 16 RESILIENT FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Vinyl composition tile flooring.
- B. Rubber tile flooring.
- C. Linoleum sheet flooring.
- D. Vinyl sheet flooring.
- E. Rubber sheet flooring.
- F. Resilient sheet stage flooring.
- G. Resilient stair treads.
- H. Resilient top-set base.
- I. Calcium chloride, relative humidity and alkalinity concrete moisture testing.

1.2 REFERENCES

- A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.
- B. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM D2047 - Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
- D. ASTM E648 - Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Energy Source.
- E. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- F. ASTM F710 - Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.
- G. ASTM F970 - Standard Test Method for Static Load Limit.
- 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 F1869 - Test method for moisture content.
- L. FS RR-T-650 - Treads, Metallic and Non-metallic, Non-skid.
- M. FS SS-T-312b - Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.
- N. ASTM F1861 - Wall Base: Rubber and Vinyl Plastic.
- O. NFPA 258 - Recommended Practice for Determining Smoke Generation of Solid Materials.
- P. ASTM F1869 – Standard test Method for Moisture Vapor Emission Rate of Concrete
- Q. ASTM F2170 – Standard test Method for Determining Relative Humidity in Concrete

1.3 REGULATORY REQUIREMENTS

- A. Resilient flooring shall 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. Products supplied for tile installation shall comply with local regulations controlling use of volatile organic compounds (VOC).
- C. Resilient flooring products shall have a minimum coefficient of friction when tested according to ASTM D2047 of 0.60 for flat floors and 0.80 for ramped surfaces.
- D. Conform to CCR, Title 24, Part 2, and ADAAG for access for the handicapped.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit substitutions under provisions of Section 01 62 00.
- C. Submit two 3-inch square Samples illustrating color and pattern for each floor material specified.
- D. Submit two 2-inch long Samples of base and stair material for each material specified.

- E. Submit two copies of concrete test results and locations map with manufacturer's acceptance of concrete slab as substrate.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Division 1.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Concrete subfloor shall 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.

1.7 EXTRA MATERIALS

- A. Provide 100 square feet of flooring and 100 lineal feet of base and stair materials of each material specified under provisions of Section 01 70 00.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE FLOORING

- A. Manufacturers: Armstrong World Industries, Mannington Commercial, or approved equal.
- B. Vinyl Composition Tile: ASTM F1066, Composition 1, Class 2; 12 inch x 12 inch size, 1/8 inch thick.
- C. Pattern: Equivalent to "Standard Excelon Imperial Texture" or "Multicolor" as manufactured by Armstrong, to be selected by Architect from manufacturer's entire color range.
- D. Feature Strips: Of same material as tile; 2 inches wide.

2.2 RUBBER TILE FLOORING

- A. Manufacturers: Burke, Flexco Company, Johnsonite, Roppe Corporation, Noraplan, or approved equal.
- B. Rubber Tile: ASTM F1344, Class I, Type B mottled color, 12 inch x 12 inch size, .125 inch thick.

- C. Pattern: Equivalent to “Constellation Marble” or “Aria”, manufactured by Burke Flooring Products, to be selected by Architect from manufacturer’s entire color range.

2.3 LINOLEUM SHEET FLOORING

- A. Manufacturers: Armstrong World Industries, “Marmorette”; Forbo Industries, Inc., “Marmoleum Real” or “Marmoleum Fresco”; or approved equal.
- B. Linoleum Sheet Flooring: ASTM F2034, sheet linoleum material consisting of linseed oil, wood flour and rosin binders meeting the following characteristics:
 - 1. Thickness: 2.5 millimeters.
 - 2. Width: Approximately 6 feet 6 inches.
 - 3. Length: Approximately 98 feet.
 - 4. Static Load Limit: ASTM F970, 450 psi.
 - 5. Backing: Jute.
 - 6. Pattern and Color: Extending throughout material. To be selected by Architect from manufacturer’s entire range.
- C. Integral Coved Base: Self-coved of same material as flooring, 6 inches high with continuous extruded aluminum cap trim and fillet support strip.

2.4 VINYL SHEET FLOORING

- A. Manufacturer’s: Armstrong World Industries, Azrock Industries, Tarkett, or approved equal.
- B. Vinyl Sheet Flooring: ASTM F1303, Type II, Grade 1, polyvinyl chloride.
 - 1. Overall Thickness: 0.080 inch.
 - 2. Minimum Weight: 5.3 ounces per square yard.
 - 3. Static Load Unit: Not less than 450 pounds per square inch.
 - 4. Welding Rods: By flooring manufacturer, in color to match selected color of flooring.
 - 5. Patterns and Colors: To be selected by Architect from manufacturer’s entire range.
- C. Integral Coved Base: Self-coved of same material as flooring, 6 inches high with continuous extruded aluminum cap trim and fillet support strip.

2.5 RUBBER SHEET FLOORING

- A. Manufacturers: “Noraplan” Rubber Flooring, or approved equal.
 - 1. Overall Thickness: 3 millimeters.
 - 2. Welding Rods: By flooring manufacturer in color to match selected color of flooring.
 - 3. Patterns and Colors: To be selected by Architect from manufacturer’s entire range.
- B. Integral Coved Base: Self-coved of same material as flooring, 6 inches high with continuous extruded aluminum cap trim and fillet support strip.

2.6 RESILIENT SHEET STAGE FLOORING

- A. Manufacturers: Lonseal, Inc., or approved equal.
- B. Resilient Sheet Stage Flooring: 0.080 inch total thickness, 7 pounds per square foot, Type 1, Grade 1, Class A backing, conforming to ASTM F1303, ASTM F970, ASTM E648, and NFPA 258 with coefficient of friction dry 0.77 and wet 0.92. Class 1 fire rating.
- C. Pattern: Equivalent to “Lonstage Black” matte finish, as manufactured by Lonseal, Inc.

2.7 RESILIENT STAIR TREADS

- A. Manufacturers: Burke, Flexco Company, Johnsonite, Roppe Corporation, or approved equal.
- B. Resilient Stair Treads: FS RR-T-650, Type 2 raised diamond pattern equivalent to “Natural Illusions”, as manufactured by Burke Flooring Products; Composition A Rubber; 1/4 inch thick, full width and depth of stair tread in one piece; return down nosing edge of tread 1-1/2 inch with tapered thickness. Two-inch visual warning strip of contrasting color and texture on top and bottom tread.
- C. Stair Risers and Stringers: Paint per Specification Section 09 91 00.

2.8 RESILIENT TOP-SET BASE

- A. Manufacturers: Armstrong World Industries, Burke, Roppe Corporation, or approved equal.
- B. Resilient Top-Set Base: ASTM F1861, rubber; Style B coved; 6 inches high; 0.125 inch thick.

2.9 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Edge Strips: Vinyl type, color as selected by Architect.
- D. Sealer and Wax: Types recommended by flooring manufacturer.
- E. Welding Rods for Linoleum Flooring: Color matched welding rod.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that concrete slabs comply with ASTM F710.
- B. Verify concrete floors exhibit acceptable moisture emission rate; 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. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
- C. Prohibit traffic from area until filler is cured.
- D. Vacuum clean substrate.
- E. Apply primer to concrete slab surfaces if recommended by flooring manufacturer.

3.3 INSTALLATION - TILE AND SHEET MATERIAL

- A. Install in accordance with manufacturers' 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. Install tile to square grid pattern with all joints aligned and to pattern indicated on drawings.
- F. Pattern grain parallel for all units and parallel to width of room. Allow minimum 1/2 full size tile width at room or area perimeter.
- G. Lay flooring with seams parallel to length of room to produce minimum number of seams. Provide minimum of 1/3 full roll width. Double cut sheet and continuously heat weld seams.
- H. Terminate flooring and provide rubber edge strip at centerline of door openings where adjacent floor finish is dissimilar.
- I. Install edge strips at unprotected or exposed edges, and where flooring terminates.
- J. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- K. Install flooring in pan type floor access covers. Maintain floor pattern.
- L. Install flooring under movable partitions and under cabinetry without interrupting floor pattern.
- M. Install feature strips, edge strips, and floor markings where indicated. Fit joints tightly.
- N. Allow for 25 percent accent color pattern unless noted otherwise.
- O. Heat weld all seams of sheet flooring.

3.4 INSTALLATION - BASE MATERIAL

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners.
- C. Field wrap external corners with longest practical lengths. "V" cut back surface to 2/3 its thickness.
- D. Install base on solid backing. Bond tight to wall and floor surfaces.
- E. Scribe and fit to door frames and other interruptions.
- F. Install base at casework where occurs in rooms scheduled for rubber base.
- G. Install integral coved base in flash-coved method. Install cap trim at top of base where edge of flooring is exposed. Install radiused backing fillet at wall and floor juncture. Heat weld all seams.

3.5 INSTALLATION - STAIR COVERING MATERIALS

- A. Install stair treads, one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

3.6 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.

3.7 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean, seal and wax floor and base surfaces in accordance with manufacturer's instructions.
- C. At the very minimum, four layers of wax shall be applied, sufficient to fully seal the floor surface to a smooth lustrous finish and to completely fill all joints and any voids or cracks between tiles.
- D. The finished floor, completely waxed, shall be reviewed by the Owner and deemed satisfactory. If, in the opinion of the Owner, additional coats are required, the Contractor shall apply these at no expense to the Owner.

END OF SECTION

SECTION 09 65 19

LUXURY VINYL TILE (LVT)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Luxury Vinyl Tile (LVT)

1.2 REFERENCES

- A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.
- B. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM D2047 – Slip Resistance: >.055 wet/dry, ADA compliant
- D. ASTM E492 – IIC Sound Rating: >= 57IIC
- E. ASTM E648 – Radiant Flux: Class 1
- F. ASTM E662 – Smoke Density Test: <= 450
- G. ASTM E2179 – Impact Sound Reductions Test
- H. ASTM F137 – Flexibility
- I. ASTM F386 – Thickness
- J. ASTM F925– Staining Test
- K. ASTM F970 – Static Load Limit: 1,500 psi
- L. ASTM F1514 – Resistance to Heat Test
- M. ASTM F1515 – Resistance to Light Test
- N. ASTM F1700 – Class III Commercial, Type B printed vinyl plank
- O. ASTM F1914 – Residual Indentation
- P. ASTM F2055 – Size & Squareness
- Q. ASTM F2199 – Dimensional Stability Test

1.3 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry

- B. Section 09 30 13 – Ceramic Tile
- C. Section 09 65 16 – Resilient Flooring

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit Product Data for all materials specified.
- C. Samples: Mount tile and apply grout on two 24 inch x 24 inch plywood panels, representative of pattern, color variations, and grout joint size variations.
- D. Submit manufacturer's installation instructions, maintenance data, and recommended cleaning and stain removal methods and cleaning materials.

1.5 REGULATORY REQUIREMENTS

- A. LVT flooring shall comply with the following fire performance characteristics as determined by testing products per ASTM test method indicated below:
 - 1. Critical Radiant Flux: Class I, per ASTM E648
 - 2. Smoke Density: Less than 450 per ASTM E662.
- B. Products supplied for tile installation shall comply with local regulations controlling use of volatile organic compounds (VOC).

LVT flooring products shall have a minimum coefficient of friction when tested according to ASTM D2047 of 0.55 for flat floors and 0.80 for ramped surfaces.
- C. Conform to CCR, Title 24, Part 2, and ADAAG for access for the handicapped.

1.6 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A137.1 for tile material.
- B. Conform to ANSI/TCA Standards and TCA Handbook for tile installation.

1.7 WARRANTY

- A. Manufacturer's 15-year standard written warranty for all labor and material, including labor to replace defective product.

1.8 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.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Material Composition: free of ortho phthalates, added formaldehyde and heavy metal stabilizers.
- B. Concrete subfloor shall 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. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.
- E. Subfloor Moisture Conditions: Moisture emission rate of both new and existing floors of no more than 3 lb/1000 sq. ft./24 hours when tested by ASTM F1869 with subfloor temperature not less than 65 degrees Fahrenheit in the presence of the Inspector of Record.
- F. Subfloor Alkalinity Conditions: A pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.
- G. Existing floor slabs may have been installed without vapor retarders, or existing retarders may be damaged. Contractor will observe existing floors for signs of moisture-induced floor, surface failures, and mitigation of excessive moisture emission or alkalinity shall be the Contractor's responsibility and at the Contractor's cost, using methods specified herein.

1.10 EXTRA STOCK

- A. Provide 100 square feet (or 10% of total installed, whichever is greater) of flooring and 100 lineal feet (or 10% of total installed, whichever is greater) of base of each material specified under provisions of Section 01 77 00.
- B. Provide quantity equal to 2 percent of units installed of each shape and color.

PART 2 - PRODUCTS

2.1 MANUFACTURER – LUXURY VINYL TILE

- A. Interface, Inc. – “Studio Set” LVT.
- B. Substitutions: Under provisions of Section 01 25 00.

2.2 MATERIAL

- A. Interface “Studio Set” luxury vinyl floor tile:
 - 1. Style Series (Product) No.: A007.

2. Nominal Size: 25 cm x 1 m.
3. Colors: Per Finish Schedule, as selected by Architect from manufacturer's full range of colors.
4. Installation Pattern: ashlar.
5. Wear Layer Thickness: 22 mil.
6. Total Thickness: 4.5 mm.
7. Finish Type: ceramic bead.
8. Backing Class: Commercial grade.

2.3 ADHESIVE

- A. Manufacturer's Special Purpose adhesive: solvent-free, non-flammable, freeze/thaw stable, and odorless when dry. No micro-biocides to inhibit the growth of mold and mildew.

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.

3.3 INSTALLATION

- A. Do not begin installation until any new concrete is fully dried and complies with moisture and alkalinity requirements.
- B. Install per manufacturer's written installation instructions.
- C. Lay tile to pattern indicated. If not indicated, request from Architect. Do not interrupt tile pattern around openings.
- D. Install with minimum plank seam stagger of 6"-8".
- E. Borders shall not be less wide than one half of plank tile width.

3.4 CLEANING

- A. Clean Work per manufacturer's written LVT maintenance guidelines.
- B. Use only neutral cleaning solution (pH of 6-8).
- C. Use of waxes and polishes is not recommended and may cause irreversible damage.

END OF SECTION

SECTION 09 67 13 RESINOUS FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fluid-applied dampproofing and leveling coats.
- B. Fluid-applied epoxy flooring and wall base with epoxy top coat.
- C. Quartz chip aggregate.
- D. Coves and other accessories.

1.2 REFERENCES

- A. ACI Committee 503.1 - Adhesion.
- B. ASTM C307 - Tensile Properties.
- C. ASTM C580 - Flexural Strength.
- D. ASTM D579 - Compressive Properties.
- E. ASTM D1044 - Resistance of Transparent Plastic Materials to Abrasion.
- F. ASTM D2240 - Surface Hardness.
- G. ASTM E648/NFPA 253 - Flammability.
- H. ASTM F-1869 - Vapor Emissions.
- I. MIL - D - 3134 - Impact Resistance Water Absorption.
- J. Gardner Impact Tester - Impact Resistance.
- K. ACI Committee #403/PP - Bond Strength.
- L. MIL 3134F - Indentation.
- M. UL - Underwriters' Laboratories.
- N. NFPA 56A - Electrical Conductivity.
- O. ASTM D-3363 - Hardness.
- P. ASTM D-2794 - Impact Resistance.
- Q. ASTM D-1211 - Thermal Shock.

- R. ASTM D-522, D-1737 - Flexibility.
- S. ASTM D-1308 - Chemical Resistance.
- T. ASTM D-695 - Compressive Strength.
- U. ASTM D-638 - Elongation.
- V. ASTM D-2240 - Surface Hardness.
- W. ASTM D-695 - Adhesion.
- X. ASTM D-1044 - Wear Resistance.
- Y. TT-C-550 A - Cleanability.
- Z. ASTM E-1745 - Vapor Retarder.
- AA. ASTM F-1869 - Vapor Emissions

1.3 COORDINATION

- A. Coordinate Work of this Section with installation of concrete under Section 03 30 00 and installation of backing board under Section 09 28 13.

1.4 QUALIFICATIONS

- A. Installer Qualifications: Engage an experienced installer or applicator who has specialized for a minimum of 5 years in installing the specific resinous flooring system required for this Project and who is acceptable to manufacturer of primary materials. Installer must provide a minimum of 3 documented and inspectable installations within 25 mile radius of the subject project at least 5 years old with project names, dates, and owner contacts provided with the submittal. The installer shall furnish a list of projects using either specified material or equivalent that they have installed during the last three years. Information shall include project name, square footage, owner contact name with owner's address and phone number. Also, the installer shall furnish resumes detailing the experience of key personnel including supervisors and mechanics. The installer shall be approved in writing by the material manufacturer for the system being installed.
- B. Single-Source Responsibility: Obtain epoxy flooring system materials (including primers, resins, hardening agents, colored aggregates and finish or sealing coats), underlayments, vapor dissipation systems, anti-fracture membranes and waterproof membranes from a single primary manufacturer. Manufacturer shall be EPA-licensed to incorporate the antimicrobial into this system.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for flooring flame/fuel/smoke ratings in accordance with UL.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit letter verifying installer qualifications.
- C. Product Data: Submit manufacturer's technical data, application instructions and general recommendations for the epoxy flooring specified herein.
- D. Warranty Letter: Letter from single-source manufacturer offering joint manufacturer/installer, labor/material warranty for the complete flooring system on this specific Project.
- E. Submit Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors and finishes available.
 - 1. Submit 24-inch square x 12-inch high inside corner/flooring/cove base Samples prepared by the actual installer in colors designated by the Architect. Factory Samples not acceptable.
 - 2. Submit 3 different 12-inch square nonslip texture Samples for Owner's approval.
- F. Material certificates signed by manufacturer certifying that the epoxy flooring and supplemental products comply with requirements specified herein.
- G. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.

1.7 MOCK-UP

- A. After approval of Sample of corner assembly required under Submittals, applicator shall prepare a field mock-up of an area not less than 9' long high by 6' wide. Mock-up shall include finish treatment of flooring and cove base at inside corner.
- B. Mock-up, once approved, may be integrated into the Work.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 70 00.
- B. Include procedures for stain removal, repairing surface, and cleaning.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01 87 00.
- B. Store materials in a dry, secure area.

- C. Maintain temperature of 55 degrees Fahrenheit.
- D. Keep products away from fire or open flame.
- E. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Conditions: Comply with epoxy flooring manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect Work.
- B. Lighting: Permanent lighting will be in place and working before installing flooring.
- C. Vapor Emissions: Contractor shall provide proper climatized conditions and hire testing agency to determine vapor emissions in accordance with ASTM F-1869. One test shall be conducted for the first 100 square feet, then one test per each additional 100 square feet in temperature/humidity conditions similar to normal occupancy.
- D. Ventilate area where flooring is being installed. Post and enforce "NO SMOKING" or "OPEN FLAME" signs until flooring has cured.
- E. Restrict traffic from area where flooring is being installed or is curing.

1.11 WARRANTY

- A. Provide two-year unconditional warranty under provisions of Section 01 70 00.
- B. Warranty: Include coverage for delamination of floor and base materials from substrate, degradation of surface finish.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: Stonhard, Inc. (www.stonhard.com).
- B. Crossfield Products Corp.
- C. General Polymers Corporation.
- D. Substitutions under provisions of Section 01 25 00.

2.2 DESIGN CRITERIA

- A. The intention of this Specification is to have all components of the specified finishes provided, installed, warranted, and maintained by one prequalified installer.
- B. Components and their specific materials shall be compatible and warranted as such by the installer.

2.3 MATERIALS

- A. Basis of Design: the specified material is “Stonshield HRI”, a proprietary system as furnished by Stonhard.

2.4 PERFORMANCE REQUIREMENTS

- A. Colors: As indicated, or if not otherwise indicated, as selected by Architect from manufacturer’s standard colors.
- B. Physical Properties:
 - 1. Provide flooring system that meets or exceeds the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses. Values below are for the full system, not for individual components.
 - a. Thickness: 3/16 inch, nominal.
 - b. Compressive Strength (ASTM C579): 10,000 psi after 7 days.
 - c. Tensile Strength (ASTM C307): 2,000 psi.
 - d. Flexural Strength (ASTM C580): 4,300 psi.
 - e. Flexural Modulus of Elasticity (ASTM C580): 2.0×10 to the 6th psi.
 - f. Surface Hardness (ASTM D2240): Durometer Shore D 85-90.
 - g. Abrasion Resistance (ASTM D4060, CS-17): .06 gm lost, max.
 - h. Impact Resistance (ASTM D2794): >160 in./lbs.
 - i. Flammability (ASTM E648): Class 1.
- C. System Components:
 - 1. Substrate Prep: Stonflex MP7 joint fill material; CT5 concrete crack treatment.
 - 2. Primer: one coat Stonhard Standard Primer.

3. Mortar Base: one coat Stonshield HRI Base.
4. Undercoat: one coat Stonshield undercoat.
5. Broadcast Media: one coat Stonshield quartz aggregate.
6. Sealer: one coat Stonkote CE4; gloss finish; medium texture level.
7. Integral Cove Base: Stonshield cove mortar.
8. All products used in the floor system shall be manufactured by the same primary manufacturer.
9. All products used in the flooring system shall have a minimum 5-year documented usage in similar applications.

2.5 COLORS

- A. Resin and Aggregate: Color as selected by Architect from manufacturer's standard color range.

2.6 ACCESSORIES

- A. Concrete Testing Equipment: American Moisture Test, Inc. (866) 670-9700.
 1. ASTM F1869 Water vapor emission.
 2. ASTM F2170 In-concrete relative humidity.

PART 3 - EXECUTION

3.1 EXAMINATION AND INSPECTION

- A. Examine the areas and conditions where the epoxy flooring is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.
- B. Perform concrete moisture testing at a rate of three tests for areas up to 1,000 square feet and one test for each 1,000 square feet thereafter in accordance with the following test methods:
 1. ASTM F1869 water vapor emission: shall not exceed 6.0 lbs.of water / 1,000 square feet of concrete slab in 24 hours.
 2. ASTM F2170 in-concrete relative humidity: shall not exceed 85%.
- C. Where slab fails to meet the requirements of the paragraph above, vapor retarder as specified in Section 07 26 00.

- D. Beginning of installation means acceptance of substrate.

3.2 PROTECTION

- A. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.3 PREPARATION

- A. Flooring System:

1. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.
2. Concrete and Tile Surfaces: Shot-blast or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable conditions. Leave surface free of dust, dirt, laitance, and efflorescence.
3. Cracks and Non-Expansion Joints:
 - a. Cracks and joints less than 1/16 inch wide after surface preparation are to be filled with 3552 Epo-Flex mixed and applied as recommended by the manufacturer.
 - b. Joints which are larger than 1/16 inch wide after surface preparation shall be routed 1/4 inch x 1/4 inch minimum and filled with "3552 Epo-Flex" mixed and applied recommended by the manufacturer.
4. New Concrete:
 - a. Concrete shall be limited to 4 inch thickness and receive proper vapor-barrier tie-in to existing vapor barrier and suitable reinforcement and doweling to existing concrete. Give concrete a light broom finish.
 - b. No curing compounds shall be used. Paper cure is to be used for 3 days, then removed. Good ventilation is to be maintained for good drying.
 - c. Concrete shall cure for minimum 2 weeks when designed in accordance with "Fast-Drying Concrete Recommendations."
 - d. After 2 weeks' drying Contractor shall conduct vapor emission test and report to Architect. Architect then to direct the vapor dissipation

system to be used (Vapor Shield I, II, III, or IV -- for emissions up to 6, 12, 18, and over 18 lbs, respectively).

e. Flooring installer shall install designated vapor dissipation system.

5. Materials: Mix resin hardener and aggregate when required, and prepare materials according to floor/wall system manufacturer's instructions.

3.4 INSTALLATION - FLOORING AND BASE

- A. General: Apply each component of epoxy mosaic composition flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
- B. Waterproofing Membrane: Apply over all joints minimum of 1 inch either side of joint to manufacturer's recommended thickness.
- C. Bond Coat: Apply bond coat over prepared substrate at manufacturer's recommended spreading rate.
- D. Body Coat: Over primer, trowel apply epoxy mortar mix at nominal 1/4 inch thickness; hand or power trowel. Allow to cure before proceeding.
- E. Grout Coats: Apply two coats of grout. Sand and inspect the surface for consistency.
- F. Finish or Sealing Coats: After grout coats have cured sufficiently, apply finish coats of type recommended by flooring manufacturer to produce finish matching approved sample and in number of coats and spreading rates recommended by manufacturer.
 - 1. Final finish coat shall be in color and skid-retardant profile as approved by the Architect.
 - 2. Finish coat shall incorporate non-slip aggregate as selected by the Owner.
 - 3. Finished floor shall be 1/4 inch thick, uniform in color and free of trowel marks.
- G. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 6 inches unless otherwise indicated. Follow manufacturer's instructions and details including taping, mixing, priming, troweling, sanding, and top-coating of cove base.

3.5 TOLERANCES

- A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

3.6 CURING, PROTECTION AND CLEANING

- A. Cure epoxy mosaic composition flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.
- B. Protect finished floor with wax paper. Use "Masonite", if rolling load traffic exists.
- C. Clean with manufacturer-recommended cleaner.

END OF SECTION

SECTION 09 72 16

VINYL-COATED FABRIC WALL COVERINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Prime painting.
- C. Wall covering.
- D. Adhesives and accessories.

1.2 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. CFFA-W-101-B - 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. UL - Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing commercial wall coverings with five years documented experience.
- B. Applicator: Company specializing in installing commercial wall coverings 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 under provisions of Section 01 33 00.
- B. Submit two 12-inch square samples of wall covering illustrating color, finish, and texture.

- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit test reports verifying flame/smoke ratings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and protect products under provisions of Section 01 87 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 Fahrenheit, unless required otherwise by manufacturer's instructions.
- B. Do not apply adhesive when substrate surface temperature or ambient temperature is below 60 degrees Fahrenheit or relative humidity is above 40 percent.
- C. Maintain these conditions 72 hours before, during, and after installation of wall covering.

1.8 EXTRA STOCK

- A. Provide 25 lineal feet of each pattern and color of wall covering under provisions of Section 01 70 00.
- B. Package and label each roll by manufacturer, color, and pattern, and designated room number; store where directed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Muraspec, North America: 'Genon' or 'Guard' brand.
- B. MDC: 'Bolta' brand.
- C. Maharam Wallcoverings.
- D. Koroseal Wallcoverings
- E. Substitutions: Under provisions of Section 01 25 00.

2.2 MATERIALS

- A. Wall Covering: Vinyl fabric roll stock, conforming to FS CCC-W-408 A and B and CFFA W-101-B for Type II wallcovering and the following:
1. Total Weight: 20.0 oz/lin yd.
 2. Roll Width: 54 inches
 3. Color: As selected by Architect.
 4. Pattern: As selected by Architect.
 5. Fire Rating, ASTM E84: Class A.
 - a. Flame Spread: 15.
 - b. Smoke Developed: 20.
 6. Stain Resistance (If Required): ASTM D-1308, Method B: 24 hour exposure followed by washing with soap and water.
 - a. Ethanol Pencil Tea 10 percent Hydrochloric Acid
 - b. Vinegar Mayonnaise Milk 10 percent Sodium Hydroxide
 - c. Detergent Bleach Coca-Cola Oleic Acid
 - d. Lemon Juice Crayon Pot Wine 10 percent
 - e. Coffee Ketchup Hydrogen Peroxide

2.3 ACCESSORIES

- A. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate. Mildew-resistant, non-staining, and strippable.
- 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.

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/foot.
- 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 stains or 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 or reverse pattern of wall covering to insure color uniformity.
- E. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- 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. 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.
- L. 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 87 00.

END OF SECTION

SECTION 09 77 23 FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Tackable wall board.

1.2 REFERENCES

- A. ASTM C208 - Insulation Board (cellulose fiber).
- B. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.
- C. ASTM D-1308 - Stain Resistance.
- D. ASTM D-1308 – Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- E. FS CCC-W-408 A and B - Wall Covering, Vinyl Coated.
- F. UL - Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in tackable wallboard work with five years' documented experience.

1.4 REGULATORY REQUIREMENTS

- A. Conform to flame spread and smoke developed ratings of no more than 25/50 for vinyl fabric covered tack surfaces when tested in accordance with ASTM E84 by UL.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Provide Product Data on vinyl coated fabric and fiberboard.
- C. Submit two 12-inch square Samples of wall covering illustrating color, finish, and texture of wall covering as specified in Section 09 72 16.
- D. Submit test reports verifying flame/smoke ratings.

1.6 EXTRA STOCK

- A. Provide ten (10) additional maximum length panels under provisions of Section 01 70 00.
- B. Label each sheet by manufacturer, color, and pattern; store where directed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - WALLBOARD FINISH

- A. As specified in Section 09 72 16.
- B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS - WALLBOARD FINISH

- A. Vinyl Surfacing: As specified in Section 09 72 16.
- B. Stain Resistance: As specified in Section 09 72 16.

2.3 SUBSTRATE AND ADHESIVE

- A. Fiberboard: Industrial insulation board, ironed and prime coated, ASTM C208, cellulosic, 1/2 inch thick, 4 feet wide x required length, beveled longitudinal edges.
- B. Wallcovering Adhesive: Manufacturer's standard for use with specified wallcovering and substrate application. Mildew-resistant, nonstaining, and strippable.
- C. Fasteners, ring shank, small head, prefinished nails. Size and color to suit.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Machine apply vinyl wallcovering continuous over length of fiberboard sheet. Wrap vinyl continuous around two edges. No seams permitted on individual panels.

3.2 INSPECTION

- A. Verify that site conditions are ready to receive Work and opening dimensions are as indicated on approved Shop Drawings.
- B. Beginning of installation means acceptance of substrate.

3.3 INSTALLATION

- A. Erect fiberboard in vertical direction. Install in full length sections with no horizontal joints. Fit boards loosely to adjacent trim so that damaged panels can be easily replaced.
- B. Install panels butted tight to adjacent materials; casework, chair rail, door frames, ceilings, floors, and soffits as indicated on the Drawings. Provide lap beneath other tack or chalk board systems to conceal unfinished edges.
- C. Attachment: Secure fiberboard to substrate with nails and sufficient support to hold in place. Apply adhesive in accordance with manufacturer's instructions.
- D. Insure backing materials are firmly attached, free from warps and surface defects and ready to receive vinyl wall covering.

3.4 TOLERANCES

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

3.5 CLEANING PROCEDURES

- A. Common dirt and stains may be removed by rubbing lightly with a moistened cloth, sponge, or stiff bristle brush using a mild soap, detergent, or non-abrasive cleanser. Clean water shall be used on a constant basis and the material shall be towel-dried.
- B. Strong organic solvents (such as Ketones) and harsh abrasive cleaners shall not be used. Contact wall covering manufacturer for special cleaning problems.

END OF SECTION

SECTION 09 91 00 PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Products and application.
- C. Surface finish schedule.
- D. Patch to match existing.

1.2 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.

1.3 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.

1.4 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 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. Regulatory Requirements: 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. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
- D. 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.
- E. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer.
- F. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Provide manufacturer's technical information and instructions for application of each material proposed for use by catalog number.
- C. List each material by catalog number and cross-reference specific coating with specified finish system.
- D. Provide manufacturer's certification that products proposed meet or exceed specified materials.
- E. Submit two 8-1/2 inch x 11 inch Samples of each paint color and texture applied to cardboard. Resubmit Samples until acceptable color, sheen and texture is obtained.
- F. On same species and quality of wood to be installed, submit two 4 x 8 inch Samples showing system to be used.

1.7 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 square feet 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the products to site and store and protect under provisions of Division 1.
- 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 45 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.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F 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: 45 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.

1.10 EXTRA STOCK

- A. Provide a ten gallon container of each finish paint color to Owner for touchup.
- B. Label each container with color, texture, and room locations in addition to the manufacturer's label.

1.11 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years' experience.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Unless specifically identified otherwise, product designations are those of the Dunn-Edwards Corporation, (800) 537-4098 and shall serve as the standard for kind, quality, and function.
- B. Subject to compliance with requirements, other manufacturers offering equivalent products are:
 - 1. Benjamin Moore Paints, (213) 722-3484.
 - 2. Frazee Paint (McCloskey, Ameron), (213) 727-2861.
 - 3. Kelly-Moore Paint Company, (650) 592-8337.
 - 4. Pittsburgh Paints, (888) 774-2001.
 - 5. Sherwin Williams, (310) 404-7422.
 - 6. Spectra-Tone Paint Corp., (909) 478-3485.
 - 7. Tnemec Company, Inc., (310) 643-5191.
 - 8. Vista Paint Corporation, (714) 680-3800.
- C. Substitutions: Under provisions of Section 01 25 00.

2.2 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. Accessory Materials: Linseed oil, shella, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES

- A. Refer to schedule at end of Section for surface finish schedule.

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, measured in accordance with ASTM D2016.
 - 4. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.
- D. Beginning of installation means acceptance of existing surfaces.

3.2 SURFACE PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect Work of this Section.
- C. Shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. 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.
- F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. 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.

- I. 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.
- J. 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.
- K. 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.
- L. 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. Spot prime paint after repairs.
- M. 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 bare steel surfaces.
- N. 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.
- O. 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.
- P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- Q. Wood Doors: Seal top and bottom edges with 2 coats of spar varnish sealer.

3.3 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.

3.4 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 over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.

3.5 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.
- G. 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.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime back surfaces of interior and exterior woodwork with primer paint.
- J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- K. Paint mill finished door seals to match door or frame.
- L. Paint primed steel glazing stops in doors to match door or frame.
- M. Cloudiness, spotting, lap marks, brush marks, runs, sags, spikes and other surface imperfections will not be acceptable.
- N. 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.

- O. 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.
- P. For painting of exterior patchwork, paint to the nearest surface break.

3.6 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 both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- F. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.
- G. Paint grilles, registers, and diffusers which do not match color of adjacent surface.
- H. Paint all mechanical and electrical equipment, vents, fans, and the like occurring on roof.
- I. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts.
- J. Do not paint over labels or equipment identification markings.
- K. Do not paint mechanical room specialties such as compressors, boilers, pumps, control panels, etc.
- L. Do not paint switch plates, light fixtures, and fixture lenses.

3.7 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.

3.8 PROTECTION OF COMPLETED WORK

- A. Protect finished installation under provisions of Section 01 87 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.

3.9 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.

3.10 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.

3.11 COLOR SCHEDULE

- A. Paint and finish colors shall be custom color, mixed and formulated to match existing finishes.
- B. Access doors, registers, exposed piping, electrical conduit and mechanical/electrical panels if not stainless steel; generally the same color as adjacent walls.
- C. Exterior and interior steel doors, frames and trim; match adjacent existing door frames.
- D. Doors: Match adjacent existing door paint or varnish.

- E. Interior and Exterior Steel Fabrications, if not Stainless Steel: Match existing or adjacent walls.

3.12 SCHEDULE - EXTERIOR SURFACES

- A. The following paint systems shall be used:

1. Wood-Painted (Flat Acrylic) - Exterior Trim and Exposed Wood Framing

1st coat:	W708 EZ Prime
2nd coat:	EVSH10 Evershield
3rd coat:	EVSH10 Evershield

2. Wood-Painted (Semi-Gloss Acrylic)

1st coat:	W708 EZ Prime
2nd coat:	EVSH50 Evershield
3rd coat:	EVSH50 Evershield

3. Wood-Painted (Gloss Alkyd)

1st coat:	W708 EZ Prime
2nd coat:	W960V Permagloss
3rd coat:	W960V Permagloss

4. Wood - Semi-Transparent

1st coat:	WPT3 "OKON Weatherpro"
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5. Concrete (Flat Acrylic) - Exposed concrete indicated on drawings to be painted

1st coat:	W709 Eff-Stop
2nd coat:	EVSH10 Evershield
3rd coat:	EVSH10 Evershield

6. Concrete Masonry Units (Flat Acrylic)

Fill coat:	W305 Blocfil
1st coat:	EVSH10 Evershield
2nd coat:	EVSH10 Evershield

7. Cement Plaster (Flat Acrylic)

1st coat:	W709 Eff-Stop
2nd coat:	EVSH10 Evershield
3rd coat:	EVSH10 Evershield

8. Cement Plaster (Flat Elastomeric)

1st coat:	Enduraseal W360
2nd coat:	Endurawall W370
3rd coat:	Eudurawall W370

9. Steel-Primed or Unprimed (Flat Acrylic)

1st coat:	43-5 Corrobar
2nd coat:	EVSH10 Evershield
3rd coat:	EVSH10 Evershield

10. Steel-Primed or Unprimed (Semi-Gloss Acrylic)

1st coat:	43-5 Corrobar
2nd coat:	EVSH50 Evershield
3rd coat:	EVSH50 Evershield

11. Steel-Primed or Unprimed (Gloss-Alkyd)

1st coat:	43-5 Corrobar
2nd coat:	10 Syn-Lustro
3rd coat:	10 Syn-Lustro

12. Steel-Galvanized (Flat Acrylic)

1st coat:	GE 123 Galva Etch, Etching Liquid
2nd coat:	43-7 Galv-Alum
3rd coat:	EVSH10 Evershield
4th coat	EVSH10 Evershield

13. Steel-Galvanized (Semi-Gloss - Acrylic)

1st coat:	GE 123 Galva Etch, Etching Liquid
2nd coat:	43-7 Galv-Alum
3rd coat:	EVSH50 Evershield
4th coat	EVSH50 Evershield

14. Steel-Galvanized (Gloss - Alkyd)

1st coat:	GE 123 Galva Etch, Etching Liquid
2nd coat:	43-7 Galv-Alum
3rd coat:	10 Syn-Lustro
4th coat	10 Syn-Lustro

3.13 SCHEDULE - INTERIOR SURFACES

A. The following paint systems shall be used:

1. Wood-Painted (Semi-Gloss Alkyd) - Wood Trim

1st coat:	W707 Unikote
2nd coat:	EVSH50 Evershield
3rd coat:	EVSH50 Evershield

2. Wood-Painted (Gloss Alkyd)

1st coat:	W707 Unikote
2nd coat:	W960V Permagloss
3rd coat:	W960V Permagloss

3. Glue-Laminated Wood and Wood Timber Members (Satin-Flat Varnish)

1st coat:	Gemini Titan Clear Waterborne Sealer WBS-0100
2nd coat:	Gemini Titan Clear Waterborne Sealer WBS-00230 Satin
3rd coat:	Gemini Titan Clear Waterborne Sealer WBS-0230 Satin

4. Wood - Transparent (Stain - Semi-Gloss Varnish)

1st coat:	Gemini Craftsman Collection Wiping Stain CC00 Series
2nd coat:	Gemini Titanium Clear Urethane WB-0260 Semi-Gloss
3rd coat:	Gemini Titanium Clear Urethane WB-0260 Semi-Gloss
4th coat:	Gemini Titanium Clear Urethane WB-0260 Semi-Gloss

5. Wood - Transparent (Stain-Semi-Gloss Lacquer)

1st coat:	Gemini Craftsman Collection Wiping Stain CC00 Series
2nd coat:	Gemini 275 VOC High Build Lacquer Sealer 200-0227
3rd coat:	Gemini Semi-Gloss 500-0281
4th coat:	Gemini Semi-Gloss 500-0281

6. Concrete (Flat-Latex)

1st coat:	W709 Eff-Stop
2nd coat:	W401V Decovel
3rd coat:	W401V Decovel

7. Concrete (Semi Gloss Latex)

1st coat:	W709 Eff-Stop
2nd coat:	W450V Decoglo
3rd coat:	W450V Decoglo

8. Concrete Floors - Sealed (Low Sheen Epoxy Acrylic)

1st coat:	Tuff Floor W-810
2nd coat:	Tuff Floor W-810

9. Concrete Block (Flat-Latex)

1st coat:	W305 Blocfil
2nd coat:	W401V Decovel
3rd coat:	W401V Decovel

10. Concrete Block (Semi Gloss-Latex)

1st coat:	W305 Blocfil
2nd coat:	W450V Decoglo
3rd coat:	W450V Decoglo

11. Concrete Block (Semi Gloss-Epoxy)

1st coat:	W305 Blockfiller
2nd coat:	9100 Series RUST-OLEUM
3rd coat:	9100 Series RUST-OLEUM

12. Steel - Primed or Unprimed (Flat-Latex) - Exposed Duct Work

1st coat:	43-5 Corrobar (or Touch up)
2nd coat:	W401V Decovel
3rd coat:	W401V Decovel

13. Steel - Primed or Unprimed (Semi-Gloss-Alkyd) - Steel Doors/Frames

1st coat:	43-5 Corrobar (or touch up)
2nd coat:	9 Syn-Lustro Semi-Gloss
3rd coat:	9 Syn-Lustro Semi-Gloss

14. Steel - Primed or Unprimed (Gloss-Alkyd)

1st coat:	43-5 Corrobar (or touch up)
2nd coat:	10 Syn-Lustro Gloss
3rd coat:	10 Syn-Lustro Gloss

15. Steel - Galvanized (Flat-Latex) - Exposed Duct Work

1st coat:	43-7 Galv-Alum
2nd coat:	W401V Decovel
3rd coat:	W401 V Decovel

16. Steel - Galvanized (Semi-Gloss - Alkyd) - Steel Handrails

1st coat:	43-7 Galv-Alum
2nd coat:	9 Syn-Lustro Semi-Gloss
3rd coat:	9 Syn-Lustro Semi-Gloss

17. Steel - Galvanized (Gloss - Alkyd)

1st coat:	43-7 Galv-Alum
2nd coat:	10 Syn-Lustro Gloss
3rd coat:	10 Syn-Lustro Gloss

18. Gypsum Board (Flat - Latex)

1st coat:	W101V PVA
2nd coat:	W401V Decovel
3rd coat:	W401V Decovel

19. Gypsum Board (Eggshell-Acrylic) - Gypsum Board Walls and Ceilings

1st coat:	W101V PVA
2nd coat:	W440V Decosheen
3rd coat:	W440V Decosheen

20. Gypsum Board (Semi-Gloss -Acrylic) - Kitchenette areas; all Interior Wood Trim

1st coat:	W101V PVA
2nd coat:	EVSH50 Evershield
3rd coat:	EVSH50 Evershield

21. Gypsum Board (Gloss -Acrylic)

1st coat:	W101V PVA
2nd coat:	W960V Permagloss
3rd coat:	W960V Permagloss

22. Gypsum Board (Gloss -Epoxy)

1st coat:	W102 Proseal
2nd coat:	9100 Series RUSTOLEUM
3rd coat:	9100 Series RUSTOLEUM

23. Plaster (Flat-Latex)

1st coat:	W709 Eff-Stop
2nd coat:	W401V Decovel

24. Plaster (Eggshell-Acrylic)

1st coat:	W709 Eff-Stop
2nd coat:	W440V Decosheen
3rd coat:	W440V Decosheen

25. Plaster (Semi Gloss-Latex) - Wet Areas U.O.N.

1st coat:	W709 Eff-Stop
2nd coat:	W450V Decoglo
3rd coat:	W450V Decoglo

26. Plaster (Semi Gloss-Acrylic)

1st coat:	W709 Eff-Stop
2nd coat:	W901V Permagloss
3rd coat:	W901V Permagloss

27. Plaster (Gloss-Alkyd)

1st coat:	W709 Eff-Stop
2nd coat:	W960V Permagloss
3rd coat:	W960V Permagloss

28. Plaster (Gloss-Epoxy)

1st coat:	9100 Series RUSTOLEUM
2nd coat:	9100 Series RUSTOLEUM
3rd coat:	9100 Series RUSTOLEUM

29. Acoustic Panels (Flat Poly Vinyl Acetate)

1st coat: W615 AcoustiKote

2nd coat: W615 AcoustiKote

30. Game Line Paint

1st coat: High-gloss oil base enamel

2nd coat: High-gloss oil base enamel

END OF SECTION

SECTION 10 11 00 VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Markerboards, lined and unlined.
- B. Tackboards.
- C. Horizontal sliding panel assembly.
- D. Wood cabinet lecture unit.
- E. Display rails.
- F. Bulletin board cabinets.
- G. Lining and lettering.

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 UL flame/fuel/smoke rating of 25/0/25 for vinyl fabric covered tackboards when tested in accordance with ASTM E84.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate wall elevations, dimensions, joint locations.
- C. Provide complete Product Data on all items specified.
- D. Submit two 12-inch square Samples illustrating materials and finish, color, and texture of markerboard and tackboard surfacing, including lined boards if used.
- E. Horizontal Sliding Panel System (Where Used): Submit 18 x 24 inch Sample illustrating materials and construction.

1.5 MAINTENANCE DATA

- A. Submit under provisions of Section 01 70 00.
- B. Include maintenance information on regular cleaning and stain removal.

1.6 WARRANTY

- A. Provide one year warranty under provisions of Section 01 70 00.
- B. Include one-year warranty against discoloration of surfaces due to cleaning, crazing or cracking and staining.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Claridge Products and Equipment, Inc.
- B. Chatfield Clarke Co., Inc.
- C. Polyvision Corporation.
- D. Substitutions: Under provisions of Section 01 62 00.

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. Particleboard: ANSI A208.1; wood shavings set with waterproof resin binder, sanded faces.

- E. Fiberboard: Industrial insulation board, ironed and prime coated, ASTM C208, 3/8 inch thick, 4 foot wide x required length.
- F. Foil Backing: Aluminum foil sheet.
- G. Honeycomb: Honeycell/Honeycomb.
- H. Tackboard Covering: Vinyl wall covering as specified in Section 09 72 16.
- I. Adhesives: Type recommended by manufacturer to suit applicable to substrate.

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. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- C. Blocking Pads: Manufacturers 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 LCS3 porcelain.
- B. Core: Particleboard, 3/8 inch thick.
- C. Backing Surface: Aluminum foil, 0.005 inch thick.
- D. Units in 8 foot increments shall be one piece construction, no joints.

2.5 FABRICATION - TACKBOARDS

- A. Outer Facing: Vinyl wall covering as specified in Section 09 72 16.
- B. Underlayment: Cork, 1/8 inch thick.
- C. Backing: Hardboard, 1/4 inch thick.
- D. Units in 8 foot increments shall be one piece construction, no joints.

2.6 FRAME AND TRIM

- A. Frame: Extruded aluminum, equivalent to Claridge Series 1; concealed fasteners; map rail with 1/4 inch thick cork insert above markerboard surfaces.
- B. Chalk tray: Extruded aluminum, equivalent to Claridge No. 271A profile; one piece, full length of markerboard; concealed fasteners.

2.7 HORIZONTAL SLIDING PANEL ASSEMBLY

A. 4 x 8 Single Sided Panel; Markerboard:

1. Surface: Porcelain markerboard, unlined or lined as indicated.
2. Core: 7/8 inch thick honeycomb.
3. Subframe: Polyvision SF-78, 2 inch x 7/8 inch aluminum tube, 4 sides.
4. Moisture Barrier: .012 inch thick aluminum sheet.

B. 4 x 8 Single Sided Panel; Tackboard:

1. Surface: Tackboard covering. (As specified in Section 09 72 16)
2. Underlayment: Cork, 1/4 inch thick.
3. Core: 5/8 inch thick honeycomb.
4. Subframe: Polyvision SF-58, 2 inch x 5/8 inch aluminum tube, 4 sides.
5. Moisture Barrier: .012 inch thick aluminum sheet.

C. 4 x 8 Double Sided Panel; Markerboard Combination:

1. Front Surface: Porcelain markerboard.
2. Back Surface: Porcelain markerboard.
3. Core: 7/8 inch thick honeycomb.
4. Subframe: Polyvision SF-78, 2 inch x 7/8 inch aluminum tube, 4 sides.

D. 4 x 8 Double Sided Panel; Markerboard and Tackboard Combination:

1. Front Surface: Porcelain markerboard.
2. Front Core: 5/8 inch thick honeycomb.
3. Back Surface: Tackboard covering.
4. Back Underlayment: Cork, 1/4 inch thick.
5. Subframe: Polyvision SF-58, 2 inch x 5/8 inch aluminum tube, 4 sides.

E. Frame, Hardware, and Accessories

1. Trim: Polyvision C-12 extruded aluminum with punched and wrapped safety corner.

2. Top Track: Polyvision C-1 extruded aluminum guide.
 3. Bottom Track: Polyvision BT-1 extruded aluminum track.
 4. Filler Strip: Polyvision BT- extruded aluminum series.
 5. Rollers: Polyvision HB Series, Model MAL-33 bottom rollers.
 6. Sheaves: Polyvision 1607 adjustable brass ball bearing sheaves. Two wheels per sheave and two sheaves per panel.
 7. Pulls: IVES chrome retractable edge pulls, two per panel, fully recessed.
 8. Locks: Polyvision JK-39 locking mechanism, one per panel.
 9. Chalkrail: Polyvision CRA-4D modified as indicated with rounded corner.
 10. Maprail: Polyvision MR-3 with vinyl backed cork and end caps.
 11. Maprail 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.
- F. Standard markerboard and tackboard configuration as indicated in the schedule at the end of this Section. Non-standard configuration as indicated on Drawings.

2.8 WOOD CABINET LECTURE UNIT

- A. Claridge Model No. 609-4WN 4 feet x 4 feet x 4-1/2 inch oak with natural lacquer.

2.9 DISPLAY RAILS

- A. Claridge Model No. 151 display rail without cork insert. Lengths as required.
- B. Claridge metal display hooks, one for each 12 inches length of display rail.

2.10 BULLETIN BOARD CABINETS

- A. Claridge Model No. 2046 4'-0" x 8'-0" with 4 doors, and Model No. 2040 4'-0" x 4'-0" with 2 doors, recessed, installation, 3/16 inch tempered glass doors, anodized aluminum satin finish with 934 hook-fab fabric, color as selected.
- B. Claridge Model No. 2035 3'-0"H x 2'-0"W with one 3/16 inch tempered glass door, recessed installation, and Model No. 2040 4'-0"H x 4'-0"W with two 3/16 inch tempered glass doors, surface mount installation, weather proof, anodized aluminum satin finish, backpanel of black vinyl directory panel. Locate where indicated. Provide storage box filled with 100 white Roman style letters and numerals 3/4" high and 1-1/2 inch high for each unit.

- C. Claridge Model No. 2041 3'-0" x 4'-0" with 2 doors, 3/16 inch tempered glass with piano hinges and flat key tumbler locks. 1-1/2 inch x 3 inch rectangular aluminum trim with clear satin anodized finish. Cabinet shall be 1-3/4 inch deep inside, and shall project not more than 3 inches from wall. Tackable back panel with vinyl wall covering finish equivalent to Claridge "Fabricork." Provide manufacturer's concealed fasteners and z-bar hangers for surface mounting.

2.11 FINISHES

- A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; white color.
- B. Tackboard Surface: Vinyl of pattern and color as indicated.
- C. Aluminum Frame and Accessories: Clear satin anodized.

2.12 LINING AND LETTERING

- A. Silk screened board graphics shall be permanently fused on boards.
- B. Locations: as shown on drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that surfaces and internal wall blocking are ready to receive work, and dimensions are as indicated on Shop Drawings.
- B. Beginning of installation means acceptance of substrate construction.

3.2 INSTALLATION

- A. Install markerboards and tackboards in accordance with manufacturer's instructions.
- B. Install 2x blocking behind markerboards and tackboards at 16 inches on center.
- 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 chalkboard and tackboards for thermostats, wall switches and similar devices.

3.3 CLEANING

- A. Clean all surfaces in accordance with manufacturer's instructions.
- B. Cover all surfaces with protective cover, taped to frame.
- C. Remove temporary protective cover at date of Substantial Completion.

3.4 HORIZONTAL SLIDING PANEL ASSEMBLY CONFIGURATION SCHEDULE (IF USED)

- A. Abbreviations: MB - Markerboard, TB - Tackboard. (U) - Unlined (L) - Lined.
- B. Schedule of Installation [TBD]:

Location	Panel Size (W x H)	Lined or Unlined	Panel Configuration
1. Classroom	4 x 4	(L)	MB/TB
2. Classroom	8 x 4	(U)	MB/TB
3. Assembly	4 x 8	(U)	MB/TB TB/TB
4. Science Room	4 x 4	(U)	CB/TB

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Door and wall signage.
- B. Exterior metal signs.
- C. Cast letters and numbers.
- D. Traffic Signs.
- E. Cast metal plaques.

1.2 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Submit dimensioned elevations of each sign configuration.
 - 1. Show sign sections indicating materials, thicknesses and attachment methods.
 - 2. Show anchors and reinforcement.
 - 3. Provide complete signage schedule indicating all signs and locations, key to room numbers and elevations. Provide space for Architect to indicate sign type and location.
- C. Product Data:
 - 1. Manufacturer's current published product literature and specifications.
 - 2. Manufacturer's installation instructions.
- D. Samples:
 - 1. Provide two Samples of each sign type required in the profiles and sizes indicated on the Drawings. Signs approved with correct color and type may be used in the final installation at the request of the Contractor.
 - 2. Provide Samples of all proposed fasteners and accessories.
 - 3. Three copies of manufacturer's color chart indicating all available standard colors for selection by the Architect.
- E. Closeout: Manufacturer's warranty.

1.3 PROJECT CONDITIONS

- A. Environmental Requirements: Install signs only when interior air and substrates have reached equilibrium moisture and temperature approximating that of normal occupied conditions.
- B. Do not install adhesive tape mounted signs when ambient temperature is below 70 degrees Fahrenheit. Maintain this temperature during and after installation of signs.

1.4 REGULATORY REQUIREMENTS

- A. Conform to C.C.R., Title 24, Part 2, Chapter 11, ADA Accessibility Guidelines (ADAAG), and American Disability Act (ADA) for accessibility requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver signs safely packed to prevent damage during shipment and prior to installation.
- B. Keep signs in protective wrapping until ready for installation.
- C. Handle carefully to prevent damage. Replace damaged parts at no cost to the Owner.
- D. Comply with the additional requirements specified in Section 01 87 00.

1.6 SCHEDULING

- A. Do not install signs until walls and/or doors have received final finish.

1.7 WARRANTY

- A. Procedures: In accordance with Section 01 78 36.
- B. Furnish manufacturer's written warranty agreeing to replace signs which fade or discolor under normal environmental exposure.
- C. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Subject to compliance with requirements specified herein.
- B. Substitutions: Under provisions of Section 01 62 00.

2.2 DOOR AND WALL SIGNAGE

- A. Cast Acrylic Sheet: ASI Sign Systems, Mohawk Sign Systems, or approved equal.
1. Monolithic tactile plaque sign with fully integrated graphics composed of high-impact polyester acrylate resins, pressure molded into a single polymerized component, using manufacturer's co-molding process.
 - a. Depth: 0.25 inch thickness.
 - b. Panel Appearance: Specify from manufacturer's standard, high contrast semi-matte color chart.
 - c. Surface Texture: Matte non-glare.
 - d. Letter Styles and Sizes and Layout Position: Specify from manufacturer's standard letter styles and color chart.
 - e. Text Schedule: Verify correct capitalization.
 - f. Sign Size: As indicated on the Drawings.
 - g. Sign Shape: As indicated on the Drawings. Square or rectangular shapes shall have radiused corners.
 - h. Installation: Provide countersunk mounting holes for mechanical fasteners.
 - i. Sign Copy: Shall be integrally molded with sign body per manufacturer's standard bonding process.
 - j. Application: Rated for exterior and interior applications.
 - k. Background Appearance: Solid color from manufacturer's standard color charts.
 - l. Braille: Integral domed-shaped California Grade 2 Braille dots, each distinct and separate.
 2. Flame Resistance: Application of a lighted match shall not produce melting, flashing, flaring or distortion. Signs shall not ignite at a temperature less than 800° F.
 3. Vandal resistant surface which can be cleaned using industrial cleansers, including acetone.
- B. Fasteners: All screws, bolts and fasteners to be tamper resistant stainless steel. All fasteners to be provided with solid anchorage to studs, blocking or concrete; do not use toggle bolts.

- C. Colors: High contrast semi-matte integral colors for graphics. All integral resins are U.V stabilized resins utilizing automotive grade pigments.
- D. Location of signs as shown on Drawings.

2.3 EXTERIOR METAL SIGNAGE

- A. Galvanized steel plate, 0.0538 inch thick, mechanically mounted.
- B. Porcelain copy, 1 inch high, colors as selected by Architect. Text and size shall be all uppercase as indicated on Drawings.
- C. Location of signs as shown on Drawings.
- D. Shop Fabricated Signs: All joints, returns and the like shall be properly joined together and welded edges shall be ground smooth to proper aluminum finish.
- E. Shapes shall be saw-cut smooth and straight and shall be deburred prior to final finishing and assembly. Square or rectangular shapes shall have radiused corners.
- F. Vandal resistant surface which can be cleaned using industrial cleansers, including acetone.
- G. Fasteners: All screws, bolts and fasteners to be tamper resistant stainless steel. All fasteners shall be to be provided with solid anchorage to studs, blocking or concrete; do not use toggle bolts.
- H. Colors: High contrast non-glare or semi-matte integral colors for graphics. All integral resins are UV stabilized resins utilizing automotive grade pigments.

2.4 CAST LETTERS AND NUMBERS

- A. Manufacturer: Gemini Sign Products (Basis of Design, www.GeminiSignProducts.com), ARK Ramos, Metal Arts Foundry, ASI Sign Systems, or approved equal.
- B. Standard cast letters: aluminum; font and color to be selected by Architect from manufacturer's full standard range including brushed, buffed, painted and anodized finishes, with Projected Spacer Mount.
- C. Verify location as shown on Exterior Elevations. Verify all text with Owner prior to ordering signage.
- D. Size of Letters: as shown on drawings.
- E. Text: as shown on drawings.

2.5 TRAFFIC SIGNS

- A. Manufacturer: Hawkins Sign Co, Inc. (510) 525-8500; Traffic Control Service Inc., (800) 884-8274; or approved equal.

- B. Types of Signs: Sheet metal with porcelain enamel finish.
 - 1. Accessible Parking Stall Signs: Complying with Title 24, Part 2, Section 7102(e) at automobile stalls and Section 1129B.5 at van stalls. At van stalls, provide separate 12 inch wide x 4 inch high sign below main sign. Text on signs shall comply with ADAAG Article 4.6.4.
 - 2. Accessible Passenger Loading Signs.
 - 3. Tow-Away Signs: Complying with Title 24, Part 2, Section 7102(e).
- C. Sign Posts: 2-inch outside diameter standard weight galvanized steel pipe, set in concrete footing.
- D. Mount signs on sign posts with bottom of sign 7 feet 2 inches above grade, unless indicated otherwise.

2.6 CAST METAL PLAQUES

- A. Manufacturer: Gemini Sign Products, ARK Ramos, Metal Arts Foundry, ASI Sign Systems, or approved equal.
- B. Construction: Cast aluminum, alloy C443.2, painted pebble background with raised graphics and single line bevel edge. Provide clear protective coating and satin highlighting finish at raised surfaces. Letter and border styles and painted background color to be selected by Architect from manufacturer's standard styles and colors.
- C. Size: as shown on drawings.
- D. Text: prior to fabrication, verify content and spelling of text with Owner's representative.
- E. Mounting: Provide hardware and blocking for wall mounting in location indicated.

2.7 FABRICATION

- A. General Requirements:
 - 1. Shop-fabricate signs to requirements indicated for materials, thicknesses, designs, shapes, sizes and details of construction.
 - 2. Sign panel surfaces shall be smooth, even and fabricated to remain flat under installed conditions. Ease all edges and corners of signs.
 - 3. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant regulations and requirements indicated for size, style, spacing, content, position and colors.

B. Tactile Graphics and Text:

1. Conform to CBC Title 24, Chapter 11B, Division 7: 11B-703 Signs, Table 11B-703.3.1, Table 11B-703.5.5, Figures 11B-703.2.5-11B-703.7.2.1.
2. California Grade 2 Braille must accompany raised text characters. Provide tactile copy and Grade 2 Braille raised 1/32 inch minimum from plaque using manufacturer's co-molding process:
 - a. Letters and numbers shall be raised 1/32 inch (0.794 mm) and shall be sans-serif uppercase characters accompanied by California Grade 2 Braille symbols.
 - b. Braille Symbols: Rounded or domed California Braille dots, each distinct and separate. Dots shall be 1/10 inch (2.54 mm) on centers in each cell with 2/10 inch (5.08 mm) space between cells. Dots shall be raised a minimum of 1/32 inch (0.794 mm) from a plaque surface.
 - c. Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I".
 - d. Character Height: Characters and numbers on signs shall be 5/8-inch minimum and 2 inches maximum high and as shown on the Drawings.
 - e. Contrast of Characters and Symbols: Characters and symbols shall be light characters with dark background with a contrast of 70 percent minimum.
3. Raised Characters and Pictorial Symbol Signs:
 - a. Letter Type: Letters and numbers on signs shall be raised 1/32 inch (0.794 mm) minimum and shall be sans-serif uppercase characters accompanied by California Grade 2 Braille.
 - b. The stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character. Reference to CBC 11B Division 7, 11B-703.2.6.
 - c. Symbol Size: Raised characters or symbols shall be a minimum of 5/8- inch (15.9 mm) and as shown on the Drawings.
 - d. Pictorial Symbol Signs (Pictograms): Pictorial symbol signs (pictograms) shall be accompanied by the equivalent verbal description placed directly below the pictogram as shown on the Drawings.
 - e. Contrast between letters and/or characters and background color must be 70 percent minimum.

- C. Silkscreening: All silkscreened graphics shall be produced with ABS paint compatible with the substrate, using mesh of 390 or finer to produce clean, sharp edges. All media are to be opaque, with full even coverage, and free from dust bubbles, blemishes and other foreign matter. Characters and symbols shall contrast 70 percent minimum with their background. Characters shall be light colors with dark background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces to receive units are true and plumb. Correct inadequate surfaces before installation of signs.
- B. Verify that moisture and temperature levels of substrate and environment have been stabilized and are acceptable prior to proceeding with the Work.
- C. Take field measurements prior to shop fabrication where necessary in order to ensure proper fitting of Work.
- D. Do not begin Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations and at mounting heights indicated on Drawings.
 - 1. Keep perimeter lines straight, plumb, and level.
 - 2. Install within 1/4 inch tolerance vertically and horizontally of intended location and in accordance with manufacturer's recommendations.
 - 3. Install product at heights to conform to C.C.R., Title 24, Part 2 and ADA Accessibility Guidelines (ADAAG).
- B. Installation on Walls: Attach securely through finish wall to rigid backing.
- C. Installation Method: Install with vandal - resistant fasteners.

3.3 CLEANING, PROTECTION AND REPAIR

- A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 5 feet.
- B. Clean installed products in accordance with manufacturer's instructions prior to District's acceptance.

END OF SECTION

SECTION 10 28 13 TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Toilet and washroom accessories.
- B. Mirror units.
- C. Concealed anchor devices and backing plate reinforcements furnished to other Sections.
- D. Attachment hardware.

1.2 REFERENCES

- A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.
- B. 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 A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- E. ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
- F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- G. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- H. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Provide Product Data on accessories, describing size, finish, details of function, attachment methods.
- C. Submit manufacturer's installation instructions.

1.4 KEYING

- A. Supply two keys for each accessory to Owner.
- B. Master key all accessories.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CCR, Title 24, Part 2, and ADAAG for access for the handicapped.

1.6 COORDINATION

- A. Coordinate the Work of this Section under provisions of Section 01 31 19.
- B. Coordinate the Work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc.
- B. American Specialties, Inc. (ASI).
- C. Bradley Corporation.
- D. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel, Type 304.
- D. Adhesive: Two-component epoxy type waterproof.
- E. Fasteners, Screws, and Bolts: Hot-dip galvanized, tamperproof.
- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 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 all ferrous metal and fastening devices.

2.4 FACTORY FINISHING

- A. Galvanizing: ASTM A123 to 1.25 ounces per square yard.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Stainless Steel: No. 4 satin finish.

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. Verify that no equipment in accessible toilet stalls protrudes past the face of the wall by more than 3 inches.

3.4 SCHEDULE

- A. Model numbers refer to Bobrick, Georgia Pacific, Waxie, and Kimberly-Clark. No Substitutions accepted.

Model No.	Description	Power	Remark
Bobrick . B-7120	Surface Mt.Hand dryer - ADA		
Pac Blue Ult. 59589	Roll Paper Towel Dispenser, battery powered	-	-
Bobrick B-68137.99	1-1/2" dia. X 36" x 54" horizontal two-wall shower compartment grab bar	-	-
Bobrick B-1659	Glass Mirror, reference Drawings for sizes	-	-
Bobrick B-295	Stainless steel shelf	-	-
Bobrick B-221	Toilet seat cover dispenser	-	-
Bobrick B-239 x 34	Custodian's mop and broom rack w/shelf	-	-
Bobrick B-2888, B-3888	Toilet tissue dispenser, non-accessible stalls	-	-
Bobrick B-3888 B-4388	Toilet tissue dispenser, accessible stalls	-	-
KP Pro 92144	Soap dispenser	-	-
Bobrick B-1556	Frameless stainless steel mirror, see drawings for sizes	-	-

Bobrick B-233	Stainless steel clothes hook	-	-
Bobrick B-3706 25	Recessed sanitary napkin dispenser - ADA	-	-
B-4388	Recessed toilet tissue dispenser	-	-

Bobrick B-207	Curtain rod and curtain, see drawings for sizes	-	-
Bobrick B-517/518	21-1/2" x 33" folding shower seat	-	-
Bobrick B-254	Sanitary napkin disposal	-	-
Bobrick B-6806.99	1-1/2" diameter x 36" long grab bar refer to Drawings for anchorage	-	-
KP Pro 92144	Hand Sanitizer Dispenser		

Model No.	Description	Power	Remark
Bobrick B-6806.99	1-1/2" diameter x 48" long grab bar refer to Drawings for anchorage		
Bobrick B-5191	14 71/16 x 18" folding shower seat	-	-
See Plumbing Drawings	Flexible spray hose 60" lg., single lever mixing valve control and shower and wand support.	-	-
	1-1/2" diameter x 24" x 36" horizontal two-wall shower compartment grab bar	-	-
Bobrick B-35303	Recessed sanitary napkin disposal	-	-

END OF SECTION

SECTION 10 44 00 FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Non-rated and fire-rated cabinets.
- C. Accessories.

1.2 REFERENCES

- A. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- B. NFPA 10 - Portable Fire Extinguishers.
- C. WARNOCK - HERSEY - Fire Test and Certification.

1.3 QUALITY ASSURANCE

- A. Conform to Title 19, CCR requirements for fire extinguishers.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Include physical dimensions, operational features, color and finish, mounting and anchorage details, rough-in measurements, location, and details.
- C. Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01 70 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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. J. L. Industries.
- B. Larsen's Mfg. Co.
- C. Potter-Roemer, Inc.
- D. Watrous, Inc.
- E. Substitutions: Under provisions of Section 01 62 00.

2.2 EXTINGUISHERS

- A. Dry Chemical Type: Equivalent to J.L. Industries "Cosmic" Model 5E, UL 2A:10B:C with valid certification tag attached.

2.3 CABINETS

- A. Semi-Recessed Non-Rated Cabinets: Equivalent to J.L. Industries "Ambassador" Model No. 1812F10 with full glazed doors, clear acrylic glazing.
- B. Semi-Recessed Fire-Rated Cabinets: Equivalent to J.L. Industries "Ambassador" Model No., 1812FX2 with full glazed doors, clear wire glass. Cabinet shall be fabricated according to ASTM E814 and shall be listed and labeled by Warnock-Hersey for one hour fire-rated wall systems.

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.
- F. Glaze doors with resilient channel gasket glazing.

2.5 ACCESSORIES

- A. Steel Cable Theft Device: Model STI 6200 as manufactured by STI Inc.

2.6 FINISHES

- A. Extinguisher: Red enamel.
- B. Cabinet, Trim and Door: Electrostatic white powder coat finish.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that 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.

3.3 SCHEDULE

- A. Provide fire-rated cabinets at all recessed locations in 1 or 2 hour fire-rated walls. See Drawings for locations and wall ratings. Provide recessed non-rated cabinets at all other non-rated wall locations.
- B. Provide J.L. Industries "Cosmic" Model 5E at all locations unless noted otherwise.
- C. Provide J.L. Industries "Cosmic" Model 5X at Kitchen where indicated, within 30 feet 0 inches of stove in the path of travel.

END OF SECTION

SECTION 10 57 13 COAT AND BACKPACK RACKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall-mounted wood and plastic coat rack system.

1.2 RELATED WORK

- A. Horizontal blocking in stud-framed walls.

1.3 QUALITY ASSURANCE

- A. Lifetime warranty.
- B. Manufacturer to replace hooks at no cost if broken.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data and Shop Drawings: Include sizes, types, finishes, scheduled locations, fasteners and details of adjoining Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. HangSafe Hooks: 165 E. State Highway CC, Nixa, MO 65714. (888) 803-7403.
- B. Substitutions: Under provisions of Section 01 25 00.

2.2 RACK SYSTEM

- A. Wall-mounted System: HangSafe coat and backpack racks.
- B. Hooks: polycarbonate plastic, with rounded ends and eased edges, polished; 8" hook spacing.
- C. Mounting Board: Solid red oak, stained with two coats of clear polyurethane.
- D. Stain Color: Architect to select from manufacturer's standard range.
- E. Fasteners: All fasteners to be stainless steel; 3/4" matching stained buttons for covering mounting holes.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify existing conditions; beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install frame plumb and level, directly into blocking.
- B. Locate as shown on drawings.
- C. Secure rigidly in place in accordance with manufacturer's written installation instructions.

END OF SECTION

SECTION 11 30 13 APPLIANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric range.
- B. Range hood.
- C. Refrigerator/freezer.
- D. Washer.
- E. Dryer.
- F. Ice maker.

1.2 SYSTEM DESCRIPTION

- A. Equipment: Conform to applicable code for UL approval.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on equipment and accessories.
- C. Operating and Maintenance Instructions: Include relevant instructions.
- D. Submit manufacturer's installation instructions.

1.4 WARRANTY

- A. Provide one-year warranty from each appliance manufacturer.

PART 2 - PRODUCTS

2.1 ELECTRIC RANGE

- A. Samsung Model NE59N6630SS true convection freestanding electric range, or approved equal.
- B. Stainless steel front, 30 inches wide x 24-1/2 inches deep x 36-37 inches high.
- C. Five-element ceramic cooktop with 5.9 cu. ft. oven.

- D. 1.4 cu. ft. storage drawer.
- E. 240V / 60 Hz / 40A.

2.2 RANGE HOOD

- A. Samsung Model NK30K7000WS/A2 30" wall-mount stainless steel hood, or approved equal.
- B. Vent Fan: provide optional 600 CFM capacity; vent through roof.
- C. Lighting: dual built-in LED's.
- D. 120V / 60 Hz / 15A.
- E. Provide square stainless steel duct enclosure from top of hood to underside of ceiling; NK-AE705PWS optional hood extension kit required.

2.3 REFRIGERATOR/FREEZER

- A. Samsung Model RT21M6215SR 21.1 cu. ft. top-freezer refrigerator, or approved equal.
- B. Ice Maker: 3.7 lbs. of ice/day.
- C. ENERGY STAR compliant.
- D. Finish: Stainless steel.

2.4 WASHER

- A. Samsung Model WA50R5200AW top load washer, or approved equal.
- B. Features: 10 preset washing cycles; 7 additional washing options; 5 temperature levels; 5 spin speeds; 5 soil levels; 3 dispenser trays.
- C. Capacity: 5.0 cubic feet DOE.
- D. ENERGY STAR compliant.
- E. Finish: white.

2.6 DRYER

- A. Samsung Model DVE50R5200W top load electric dryer, or approved equal.
- B. Features: sensor dry; 10 preset drying cycles; 9 additional drying options; 5 temperature levels; 5 dry levels.
- C. Capacity: 7.4 cubic feet DOE.

D. ENERGY STAR compliant.

E. Finish: white.

2.7 ICE MAKER

A. Marvel Model MA15CRS1XS 15" low profile ADA height crescent ice maker, or approved equal.

B. Features: 25 lbs. of ice/day; store 25 lbs.

C. Finish: stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that openings and utility services are ready to receive Work and opening dimensions are as instructed by the manufacturer.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Set and adjust units level and plumb.

C. Activate units to confirm correct operation.

END OF SECTION

SECTION 12 21 16

VERTICAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Vertical louver blinds
- B. Shroud and fascia assemblies.
- C. Operating hardware.
- D. Related Work:
 - a. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting blinds and accessories
 - b. Section 09 29 00 - Gypsum Board: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories

1.2 REFERENCES

- A. ASTM E84 - Flame Spread.
- B. FS CCC-C-521E - Fire Retardancy.
- C. NFPA 701 – Standard Methods of Fire Tests of Flame Propagation of Textiles and Films.
- D. ASTM G-21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.3 SYSTEM DESCRIPTION

- A. Vertical louver blinds.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00. Coordinate with window submittals.
- B. Submit Shop Drawings indicating opening sizes, tolerances required, installation of blind at window opening, method of attachment, clearances and operation.
- C. Submit Product Data indicating physical and dimensional characteristics such as light filtration capabilities and operating features.
 - 1. Preparation instructions and recommendations.
 - 2. Samples: of each type and color of material specified.

3. CHPS Low-Emitting Materials Product List or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.
 4. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, light filtration capabilities and operating instructions.
 5. Storage and handling requirements and recommendations.
 6. Mounting details and installation methods
- D. Submit two 6 inch long Samples illustrating louver blind material and color.
- E. Submit manufacturer's detailed written installation instructions.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with ten years documented experience.
- B. Installer: approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Division 1.
- B. Deliver products in original unopened packaging with shipping labels intact, wrapped and crated in a manner to prevent damage to components or marring of surfaces.
- C. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, warping or exposure to water.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Install vertical blinds after roof is tight, glazing installed and finish work including painting is complete. Maintain ambient temperature and humidity conditions at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

- A. Vertical Louver Blinds: Manufacturer's standard non-depreciating limited lifetime warranty: repair or replace at no cost.
- B. Installation warranty: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Levolor Commercial, 1400 Davon Drive, McKinney, TX 75069. www.commercial.levolor.com
- B. Hunter Douglas Architectural.
- C. Substitutions: Under provisions of Section 01 25 00.

2.2 MATERIALS

- A. Vertical Louver Blinds, Basis of Design: Levolor Commercial.
 - 1. Head Rail System: Levolor Zirlon, extruded aluminum, Delrin sprocket wheels, end cap covers.
 - 2. Vanes: 3-1/2 inches wide, 180 degree rotation, minimum 3/8" overlap, solid vinyl with UV inhibitors; solid curved or perforated; hang straight for a minimum of 10 feet.
 - 3. Wand: 3/8" diameter, finish as selected by Architect.
 - 4. Finish: to be selected by Architect from manufacturer's complete color range, including solids and perforated.
 - 5. Carriers: Made of Delrin with Zirlon wheels; no glides or sliders permitted.
 - 6. Traversing Control: Non-stretch traverse cord traveling along smooth surfaces.
 - 7. Installation Brackets: As recommended by manufacturer.
 - 8. Options: DesignLine valance, tailored valance corner return, bottom chain.

2.3 MOUNTING

- A. Mounting Types:
 - 1. Outside Mounting: Shade or blind mounts through back of head assembly to outside of window opening on wall surface. Slats or shade shall overlap the opening by minimum 1 inch each side.
 - 2. Inside Mounting: Shade or blind mounts through top of head assembly to inside of window opening. Slats or shade shall be sized with current clearance not to come in contact with sides of window opening, and shall be wide enough to block the maximum amount of light.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive the Work.
- B. Do not commence fabrication or installation until field measurements are confirmed.
- C. Ensure head rail supports are correctly placed.
- D. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION

- A. Install shades in accordance with manufacturer's detailed written instructions.
- B. Secure in place with concealed fasteners.
- C. Verify that wands and other operators are easily reachable for ease of operation at floor level.

3.3 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/8 inch.
- B. Maximum Offset From Level: 1/16 inch.

3.4 ADJUSTING

- A. Adjust Work under provisions of Division 1.
- B. Adjust blinds for smooth operation.

3.5 CLEANING

- A. Clean vanes using only mild liquid detergent soap solution with water. Do not use abrasive cleaners. Ensure proper drying following cleaning by providing adequate ventilation.

END OF SECTION

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manual sunscreen roller shades.
- B. Motorized sunscreen roller shades.
- C. Motorized double-roller sunscreen and room-darkening shades
- D. Shroud and fascia assemblies.
- E. Operating hardware.
- F. Local group and master control system for shade operation.
- G. Related Work:
 - a. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories
 - b. Section 09 29 00 - Gypsum Board: Coordination with gypsum board for installation of shade pockets, closures and related accessories
 - c. Division 26 - Electrical: Electric service for motor controls

1.2 REFERENCES

- A. ASTM E84 - Flame Spread.
- B. FS CCC-C-521E - Fire Retardancy.
- C. NFPA 701 – Flame Propagation of Textiles.
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- E. NFPA 70 - National Electric Code

1.3 SYSTEM DESCRIPTION

- A. Fabric roller window shades.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00. Coordinate with window submittals.
- B. Submit Shop Drawings indicating opening sizes, tolerances required, installation of blind at window opening, method of attachment, clearances, and operation.

Include room schedule listing blind type, shade cloth, mounting type, size and control location.

- C. Submit Product Data indicating physical and dimensional characteristics such as light filtration capabilities (“openness factors”) and operating features.
 - 1. Manufacturer’s preparation and installation instructions.
 - 2. CHPS Low-Emitting Materials Product List or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.
 - 3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, light filtration capabilities and operating instructions.
 - 4. Storage and handling requirements and recommendations.
 - 5. Mounting details and installation methods.
 - 6. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.
- D. Submit two 6 inch long samples illustrating material weave and fabric color.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 87 00.
- B. Deliver products wrapped and crated in a manner to prevent damage to components or marring of surfaces.
- C. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

- A. Roller Shade Hardware, Chain: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Shade Cloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

- C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating warranty.
- D. Roller Shade Installation: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. MechoShade Systems.
- B. Hunter Douglas.
- C. Levolor Commercial.
- D. Lutron Shading Systems.
- E. Substitutions: Under provisions of Section 01 25 00.

2.2 MATERIALS

- A. Roller Shades: Based on MechoShade manually-operated units as a standard of quality.
 - 1. Shade: "Thermoveil" 2100 Group sunscreen, open basket-weave, meeting the requirements of FS CCC-C-521E for fire retardancy and ASTM E 84-90 for flame spread 17, smoke density index 118.
 - 2. Shade at Multi-Purpose Room: "Acoustiveil Dimout" Series 0890; "Chelsea Blackout" Series 0250, PVC-free, opaque shadecloth.
 - 3. Openness Factor:
 - a. North-facing window: 5%
 - b. South-facing window: 3%
 - c. West-facing window: 3%
 - d. East-facing window: 3%
 - e. Multi-Purpose Room: 0-1%
 - 4. Manual Operator: One-piece, chain-operated, clutch-molded and a linear disc-brake opposed to a flat steel backing plate and concealed variable adjustment system, adjustable from 100% friction (static) to 15% friction (dynamic).
 - 5. Power Operator: Mecho WhisperShade IQ2 Electronic Drive Unit (EDU), 120 VAC, with MechNet Wireless Daylight Sensor, double-motorized.

6. Blackout Channels: Side and sill, extruded aluminum, clear anodized.
7. Fascia Concealer: Snap-on extruded aluminum, clear anodized.
8. Accessories: As required for mounting directly to window frame assembly.
9. Cord: Chain (ball type).
10. Factory Finishing: Manufacturer's standard color shade. Clear anodized aluminum accessories.

2.3 MOUNTING

A. Mounting Types:

1. Outside Mounting: Shade mounts through back of head assembly to outside of window opening on wall surface. Shade shall overlap the opening by minimum 1 inch each side.
2. Inside Mounting: Shade mounts through top of head assembly to inside of window opening. Shade shall be sized with current clearance not to come in contact with sides of window opening, and shall be wide enough to block the maximum amount of light.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive the Work.
- B. Do not commence fabrication until field measurements are confirmed.
- C. Ensure head rail supports are correctly placed.
- D. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION

- A. Install shades in accordance with manufacturer's instructions.
- B. Secure in place with concealed fasteners.
- C. Verify that wands and other operators are easily reachable for easy operation at floor level.

3.3 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/8 inch.
- B. Maximum Offset From Level: 1/16 inch.

3.4 ADJUSTING

- A. Adjust Work under provisions of Section 01 70 00.
- B. Adjust blinds for smooth operation.

3.5 CLEANING

- A. Clean Work under provisions of 01700.

END OF SECTION

SECTION 12 35 50 EDUCATIONAL CASEWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- A. Division 1: Cleaning and Waste Management
- B. Section 06 10 00: Rough Carpentry
- C. Section 12 36 00: Countertops

1.3 REFERENCES

- A. WI - Woodwork Institute: Manual of Millwork.
- B. NEMA LD3.1: High-Pressure Decorative Laminates.

1.4 QUALITY ASSURANCE

- A. Manufacture casework items in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.
- B. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of casework.
- C. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing the results of the reinspection.
- D. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.5 MOCK-UP

- A. Prepare mock-up under provisions of Section 01 33 00.
- B. Provide full size base cabinet and upper cabinet of each type indicated, in specified finish with hardware installed.
- C. Units will be examined to ascertain quality and conformity to WI standards.
- D. Units will establish a minimum standard of quality for this Work.

- E. Approved units may be used as part of the Work.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes. Provide WI Certified Compliance label on first page of each set.
- C. Submit Samples of each color/pattern of plastic laminate cabinet facing.

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.
- B. Substitutions: Under provisions of Section 01 62 00.

2.2 CABINET DESIGN

- A. Individual cabinets are indicated on the Drawings by the WI Design Numbering System, Section 15, Supplement No. 3.
- B. A WI number followed by an "L" indicated on the Drawings requires that each door or pair of doors and drawers within that WI cabinet be individually lockable.

2.3 CASEWORK - LAMINATED PLASTIC COVERED

- A. Fabricate in accordance with Section 15 of the Manual of Millwork:
 - 1. WI Grade: Custom.
 - 2. Type: Type I.
 - 3. Construct.: Style A-Frameless.
 - 3. Joinery: Doweled Joints.
 - 4. Cabinet Backs: Dadoed (Detail 2C and 7C Millwork Manual).
 - 5. Cabinet Door Type: Type A. Flush Overlay. Stile and rail (for glass).
 - 6. Shelves: 1-M-2 particle board, 1 inch thick, MOE of 950, capable of supporting 50 lb/sq ft load with deflection of L/144.

7.	Shelf Edge Bands:	0.028 inch high pressure plastic laminate in color to match shelf. All 4 edges of adjustable shelves to receive banding.
8.	Door, Drawer, and Cabinet Drawer Box Edge Bands:	0.028 inch high pressure plastic laminate the same as exposed faces.
9.	Exposed Surfaces (Including Shelves and Interior of Open Front Cabinets); also Impact-Resistant Gyp Panels:	0.028 inch high pressure plastic laminate, color and pattern as selected by Architect. A maximum of 5 colors and patterns to be selected by Architect from Nevamar's standard ARP textured, satin and woodgrain pattern finish.
10.	Semi-Exposed Surfaces (Behind Doors and Inside Drawers):	Low pressure decorative polyester or melamine laminate ALA-85.
11.	Exposed Laboratory Surfaces (Including Shelves and Interior of Open Front Cabinets):	Acid-resistant laminated plastic "Chemsurf" by WilsonArt, color as selected by Architect from standard patterns, satin finish.
12.	Security and Dust Panels:	Particleboard, 3/4 inch thick at all lockable drawers.
14.	Track for Sliding Glass Doors	Knape & Vogt No. [965.] [1092.]

2.4 GLAZING

- A. 1/4 inch thick clear laminated safety glazing with all exposed edges ground smooth.
- B. Glass shelves (if indicated) 5/8 inch thick clear laminated safety glazing with all exposed edges ground smooth.

2.5 HARDWARE

- A. Finish: Polished chrome or stainless steel.
- B. Shelf Standards: Knape & Vogt 255Z (bright zinc plated).
- C. Shelf Support Clips: Knape & Vogt 256Z (bright zinc plated).
- D. Wire Shelf Support Bracket: Knape & Vogt 243Z (bright zinc plated), 2 each shelf.
- E. Shelf Bracket: Knape & Vogt 299 series, size to match width of shelf (anochrome finish).
- F. Drawer and Door Pulls: Epco MC-402-3.

- G. Cabinet Locks: Corbin 0737/8, Olympus 500/600.
- H. Drawer Slides: Accuride heavy-duty, 170 lbs. minimum, full-extension.
- I. Hinges: Rockford Process Control, No. 851, heavy duty wrap-around, tight pin butts of steel, 2-3/4 inch minimum width with companion magnetic door catch capable of a minimum 10 pound pull capacity. Stanley FW or SLCO equivalents are acceptable.
- J. Magnetic Door Catch: Epco 591/592.
- K. Sliding Door Track Assemblies: Grant 2023N sheaves and Grant 2011 track.
- L. Grommets: Doug Mockett & Company, Inc. SG Series; plastic 3-1/2 inch diameter. Colors and locations as selected by Architect.
- M. Vents: Doug Mockett & Company, Inc. EDPAVG2 air vent grommet cap, with separate liner.
- N. Hanger Rods: 1-1/16 inch diameter tubing, stainless steel.
- O. Seismic Shelf Lip: 1/4 inch thick x 3 inch high acrylic plastic edging of color selected by Architect. Ease all edges of plastic.
- P. Remainder of hardware required shall be as listed in Supplement No. 1 to Sections 14 and 15 of the Manual of Millwork.

2.6 FABRICATION

- A. Where mortised shelving standards are to be installed in the back of cabinets at teaching walls, provide thicker back to accommodate standards.
- B. Shop assemble casework for delivery to site in units easily handled and sized to permit passage through building openings.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- D. 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.
- E. In freestanding base casework with utilities, provide enclosed chase from penetration into casework (includes through floor penetrations) to termination at fixture. Utilities to be entirely concealed by chase. Provide plastic laminate clad face and edged banded removable access panels as necessary for full accessibility to utilities. Access panels to be located at unexposed portion of

casework. Chase and access panels shall in no way reduce or infringe on ADA and Title 24 accessibility requirements.

- F. Install plastic grommets in the field in plastic laminate casework and Owner-furnished furniture as directed by the Owner's Representative and/or Architect.
- G. Install seismic shelf lips on all exposed edges of open laboratory shelving with flathead countersunk wood screws spaced 6 inches on center. Finish exposed screw heads to match color of shelf lip.
- H. Install one adjustable shelf for each 12 inches of height for all wall mounted cabinets.
- I. Provide stretcher at top face of all door and drawer fronts.
- J. Fabricate base and full height cabinets 24 inches deep unless shown otherwise.
- K. Fabricate wall mounted upper cabinets 12 inches deep unless shown otherwise.
- L. Provide locks as indicated at location shown on Drawings for both doors and drawers.
- M. Provide acid-resistant laminated plastic at all exposed surfaces (including shelves and interior of open front cabinets.)

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 Installation of Architectural Millwork, Section 26 of the Manual of Millwork.

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, shelves, hardware, fittings and fixtures.

3.4 SCHEDULE

- A. All casework shall be plastic laminate covered unless specifically noted otherwise.

END OF SECTION

SECTION 12 36 00 COUNTERTOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Laminated plastic countertops.
- B. Epoxy resin countertops and sinks.
- C. Solid surfacing countertops and sinks.
- D. Splash panels.
- E. Preparation for utilities.

1.1 RELATED SECTIONS

- A. Section 12 35 50, Educational Casework.

1.3 REFERENCES

- A. WI - Woodwork Institute: Manual of Millwork.
- B. NEMA LD3.1: High-Pressure Decorative Laminates.

1.4 QUALITY ASSURANCE

- A. Manufacture countertops in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.
- B. Issue WI Certified Compliance Certificate to Architect prior to delivery of countertops and provide WI Certified Compliance Labels on all countertops.
- C. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing the results of the reinspection.
- D. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.5 MOCK-UP

- A. Prepare mock-up under provisions of Section 01 44 00.
- B. Provide full size countertops of each type indicated.
- C. Units will be examined to ascertain quality and conformity to WI standards.
- D. Units will establish a minimum standard of quality for this Work.

- E. Approved units may be used as part of the Work.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes. Provide WI Certified Compliance label on first page of each set.
- C. Submit Samples of each type of countertop material.

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.
- B. Substitutions: Under provisions of Section 01 25 00.

2.2 LAMINATED PLASTIC COUNTERTOPS

- A. Fabricate in accordance with Section 16 of the Manual of Millwork:
 - 1. WI Grade: Custom.
 - 2. Core Thickness: 0.75 inch minimum.
 - 3. Laminate Thickness: 0.050 inch.
 - 4. Edge Covering: Rolled [_____].
 - 5. Backsplash: Square butt [_____].
 - 6. Top of Backsplash: Waterfall [_____].
 - 7. Plastic Colors and Pattern: To be selected by Architect from Nevamar's standard ARP, textured, satin and woodgrain pattern finishes
 - 8. Laboratory Exposed Shelves And Reagent Shelves: Acid-resistant laminated plastic "Chemsurf" by WilsonArt, color as selected by Architect from standard patterns, satin finish.

2.3 EPOXY RESIN COUNTERTOPS

- A. Epoxy resin tops and splashes as manufactured by Laboratory Tops, Inc., (512) 352-5591, Trespa Toplab (800) 487-3772, or approved equal, shall be fabricated in accordance with the following:
 - 1. Core Thickness: 1 inch (Trespa: 3/4 inch).

2. Edge: Radius 1/4 inch with drip groove.
 3. Sink Edge: 1/4 inch deep x 5/16 inch wide continuous rabbet.
 4. Backsplash: Square butt.
 5. Color: Black.
- B. Epoxy resin sinks (drop in type) as manufactured by Laboratory Tops, Inc., (512) 352-5591, or approved equal, shall be fabricated in accordance with the following:
1. Wall Thickness: 1/2 inch.
 2. Edge: 1/4 inch thick lipped rim.
 3. Color: Black.
 4. Type : (As indicated on Plumbing Drawings)
 - a. [SK-10:] [____:] Rim dimensions 29-5/8 inches long x 16-5/8 inches wide x 12 inches inside bowl depth, end drain location.
 - b. [SK-11:] [____:] Rim dimensions 29-5/8 inches long x 16-5/8 inches wide x 6 inches over all depth. This sink must be disabled accessible.
 - c. [SK-12:] [____:] Rim dimensions 15-5/8 inches square x 6 inches over all depth. This sink must be disabled accessible.

2.5 SOLID SURFACING COUNTERTOPS

- A. Solid surfacing countertop as manufactured by DuPont de Nemours, Samsung Chemicals USA or Wilsonart Contract.
- B. Basis of design is DuPont Corian solid surface: non-porous, homogenous material of acrylic polymer, aluminum trihydrate filler and pigment.
- C. Finish: matte, with a 60 degree gloss rating of 5-20.
- D. Flammability: Class 1 and A when tested to UL 723.
- E. Adhesive for Bonding to Other Products: one-component silicone, tested to ASTM C920.
- F. Counter Perimeter Frame: 3/4" thick exterior grade plywood with waterproof glue.
- G. Joints: use manufacturer's standard joint adhesive; joints to be inconspicuous and without voids.
- H. Joint Reinforcing: 2" wide strip of Corian under each joint, unless using DuPont Joint Adhesive 2.0.

2.6 HARDWARE

- A. Grommets: Doug Mockett and Company, Inc. SG Series; plastic 3-1/2 inch diameter. Colors and locations as selected by Architect.
- B. Countertop Support Brackets: 1/8 inch thick x 18 inch x 24 inch steel legs, 1-1/2 inch forms with six 1/4 inch mounting holes per side, 1,000 lbs minimum load support, 45 degree cut out as manufactured by A & M Hardware, Inc., or approved equal.
- C. Piano Hinge for Countertop: Stanley No. 311, or approved equal.
- D. Remainder of hardware required shall be as listed in Supplement No. 1 to Sections 14 and 15 of the Manual of Millwork.

2.7 FABRICATION

- A. Shop assemble countertops for delivery to site in units easily handled and sized 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. Install plastic grommets in the field in countertops as directed by the District's Representative and/or Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify adequacy of backing and support framing.
- B. Examine countertops for defects. Correct all defects prior to installation.

3.2 INSTALLATION

- A. Install countertops in accordance with Installation of Architectural Millwork, Section 26 of the Manual of Millwork.
- B. Make joints neatly, with uniform appearance.
- C. Install Work plumb, level, true, and straight, with no distortions. Install with no variation in flushness of adjoining surfaces.

- D. Shim as required, using concealed shims.
- E. Scribe and cut to fit adjoining Work.
- F. Repair damaged and defective Work to eliminate visual and functional defects; where repair is not possible, replace Work.
- G. Sealant: Install sealant as specified in Section 07 92 00, as required to close any small unavoidable gaps between counter and abutting surfaces.

3.3 ADJUSTING AND CLEANING

- A. Protect countertops from damage until acceptance.
- B. Clean countertops with materials and equipment that will not cause damage to surfaces.

3.4 SCHEDULE

- A. Each base cabinet shall receive a countertop.
- B. All countertops shall be plastic laminate-covered unless specifically noted otherwise.

END OF SECTION

SECTION 22 00 50

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric motors.
 - 2. Motor starters.
 - 3. Strainers.
 - 4. Valve boxes.
 - 5. Gauges.
 - 6. Thermometers.
 - 7. Access Doors.
 - 8. Expansion loops.
 - 9. Flexible joints.
 - 10. Insulation.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 22 Section.

1.3 ADDITIONAL REQUIREMENTS

- A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.
- C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.4 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.
1. CSA – Canadian Standards Association International.
 2. ANSI - American National Standards Institute.
 3. ASTM - American Society for Testing and Materials.
 4. CCR - California Code of Regulations.
 - a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.
 5. NCPWB - National Certified Pipe Welding Bureau.
 6. CEC - California Electrical Code.
 7. NEMA - National Electrical Manufacturers' Association.
 8. NFPA - National Fire Protection Association.
 9. OSHA - Occupational Safety and Health Act.
 10. UL - Underwriters' Laboratories, Inc.
- B. Requirements of Regulatory Agencies:
1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2019.
 - b. California Electrical Code, 2019.
 - c. California Energy Code, 2019.
 - d. California Fire Code, 2019.
 - e. California Green Building Standards Code, 2019.
 - f. California Mechanical Code, 2019.
 - g. California Plumbing Code, 2019.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.

- j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - l. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.
 - n. Other applicable state laws.
2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

- A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
 - 2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
 - 3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.
 - 4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

- A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.
 - 1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.
- C. Prior to the start of construction, contact local gas company representative and coordinate location of gas meter and piping. In addition, coordinate time required for installation, in order to avoid delay to the Project.
- D. Obtain permits to operate compressed air tanks required to be furnished under this Work. Pay costs, and perform tests required to obtain permits. Post permits under glass in a conspicuous place on or near tanks, or as required by authorities having jurisdiction.
- E. Coordination:
 - 1. General:
 - a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.
 - 2. Electrical Coordination:
 - a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.

- 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

- a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
- b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
- c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.
- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
 1. Partial or incomplete submittals will not be considered.
 2. Quantities are Contractor's responsibility and will not be reviewed.
 3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.

5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 6. Organize submittals in same sequence as in Specification Sections.
 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.
1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.
- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
- D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.
- E. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
 - 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 - 3. Supports, anchorages and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly

applied in accordance with general information notes of pre-approval documentation. Gas pipe bracing shall be designed in accordance with California Building Code Section 1615A.1.22 and ASCE 7-10 Section 13.6. Coefficient $I_p = 1.5$ shall be used for gas piping bracing calculations.

- b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2019 California Building Code

- 4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

- A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:

- 1. Refer to Division 01 for complete instructions.
- 2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

- a. Sets shall incorporate the following:

- 1) Product Data.
- 2) Shop Drawings.
- 3) Record Drawings.
- 4) Service telephone number, address and contact person for each category of equipment or system.
- 5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
- 6) Copies of guarantees/warranties for each item of equipment and systems.

- 7) Test data and system balancing reports.
 - 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
 - 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) Control diagrams and literature.
 - 11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
 - 12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
 - 13) Commissioning and Preliminary Operation Tests required as part of the Work.
- b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Project Inspector for all record drawings.

1.11 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of

conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is the Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.
- G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.
- C. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.
- D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.
- E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.
- B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with the above warranty within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS AND PRODUCTS

- A. No material installed as part of this Work shall contain asbestos.
- B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.3 ELECTRIC MOTORS

- A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. U.S. Motors.
 - b. Century Electric.
 - c. General Electric.
 - d. Lincoln.
 - e. Gould.
- B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
 - 1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish

motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.

- C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
 - 1. Multispeed motors shall have separate windings for each speed.
- D. Polyphase Motors with Additional Requirements:
 - 1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
 - 2. Motors Used with Variable Frequency Controllers:
 - a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - c. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - f. Each motor shall be provided with a shaft grounding device for stray current protection.
 - 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- E. Single-Phase Motors:
 - 1. Select motors with service factor of 1.15.
 - 2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

- a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
- 3. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- 4. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- 5. Motors 1/20 HP and Smaller: Shaded-pole type.
- F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

- A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.
- B. Provide magnetic motor starters for equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
 - 1. All starters shall have the following:
 - a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
 - b. Ambient compensated thermal overload.
 - c. Fused control transformer (for 120 or 24 volt service).
 - d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
 - 2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
 - 3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
 - 4. Provide OSHA label indicating the device starts automatically.

2.5 STRAINERS FOR POTABLE WATER SYSTEMS

- A. Strainers: Full line size, conforming to lead-free requirements of California Health and safety Code Section 116875. "Y" pattern, 125 psi SWP minimum, with 304 stainless steel screens. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 3 inches and smaller: bronze or brass body, threaded ends, with 20 mesh screen. Watts LF777SI, Wilkins SXL.
 - b. 4 inches and larger: Cast iron body, flanged ends, 1/16 inch or 1/8 inch screen as normally supplied for each size. Watts 77F-DI-125, Mueller 758.

2.6 STRAINERS FOR NON-POTABLE WATER SYSTEMS

- A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.7 VALVE BOXES

- A. General:
 - 1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular "vault" type adequately sized for condition and similar in construction to those specified above.
 - 2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
 - 3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.
- B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.
- C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

- D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.8 GAUGES

- A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.9 THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
 - 1. Provide extension for insulation.
 - 2. Provide thermometers with steel bulb chambers and brass separable sockets.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.10 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 - 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

- D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.11 EXPANSION LOOPS

- A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide assembly selected for 4 inches of movement.
- B. Provide CSA certified expansion loops listed for 4 inches of movement for use in natural or propane gas piping systems.
- C. Where used in potable water systems, provide expansion loops of certified lead-free construction.
- D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Metraflex Inc., Metraloop series.
 - 2. Unisource Manufacturing, Inc., V series.

2.12 FLEXIBLE JOINTS

- A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

- B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.13 PIPE GUIDES

- A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.14 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.15 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legends and flow arrows shall conform to ASME A13.1.

2.16 INSULATION WORK

- A. General:
 - 1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
 - 2. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 - 3. The term "piping" used herein includes pipe, valves, strainers and fittings.
 - 4. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
 - 5. Provide pre-formed PVC valve and fitting covers.
 - 6. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

7. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
8. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
9. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:

1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:
 - a. Pipe 3/4 inches and smaller: 1 inch thick.
 - b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.
 - c. Pipe 2 inches and larger: 2 inches thick.
2. Insulate domestic hot water piping under slab on grade and cold water piping exposed to the weather with 3/4 inch thick Therma-Cel, Armaflex, or equal; seal water tight per manufacturer's directions.
3. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
4. Insulate domestic cold water piping outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
5. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor's option.
6. Insulate condensate drain piping in freezer with 3/4 inch thick Therma-Cel, Armaflex, or equal. Seal water tight per manufacturer's directions. Install heat tape prior to insulation of piping, in accordance with manufacturer's directions.

7. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing 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. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.
 - a. Fitting covers:
 - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 2) Tee covers.
 - 3) Flange and union covers.
 - 4) End caps.
 - 5) Beveled collars.
 - 6) Valve covers.
 - 7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - b. Jacket thickness:
 - 1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
 - 2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS

- A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.
- B. Removed materials which will not be re-installed and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully

remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

- C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.
- D. Existing piping, ductwork, and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.2 FRAMING, CUTTING AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.
- C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.
- D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.
- E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 PLUMBING DEMOLITION

- A. Refer to Division 01 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.
 - 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 to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.

3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

- A. Drawing plans, schematic 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.

3.6 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and Painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 EXCAVATING

- A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.
- B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that 100 percent of the material will pass a No. 200 sieve shall be

compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

- C. Maintain all warning signs, barricades, flares, and red lanterns as required.
- D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.8 BACKFILLING

- A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.
- B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.
 - 1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.
- C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.
- D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.9 PIPING SYSTEMS INSTALLATION

- A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
10. Install horizontal valves with valve stem above horizontal.
11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
12. Verify final equipment locations for roughing-in.
13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per

manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.

15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.
16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

D. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

E. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.
3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. All above Systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

G. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. Elmdor/Stoneman Model 1540, 1550, 1570, or equal.
2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum

skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4, 1100-5, 1100-7, or equal.

H. Hangers and Supports:

1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers. Hanger and support components shall support weight of equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.
 - a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - 1) Provide copper-plated or felt-lined hangers for use on copper tubing.
2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
3. Riser clamps: B-line model B3373, or equal.
4. Pipe Hanger and Support Placement and Spacing:
 - a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded (Note 3)</u>	<u>Steel Gas</u>	<u>Copper Brazed or Soldered (Note 3)</u>	<u>CPVC & PVC (Note 2)</u>
1/2 - 1"	12 ft.	6 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to	Each Floor, Not to	Base and Each Floor

		Exceed 10 ft.	Exceed 10 ft..	(Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- 1) Note 1: Provide mid-story guides.
 - 2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - 3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- b. Vertical cast iron piping support spacing: Base and each floor not to exceed 15 feet.
- c. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded (Note 2)</u>	<u>Steel Gas</u>	<u>Copper Brazed or Soldered (Notes 2, 3)</u>	<u>CPVC & PVC (Note 1)</u>
1/2 - 1"	6 ft.	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	10 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	10 ft.	4 ft.

- 1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- 2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

- 3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.
- d. Horizontal cast iron piping support spacing:
 - 1) Support piping at every other joint for piping length of less than 4 feet.
 - 2) For piping longer than 4 feet, provide support on each side of the coupling, within 18 inches of each joint.
 - 3) Hanger shall not be installed on the coupling.
 - 4) Provide support at each horizontal branch connection.
 - 5) Provide sway brace at 40 foot maximum spacing for suspended pipe with no-hub joints, except where a lesser spacing is required by the seismic design criteria used in delegated design for seismic systems. Refer to Article, Submittals.
 - 6) Provide a brace on each side of a change in direction of 90 degrees or more.
5. Suspended Piping:
 - a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

<u>Pipe Size</u>	<u>Rod Size Diameter</u>
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

- b. Provide 3/8 inch rod for support of PVC and CPVC and provide continuous support.
- c. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.
- d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.

- e. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.
 - f. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
 - g. Steel Connectors: Beam clamps with retainers.
6. Support to Structure:
- a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.
 - 1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062 MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

- 2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
 - 3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.
 - b. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.
7. Rubber Neoprene Pipe Isolators:
- a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.

- b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
- c. Acceptable Suppliers:
 - 1) Vertical runs: Acousto-Plumb or equal.
 - 2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
- 8. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
- 9. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
- 10. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
- 11. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
- 12. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.10 UNION AND FLANGE INSTALLATION

- A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 116875.
- B. Install unions in piping NPS 2" and smaller, and flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 116875.
- C. Locate the unions for easy removal of the equipment, tank, or valve.

3.11 ACCESS DOOR INSTALLATION

- A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment,

etc. Access doors shall provide for complete removal and replacement of equipment.

3.12 CONCRETE WORK

- A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.
- B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.13 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
 - 1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Royston Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Royston Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 - 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-10 or V-20", "Scotchwrap 50", Slipknot 100, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.
- E. Sleeve copper piping/tubing installed below slab with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer's recommendations and instructions.
- F. Sleeve copper piping/tubing installed outside building below grade with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer's recommendations and instructions.
- G. Sleeve cast iron and ductile iron pipe below grade and below slab with "Polywrap" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer's recommendations and instructions.
- H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.14 PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.
- B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
 1. Apply legend and flow arrow at approximately 10'-0" intervals in science classrooms and science prep rooms.
- C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.
- D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.
- E. Apply markings after painting and cleaning of piping and insulation is completed.

3.15 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Refer to Structural Drawings.
- B. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer's recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.
- C. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.
- D. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.
- E. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.16 PIPING SYSTEM PRESSURE TESTING

- A. General:
 - 1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.
 - 2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:
 - 1. Authority having jurisdiction shall witness tests of piping systems.
 - 2. Notify Architect at least seven days in advance of testing.
 - 3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
 - 4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.

5. Isolate from system equipment that may be damaged by test pressure.
 6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.
 - a. Authority having jurisdiction shall witness final connection to system.
- C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.
- D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer's recommendations. Test to 10 feet above highest point in the system.

<u>System Tested</u>	<u>Test Pressure PSI</u>	<u>Test With</u>
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid
Compressed Air	200 lb.	Air & Non-corrosive Leak Test Fluid
Deionized Water	50	Water

1. Flush deionized water lines with deionized water after test and approval.
2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.17 TRACER WIRES

- A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #12 tracer wire with low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints. Tracer wire insulation shall be colored yellow for gas piping, blue for water piping.

- B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.
- C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than 1/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.18 OPERATION OF SYSTEMS

- A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:
 - 1. Complete all requirements listed under "Check, Test and Start Requirements."
 - 2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 - 3. Filters, strainers etc. are in place.
 - 4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 - 5. Equipment has been run under observation, and is operating in a satisfactory manner.
- B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.19 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
 - 1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.

2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 4. When work has been completed, provide copies of reports for review, prior to final observation of work.
- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.20 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
 2. Correct rotation of motors and ratings of overload heaters are verified.
 3. Specified filters are installed and spare filters have been turned over to Owner.
 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 5. All equipment has been cleaned, and damaged painted finishes touched up.
 6. Missing or damaged parts have been replaced.
 7. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.

9. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 10. Preliminary test and balance work is complete, and reports have been forwarded for review.
 11. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 12. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
 2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
 3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
 4. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.
- C. Review of Contractor's Tests:
1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.
- D. Test Logs:
1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.
- E. Preliminary Operation:
1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.21 CERTIFICATES OF INSTALLATION

- A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.22 DEMONSTRATION AND TRAINING

- A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
 - 1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
 - 2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
 - a. Listing of Owner-designated personnel completing training, by name and title.
 - b. Name and title of training instructor.
 - c. Date(s) of training.
 - d. List of topics covered in training sessions.
 - 4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 22 10 00 PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Valves.
 - 3. Domestic water piping specialties.
 - 4. Gas piping specialties.
 - 5. Drain and waste piping specialties.
 - 6. Heat tracing.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.4 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Provide welding certificate for all gas pipe welders.
- C. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

1.5 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.7 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Gas Pipe Installer Qualifications: Individuals performing tasks requiring qualifications under Federal and State regulations shall be qualified by the gas utility supplying Project site. The qualifications shall be current at the time of performing the Work.
- C. NFPA/ANSI Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54/ANSI Z223.1 "National Fuel Gas Code."
- D. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- E. Fabricate and install natural gas systems in accordance with California Plumbing Code.
- F. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

- A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.
- B. Drain and Waste Pipe Above Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, vertical piping above floor from lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV weld pipe and fittings.
 - 1. Joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more. Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).
 - a. Joints located over critical areas including food preparation, food storage, food serving, and eating areas shall be ANACO-Husky SD 4000, Clamp-All 125, or equal, meeting the requirements of FM 1680, SD Class I and ASTM C1540.
- C. Drain and Waste Pipe Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.
 - 1. Joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.
 - 2. Joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.
- D. Vent Pipe:
 - 1. 3 inch and larger: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe above grade.
 - 2. 2-1/2 inch and smaller: Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.
 - 3. Vent pipe buried in ground and to 6 inches above ground: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe

Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.

- E. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.
- F. Temperature and Pressure Relief Valve Piping: ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass.
- G. Gas Pipe: Schedule 40 black steel conforming to ASTM A53, with malleable iron threaded fittings above grade for piping 2 inch and smaller; welded piping below grade and for above grade piping larger than 2 inches, with Class 150 welding fittings.
 - 1. Appliance Flexible Connectors for Indoor Equipment Without External Spring Isolation:
 - a. Contractor may choose one of the following:
 - 1) Direct gas pipe connection.
 - 2) Appliance flexible connector:
 - a) Comply with ANSI Z21.24.
 - b) Polymer or hot-dipped PVC coated corrugated 304 stainless steel.
 - c) Operating-Pressure Rating: 0.5 psig.
 - d) End Fittings: Zinc-coated steel.
 - e) Maximum Length: 30 inches.
 - f) Manufacturers: Dormont, Series 30C, 31, 40C, 41, and 51, Brasscraft model ProCoat, or equal.
 - b. Provide with end connections compatible with equipment and piping system.
 - c. Equipment located in spaces normally accessible to building occupants, other than maintenance personnel, shall utilize direct gas pipe connection.

- d. Provide anti-microbial PVC coating for use with appliances located in kitchen areas.
- 2. Flexible Gas Connector for Outdoor Equipment Without External Spring Isolation:
 - a. Contractor may choose one of the following:
 - 1) Direct gas pipe connection.
 - 2) Corrugated stainless steel hose with 304 stainless steel braid covering, CSA certified. Metraflex model GASCT, Unisource Manufacturing series 400, or equal. Provide with end connections compatible with equipment and piping system.
- 3. Flexible Gas Connector for Equipment with External Spring Isolation, Indoors and Outdoors:
 - a. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide metal flexible connectors, Metraflex Metraloop, or equal by Unisource Mfg. Co., or Flexicraft Industries, CSA certified for 4 inches of movement in all directions.
- 4. Flexible Gas Connection System for Movable Gas-Fired Cooking Equipment:
 - a. System shall include flexible PVC coated braided stainless steel hose, quick disconnect fitting, full port CSA certified ball valve, 2 swivel elbows, coiled steel restraining cable and mounting hardware. Assembly shall be certified per ANSI Z21.69/CSA 6.16, "Connectors for Movable Gas Appliances." Size as required for appliance connection, 48" minimum hose length. Install per manufacturer's instructions. Connectors shall be Dormont Safety System, T&S Safe-T-Link, or equal.

H. Condensate Drain Piping:

- 1. Inside buildings provide ASTM B88, Type L copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought or cast DWV fittings for sizes 1-1/4 inch and larger.
- 2. Outside buildings provide ASTM B88, Type L copper pipe and fittings, cast iron drain pipe and fittings or Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.
- 3. Connect condensate drains to mechanical equipment per equipment manufacturer's recommendations; provide P-trap where required. Slope piping to drain, with 1 inch in 10 foot minimum pitch. Provide di-electric couplings or unions at connections to dissimilar materials.

4. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide threaded metal connector at mechanical equipment, Metraflex Model SST, or equal by Unisource Mfg. Co., or Flexicraft Industries. Arrange flexible connection to ensure drainage of condensate, and support flexible connection at each end of connector, to ensure proper alignment.
 5. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8 inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of trap should be 4 inches, or as recommended by the manufacturer in printed literature.
 6. Provide cleanout tees or "Y" at each change in direction.
- I. Condensing-Type Equipment Condensate Drain Pipe: CPVC pipe and fittings conforming to ASTM D-2846.
1. Provide CPVC condensate drain pipe for condensing water heaters, furnaces, and where shown on Drawings.
 2. Provide continuous support for horizontal piping, B-line, Grinnell, or equal PVC coated channel systems, series B11 through B72 with matching pipe clamps as appropriate, or equal.
 3. Piping and fittings shall be as manufactured by Spears Manufacturing, Charlotte Pipe and foundry Co., or equal.

2.3 SITE PIPING AND FITTINGS TO 5 FEET FROM BUILDINGS

- A. Buried Drain, Waste, and Vent Piping:
1. Install piping from street connection to the property line in accordance with local requirements.
 2. 4 inches and larger: PVC, ASTM D3034 - SDR 35; use matching Ring Tite fittings.
 3. 3 inches and smaller: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler pipe, or equal. Provide ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540. Pipe and fittings shall be the product of a single manufacturer.
- B. Water Service Piping:
1. Sizes 2 inches and larger (not under building): Gasket style PVC conforming to ASTM D2241-SDR21, Class 200 with gasket type fittings or

ductile iron mechanical joint couplings. Gasket fittings shall be one piece injection molded PVC fittings, equal to Flo-Seal water main fittings for PVC pressure pipe, 200 psi, ASTM D-3139.

2. Sizes less than 2 inches: Type K copper tubing, hard temper, with wrought copper fittings. See Section 22 00 50 for pipe protection requirements for below grade copper piping.
 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. J.M. Eagle.
 - b. P.W. Pipe.
 - c. Ipex Series Pipe.
- C. Water Service Piping Above Grade:
1. Sizes 2 inches and larger: Class 150 flanged ductile cast iron water pipe conforming to AWWA/ANSI C150/A21.50 and manufactured in accordance with AWWA/ANSI C151/A21.51. Fittings shall conform to AWWA/ANSI C110/A21.10, Class 250 pattern. Pipe and fittings shall have factory applied cement-mortar lining in accordance with AWWA/ANSI C104/A21.4. Flanges shall conform to ASME/ANSI B16.1.
 2. Piping 1-1/2 inches and smaller: Type L copper tubing, hard temper, with brazed wrought copper fittings.
- D. Gas Piping Underground: Performance Pipe, "DriscoPlex" 6500 PE 2708 (yellow), Polypipe, Inc., "Polypipe", or equal, polyethylene gas distribution pipe, ASTM D2513, ASTM D3261, and ASTM D2683 fittings with fusion welded joints. Provide piping labeled for natural gas in accordance with CPC.
1. Electrically isolate underground ferrous gas piping from the rest of the gas system with listed or approved isolation fittings installed a minimum of six inches above grade.
 2. Provide Central Plastics Corp., Perfection, or equal, anodeless, single seal riser for transition from below grade polyethylene to schedule 40 steel piping above grade. Minimum horizontal length shall be 30 inches. Minimum vertical length shall be 30 inches, or greater as required. Provide fusion connection to polyethylene pipe below grade, and screwed connection to steel pipe above grade.
- E. Gas Piping Aboveground to 30 inches Belowground: Schedule 40 black steel with beveled ends for welding, with Class 150 welding fittings. Mitering to form elbows or tees will not be permitted; where branch tee connections of welded piping are required, Bonney "Weldolet" Allied Pipe Fittings, or equal fittings may be used if the branch is one-half of the diameter of the main or less.

2.4 FIRE PROTECTION PIPING

- A. Refer to specification Section 21 10 00 "Fire Protection."

2.5 PIPE JOINING MATERIALS

- A. Refer to piping Articles in this Section 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 (3.2-mm) 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 C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
 - 3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.
 - 4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, 100 percent lead free alloys. Include water-flushable flux according to ASTM B813.
- D. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
- E. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Solvent Cements for Joining CPVC Piping: ASTM F 493.
 - 1. CPVC solvent cement shall have VOC content of 490 g/L or less.
 - 2. Adhesive primer shall have VOC content of 550 g/L or less.
 - 3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have VOC content of 510 g/L or less.
2. Adhesive primer shall have VOC content of 550 g/L or less.
3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.6 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:

1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 116875.
 - a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.
 - 1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 116875.

B. Gate Valves:

1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.
2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.
3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.
4. Main distribution gate valves underground outside building above 1-1/2 inches:
 - a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.
 - 1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - 2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.
2. 2-1/2 inches: Apollo 77C-LF10, or equal.

D. Swing Check Valves:

1. Minimum 200 psi CWP, bronze or brass body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Milwaukee UP509, Nibco T-413LF, Kitz 822T, or equal.

E. Butterfly Valves:

1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
2. Provide valves with the following:
 - a. Seats: suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
 - b. Bodies: ductile iron or cast iron.
 - c. Discs: Bronze or stainless steel.
 - d. Stems or Shafts: Stainless steel. Install valves with stems horizontal.
 - e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 2 through 12 inches: Watts Regulator Co., model DBF-03.

F. Silent Check Valves (for use on pump discharge):

1. General: Provide spring loaded check valves at pump discharge of all pumps.

- a. 2 inches and smaller: Minimum 300 psi CWP, bronze body, Apollo 61LF, Milwaukee UP548-T, or equal.
- b. 2-1/2 inches and larger: Class 250, cast iron body, suitable for regrounding, Mueller 103MAP, or equal.

G. Calibrated Balancing Valves:

- 1. General: Calibrated orifice ball type rated for 400 psig maximum operating pressure and 250 degrees F. maximum operating pressure.
 - a. Body: Brass.
 - b. Ball: 304 Stainless Steel.
 - c. Seat: Glass and Carbon filled TFE.
 - d. End Connections: Threaded.
 - e. Pressure Gage connections: Integral capped readout valves with internal check valves and drain port, for use with portable pressure differential meter.
 - f. Handle Style: Dial, with memory stops to retain set position.
- 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 1 inch and smaller: Bell & Gossett model CB, "LF" series.

2.7 VALVES AND FITTINGS FOR NON-POTABLE WATER, COMPRESSED AIR, AND GAS SYSTEMS

A. Gate Valves:

- 1. 2-1/2 inches and smaller: Class150, bronze body, union bonnet, rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Hammond IB641, IB648, Nibco T-134, S-134, Milwaukee 1151, 1169, or equal.
- 2. 3 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, non-rising stem, solid wedge, flanged ends, conforming to MSS SP-70. Hammond IR-1138, Nibco F619, Milwaukee F2882A, Stockham G-612, or equal.
- 3. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.

- a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- B. Ball Valves:
 - 1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.
 - 2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.
 - 3. Compressed Air Services: 600 psi CWP, 150 psi SWP, bronze body, full port, three piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco Model T-595-Y, Milwaukee BA-300, or equal.
- C. Swing Check Valves: Class 125 or 150, bronze body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Stockham B-321, Milwaukee 509, Nibco T-433, or equal.
- D. Butterfly Valves:
 - 1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
 - 2. Provide valves with the following:
 - a. Seats: Suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
 - b. Bodies: Ductile iron or cast iron.
 - c. Discs: Bronze or stainless steel.
 - d. Stems or Shafts: Stainless steel.
 - e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 2 through 12 inches: Milwaukee Valve, CL series, Nibco, Inc., Model LD2000-3, or equal.
- E. Silent Check Valves (for use on pump discharge):
 1. General: Provide spring loaded check valves at pump discharge of all pumps.
 2. 2 inches and smaller: 250 psi CWP, bronze body, Nibco Model T-480, Milwaukee 548-T, or equal.
 3. 2-1/2 inches and larger: Class 250, cast iron body, wafer style, suitable for regrinding. Nibco Model F960, Milwaukee 1400, Mueller 103MAP, or equal.
- F. Calibrated Balance Valves (Symbol CBV): Provide globe style valves for precision regulation and control rated 175 psi for sizes 2-1/2 inches through 12 inches and rated 240 psi for bronze sizes 2 inches and below. Each valve shall have two metering/test ports with internal check valves and protective caps. All valves must be equipped with visual position readout and concealed memory stops for repeatable regulation and control.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Bell & Gossett Circuit Setter Plus.
 - b. Armstrong CBV.
 - c. Flow Design Inc. Accusetter.
 - d. Tour & Andersson.
 - e. Circuit Sensor with butterfly valve above 3 inches.
 - f. Illinois Series 5000 through 2 inches.
- G. Building Gas Shut-Off Valves:
 1. 2 inches and smaller: Provide 175 psi SWP ball valve, CSA listed, full port, lockwing type, with AGA painted grey finish. Jomar 175-LWN, or equal.
 2. Above 2 inches: Provide ReSun D-126, Key Port, or equal, lubricated plug cock, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide T-Handle socket wrench and adapter fittings as

required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.

3. Provide valves same size as upstream piping. Make any reduction in size of gas piping downstream of shutoff valves.

H. Gas Shut-off Valve Above Grade:

1. 2 inches and smaller: Provide Milwaukee BB2-100, Jomar T-100NE, or equal, ball valve, CSA listed, full port.
2. Above 2 inches: Provide ReSun D-126, Key Port, or equal, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.
3. Provide valves same size as upstream piping. Make any reduction in size of gas piping downstream of shutoff valves.

I. For Gas Service Below Grade:

1. Lubricated plug cocks: ReSun Model D-126, Key Port, or equal, lubricated plug cock, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide extended lubrication stem, arranged to allow for lubrication of the valve from grade. The extension must be constructed to allow for lubrication of the valve and for operation of the valve from grade. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.
 - a. Provide flanged ends on valves installed below grade. Connect to polyethylene piping with flanges and stainless steel bolts.
 - b. Anchor each valve flange to valve box with welded angle iron, or provide vertical stiff leg, minimum 18 inches into earth.
 - c. Provide Central Double O Seal Transition Fittings, or equal, flanged style for connection between valve and piping system.
 - d. Wrap valve, flanges and exposed pipe with PASCO Specialty & Mfg., Inc., or equal tape wrap, installed in accordance with requirements listed under "Pipe Protection".
2. Molded polyethylene body ball valves: Nordstrom Valves - Polyvalve II for sizes 1-1/4 inches to 2 inches, and Polyvalve for sizes 2 inches and

larger, or equal. Valves 1 inch and smaller shall be listed lubricated plug cocks, with transition fittings..

- a. Provide stub ends to match SDR of the piping, arranged for butt fusion welding. Provide valve body material to suit the adjacent piping system.
 - b. Provide wrench to suit the valve operator.
- J. Seismic Gas Shut-Off Valves: Certified by State of California and compliant with ASCE 25. Provide standard or high pressure model as required to match site gas pressure. Provide unit arrangement per Drawings schedule and details.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Little Firefighter Corporation, models NAGV, VAGV, and AGV.
 - b. Seismic Safety Products, LLC, Northridge series.
- K. Quick Coupling Valves:
- 1. Provide quick coupling valves, heavy duty brass construction with yellow thermoplastic rubber cover, stainless steel internal valve spring, one piece body.

2.8 DOMESTIC WATER PIPING SPECIALTIES

- A. Hose Bibbs:
- 1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Acorn Engineering Co.
 - b. Woodford Manufacturing Co.
 - 2. Hose Station: Leonard THS-25-VB-CW, Symmons, or equal.
- B. Wall Hydrants:
- 1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Acorn Engineering Co.
 - b. Woodford Manufacturing Co.
 - c. Mifab, Inc.

C. Water Hammer Arrestors:

1. Provide water hammer arrestors conforming to lead-free requirements of California Health and Safety Code Section 116875, with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Water hammer arrestors shall be sized for type and number of fixtures served. Provide all stainless steel shell construction with stainless steel bellows and threaded connection to water system.
2. Water hammer arrestors shall be certified under P.D.I. Standard WH201 and by ASSE Standard 1010.
3. Select units in accordance with the requirements of Plumbing and Drainage Institute Standard P.D.I. WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.
4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Josam Company, series 75000.
 - b. Smith (Jay R.) Mfg. Co., Hydrotrol 5005-5050.
 - c. Mifab, series WHB.

D. Water Filters:

1. Provide Cuno Incorporated, Aqua Pure model AP510, or equal, point of use water filters, conforming to lead-free requirements of California Health and Safety Code Section 116875, in locations indicated on Drawings.
 - a. Provide model AP517 filter cartridge at each location, with 5 micron rating and 2,000 gallon rating, to remove sediment, rust, scale and chlorine taste and odor from incoming water. 2 gallon per minute capacity.
 - b. Provide one spare cartridge for each unit provided.

E. Potable Water Pressure-Regulating Valve:

1. Provide pressure-regulating valves, single-seated, direct-operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003, and the lead-free requirements of California Health and Safety Code Section 116875. Size for maximum flow rate and inlet and outlet pressure indicated on Drawings.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Cla-Val Company.
 - b. Watts Regulator Company.

F. Thermostatic Water Temperature Control Valve:

1. Provide thermostatic water temperature control valve conforming to lead free requirements of California Health and Safety Code Section 116875, with size as noted on Drawings, complete with union angle strainer checkstops. Valves shall be thermostatic type, with a maximum temperature setting as follows:
2. Provide surface recessed semi-recessed mounted, white enameled or stainless steel cabinet with locking door for control valves. Including:
 - a. Control valve cabinet and valve shall be provided as a package, and include thermostatic water mixing valve, thermometer, safety checkstops, volume control valve and internal piping.
3. Where indicated on drawings, provide a temperature alarm system, utilizing a micro-processor based controller and solid state temperature controller. Provide audible and visual indication of high and low temperature set points. Provide required hardware and wiring for a complete operating system.
 - a. Provide isolation transformer for control of the alarm system.
 - b. Provide solenoid valve and shock absorber, installed and wired to the alarm module.
4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Leonard Valve Company.
 - b. Lawler Manufacturing Co., Inc.
 - c. Powers.

G. Relief Valves:

1. Provide relief valves as indicated, of size and capacity as selected by Contractor for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI A21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 150 psi.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Watts Regulator Company.
 - b. Cash (A.W.) Valve Manufacturing Corporation.
 - c. Zurn Industries, Inc.; Wilkins-Regulator Division.

H. Trap Primers:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. MiFab, Inc.
 - b. Precision Plumbing Products.
 - c. Sioux Chief Manufacturing Company.

2.9 GAS PIPING SPECIALTIES

A. Gas Pressure Regulating Valves:

1. Provide single-stage, spring-loaded, corrosion-resistant gas pressure regulators, with die-cast aluminum or cast iron body, complying with ANSI Z21.80. Unit shall be with atmospheric vent, internal relief overpressure protection, threaded ends for 2 inches and smaller, flanged ends for 2-1/2 inches and larger. For inlet and outlet gas pressures, specific gravity, and volume flow refer to Drawings schedule.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

<u>Size</u>	<u>Manufacturer/Model</u>
1/2 inch	Elster (American, Singer) model 1213B Itron (Actaris, Slumberger, Sprague) model B42R.
3/4 thru 1-1/4inches	Elster (American, Singer) model 1813C Sensus (Ivensys, Equimeter, Rockwell) model

	143-80-12 Itron (Actaris, Slumberger, Sprague) models B42R, B57R, B58R
1-1/2 thru 2 inches	Elster (American, Singer) models 1813, 1813B Sensus (Ivensys, Equimeter, Rockwell) model 243 Itron (Actaris, Slumberger, Sprague) models B43SR, B34R, B38R

B. Gas and Air Outlets:

2.10 DRAIN AND WASTE PIPING SPECIALTIES

A. Cleanouts:

1. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and where required for satisfactory use.
 - a. Provide cleanouts in waste drop from each sink and urinal.
 - b. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.
2. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.
3. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).
4. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.
5. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within ½ inch of front face of finished wall.
 - a. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.

- b. Install face of cleanout plug within 1/2 inch of front face of finished wall.
- 6. Cleanouts exterior to building in landscaped areas: Zurn Z-1449-BP, or equal, cleanout ferrule with tapered bronze plug. Where located at grade, provide 18 by 18 by 6 inch concrete pad; Trowel concrete smooth and edge; set flush with finished grade.
- 7. Cleanouts in drive areas: Zurn -1400-HD-KC, or equal, with heavy-duty top and ABS plastic plug.
- B. Floor Drains:
 - 1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. MIFAB.
 - c. Watts.
 - d. Zurn.
- C. Floor Sinks:
 - 1. Floor Sinks: Provide anchoring flange (seepage pan) at all floor sinks, and provide flashing clamp in locations where floor membrane is used. Provide cast iron "P" trap and trap primer connection at P-Trap.
 - 2. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. MIFAB.
 - c. Watts.
 - d. Zurn.
- D. Hopper Drains:
 - 1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Zurn.
 - b. J.R. Smith.

2.11 HEAT TRACING

- A. Domestic Hot Water: Provide U.L. listed, 115 degrees F nominal temperature operation heat cable, in locations indicated on drawings. Provide all components required for complete system, including cable, power connections, end seals, splices, tees and accessories. Manufacturer shall be Raychem HWAT-R2, Thermon, or equal, 208 volt single phase.
- B. Label all heat traced piping every 10 feet with "ELECTRIC TRACED" label.
- C. Freezer Boxes: Where condensate drain piping is provided in freezer boxes, provide insulation and Raychem XL-Trace, Thermon or equal, selected to suit manufacturers' recommendations for the ambient temperature expected. Install in accordance with manufacturers recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.
- B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.
- C. Determine sanitary sewer and storm drain location and elevation at all points of connection before installing any piping. Notify Architect immediately if indicated grades cannot be maintained.
- D. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.2 INSTALLATION OF WATER PIPING

- A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.
- B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.

1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.
 2. Install water hammer arrestors above accessible ceilings, or install access doors for service.
- C. In freezing locations arrange water piping to drain as shown.
- D. Install piping on room side of building insulation.
- E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.
- F. For all faucets, hose bibbs, or other water outlets delivering industrial hot and/or cold water, provide a sign, permanently mounted, indicating "CAUTION: NON-POTABLE WATER, DO NOT DRINK". Each sign shall be permanently engraved with black uppercase letters on a yellow background. Letters shall be minimum 1-1/4 inch high.

3.3 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

- A. Make joints in PVC sewer pipe with PVC-type couplings and rubber rings.
- B. Check final location of rubber rings within the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.
1. Ring-Tite cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the pipe with PVC couplings.
- C. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- D. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- E. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.
- F. Grade all vent piping so as to free itself quickly of any water condensation.

- G. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.
- H. Install drip pan under storm drain piping, sanitary drain piping, and vent piping that must be run over kitchen areas.
- I. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.4 INSTALLATION OF NATURAL GAS PIPING

- A. Install natural gas piping in accordance with Division 22 Basic Plumbing Materials and Methods sections.
- B. Use sealants on metal gas piping threads that are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.
- C. Remove cutting and threading burrs before assembling piping.
- D. Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped, or damaged.
- E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.
- F. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.
- G. Install drip-legs in gas piping where indicated and where required by code or regulation.
 - 1. Install "Tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.
 - 2. Where gas supply is connected to equipment with flexible connectors, install drip-leg in piping on downstream side of flexible connector, and install shut off valve on piping on upstream side of flexible connector.
- H. Install piping with 1/64 inch per foot (1/8 percent) downward slope in direction of flow.
- I. Install piping parallel to other piping.
- J. Paint all gas piping installed in exposed exterior locations. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods, article, Painting.
- K. Provide shutoff valve downstream of meter.

- L. Provide exterior shutoff valve at each building. Provide sign affixed to wall at valve location reading: "Gas Shut-Off." Size and location of the sign shall be as required by the Authority Having Jurisdiction. Where gas piping enters a building in more than one location, exterior shutoff valves shall have a permanently attached metal tag identifying the area served by that valve, in addition to sign on wall.
- M. Provide watertight Schedule 40 PVC conduit to protect gas piping installed below covered walk, covered driveways, and where noted on Drawings. Extend sleeve at least 12 inches beyond any area where it is required to be installed, and terminate with valve box extended to grade, and marked "GAS".
- N. Maintain minimum of 12 inch clearance between gas piping and steam piping above 200 degrees F.

3.5 PIPE JOINTS AND CONNECTIONS

- A. General:
 - 1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
 - 3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.
- B. Threaded Pipe: 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 thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Piping: Join according to ASTM D 2855.
- E. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.
1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.
- F. Cast Iron Soil Pipe:
1. No-Hub fittings shall be made with a torque wrench.
 2. Hub joints shall be with Ty-Seal couplings.
 3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.
 4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified LOP reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.
- G. Welded Pipe:
1. Make up with oxyacetylene or electric arc process.
 2. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.
 3. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Thredolets, Nibco, or equal, may be used in lieu of welding tees.
- H. PVC Sewer and Drainage Pipe (outside building as allowed only): Four inches and larger shall be bell and spigot, assembled in accordance with manufacturer's recommendations. Joint shall be tested in accordance with ASTM D3212. Solvent weld joints below 4 inches in size, schedule 40 PVC with matching fittings, assembled per manufacturer's instructions.
- I. Polyethylene and Polypropylene Pipe: Assemble with fusion joints in strict accordance with manufacturer's instructions.
- J. Flexible Connections:
1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.

2. Anchor piping securely on the system side of each flexible connection.

3.6 INSTALLATION OF VALVES

A. Install valves as indicated on Drawings and in the following locations:

1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.
3. Provide gate or globe valves on inlet and outlet of each water heater or pump.

B. General:

1. Valves shall be full line size unless indicated otherwise on Drawings.
2. Install horizontal valves with valve stem above horizontal, except butterfly valves.
3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
4. Locate valves for easy access and provide separate support where necessary.
5. Install valves in position to allow full stem movement.
6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
7. Butterfly valves conforming to the paragraph "Butterfly Valves" may be used in lieu of gate or globe valves for locations above grade.
8. Ball valves conforming to the paragraph "Ball Valves" may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.
9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.
10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.

C. Gate Valves:

1. Furnish valves in copper lines with adapters to suit valve / line requirements.
2. Underground gate valves:
 - a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- D. Swing Check Valves: Install in horizontal position with hinge pin level.
- E. Butterfly Valves: Install with stems horizontal.
- F. Silent Check Valves: Install in horizontal or vertical position between flanges.
- G. Calibrated Balancing Valves: Install calibrated balancing valves per manufacturers' recommendations, including requirements for straight pipe lengths at valve inlet and outlet.
- H. Gas Shut-Off Valves:
 1. Provide line size ball valve in gas line to each appliance.
 2. Provide line size ball valve in gas line, to be used as emergency shut-off for science classrooms. Install valve in locking box where indicated on the drawings.
 3. Provide line size electric solenoid gas valve in gas line to kitchen equipment (if not supplied with appliance) under Type 1 hood. Interlock with hood fire alarm system.
- I. Valve Adjustment: 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.

3.7 INSTALLATION OF CLEANOUTS

- A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.
- B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.8 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

- A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate

with other trades to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.

- B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.9 INSTALLATION OF HOPPER DRAINS

- A. Install hopper drain in wall, in sheet metal box, with access door.
 - 1. Size access door and box to suit the size required for hopper drain and trap primer, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door in occupied spaces.
- B. Grind top and sides of funnel, if required, to suit wall thickness.

3.10 TRAP PRIMER INSTALLATION

- A. Install as indicated in manufacturers printed literature, with 1/2 inch, Type L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings. At Contractor's option, Type K annealed copper tubing without joints may be used below slab only. See Section 22 00 50 for pipe protection requirements for below slab copper piping/tubing.
- B. Install trap primer piping with 1/4 inch per foot slope, to insure that the line will drain fully to the floor drain or floor sink.
 - 1. Provide ball valve to the inlet at each trap primer location.
- C. Install trap primer and distribution unit exactly as called for in manufacturers printed installation instructions. Connect to domestic water piping from the top of the water line, in order to prevent foreign material from entering directly into primer assembly.
- D. Mount trap primer in wall, in sheet metal box, with Karp or equal access door. Size access door and box to suit valve operation, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door where installed in occupied spaces.
- E. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.

3.11 INSTALLATION OF GAS PRESSURE REGULATING VALVES

- A. Install as indicated; comply with utility requirements. In locations where regulators are installed in confined spaces, pipe atmospheric vent to outdoors, full size of outlet. Install gas shutoff valve upstream and downstream of each pressure-regulating valve.

3.12 GAS PIPING EQUIPMENT CONNECTIONS

- A. Connect gas piping to each gas-fired equipment item, with union, drip leg and shutoff gas cock full size of supply line shown. Reduce only at connection to equipment. Comply with equipment manufacturer's instructions.
 - 1. Route gas vent and gas relief to outside.
 - 2. Gas shutoff valve shall be placed as close as possible to equipment in a location where it can be serviced. Distance from equipment to valve shall not exceed 6 feet.

3.13 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.
- B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

3.14 HEAT TRACING INSTALLATION

- A. Provide heat cable on all domestic hot water piping.
- B. Manufacturer's installation recommendation shall be considered as part of this specification.
- C. Field testing of insulation resistance and continuity of the units shall be carried out with a 500 volt meter and recorded by the contractor. Testing shall be done when received on the job site, after installation on the pipe, and after the heat insulation has been installed. Insulation resistance shall be consistently not less than 50 megohms with no decline in reading.
- D. Where source of supply does not coincide with location of thermostat, cable shall be run along the pipe under the insulation to the thermostat.
- E. All junction boxes shall be located above grade level. Covers shall be kept on boxes at all times when not working therein. Where allowable, a hole shall be provided in bottom of junction boxes to permit moisture to escape.
- F. All terminations shall be protected from the water and from physical damage.
- G. Any field alterations or deviations shall proceed only after authority via signed change order has been issued by Architect. All changes shall be accurately recorded by the Contractor and shall be turned over to the Engineer upon completion of that phase of the work.
- H. All lines shall be insulated within 24 hours upon cable installation and acceptance.

- I. Junction boxes, thermostats, transformers and the like shall not be attached to the insulation, but shall be mounted on brackets fabricated of galvanized angle, channel or other material of sufficient strength to support equipment mounted on them. Brackets shall not be mounted on pipe, but rather on separate supports.
- J. Heating cables to be laid out along sections of piping to be heat traced to ensure uniform distribution of heat. It is recommended that the cable first be "roughed-in" using tape or rubber bands which are to be removed after permanent bending. The cable shall not be pulled taut, but allowed reasonable waving along axis of pipe.
- K. Cable sheaths shall not cross or touch one another nor shall cables be installed directly on top of pipe.
- L. Heating cable shall be strapped to two-inch and larger pipe using one-half inch wide stainless steel banding at intervals not exceeding one foot per CEC. Stainless steel tie wire #18 AWG, or larger, shall be used to hold the cable to irregular surfaces such as valves. Tie wire and strapping shall be snug but not so tight as to indent cable sheath. On small diameter and low temperature pipe, nylon ties or glass tape may be used.
- M. Extra cable to be provided at areas of increased heat loss such as valves and flanges to allow dismantling and removal of equipment.
- N. Thermostat bulb to be located as far away from heating cable as possible. Thermostat capillary and control wire shall have mechanical protection between the equipment rack and the pipelines.
- O. Apply "ELECTRICALLY HEATED" signs to the outside of the thermal insulation.

3.15 DOMESTIC WATER SYSTEM STERILIZATION

- A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.
 - 1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.16 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.17 OPERATIONAL TESTS

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.18 TESTING AND BALANCING

- A. See Section 23 05 93 of Specifications for testing and balancing requirements.

3.19 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water supplies and stops.
 - 2. Plumbing fixture hangers and supports.
 - 3. Refrigerator ice maker outlet boxes.
 - 4. Dishwasher air gap fittings.
 - 5. Solids interceptors.
 - 6. Washing machine hose/supply boxes.
 - 7. Plumbing fixtures and trim.
 - 8. Flush valves.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.5 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this Section:
 - 1. California Building Code – CBC
 - 2. California Plumbing Code – CPC
 - 3. California Health and Safety Code
 - 4. American National Standards Institute - ANSI
 - 5. Federal Standards - F.S.
 - 6. National Sanitary Foundation – NSF International
- C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”
- D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.
- E. UL Labels: Provide water coolers that have been listed and labeled by Underwriters' Laboratories.
- F. ARI Labels: Provide water coolers that are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.
- G. Americans with Disabilities Act (ADA).
- H. California Green Building Standards Code Requirements:
 - 1. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. General: Provide factory fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.
 - 1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.
 - 2. Take location and mounting heights for roughing-in from Architectural Drawings.
 - 3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.
 - 4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.2 MATERIALS

- A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.
- C. Handles on all faucets and stops shall be all metal chromium plated.
- D. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.
 - 1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

- B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.
- C. Carriers: Provide cast iron supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated. Where the carrier for wall mounted water closets are installed more than 6 inches behind the finished wall, provide water closet support for wide pipe chase.
- D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.
- F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.
- G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.4 MANUFACTURERS

- A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.
- B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:
 - 1. Vitrified China Plumbing Fixtures:
 - a. American Standard, U.S. Plumbing Products.
 - b. Eljer Plumbingware Div., Wallace-Murray Corp.
 - c. Kohler Co.
 - d. Vitra.
 - 2. Plumbing Trim:
 - a. McGuire Manufacturing Co., Inc.
 - b. Delta Commercial.
 - c. Chicago Faucet Co.

- d. T&S Brass and Bronze Works, Inc.
- 3. Flush Valves:
 - a. Sloan Valve Co.
 - b. Zurn Industries, Hydromechanics Div.
 - c. Toto USA, Inc.
- 4. Faucets:
 - a. Chicago Faucet Co.
 - b. Symmons Scott.
 - c. T&S Brass and Bronze Works, Inc.
 - d. Delta Commercial.
- 5. Fixture Seats:
 - a. Church Seat Co.
 - b. Bemis Mfg. Co.
 - c. Beneke Corp.
- 6. Water Coolers and Drinking Fountains:
 - a. Haws Corporation.
 - b. Halsey Taylor Mfg. Co.
 - c. Elkay Mfg. Co.
 - d. Acorn Aqua.
- 7. Exterior Drinking Fountain / Bottle Filler:
 - a. Most Dependable Fountains, Inc.: Model 10145 SMSS Pedestal Bottle Filler in stainless steel, with dual (hi-lo) drinking fountains; optional 10" stainless steel surface carrier; powder-coat finish over SS, from manufacturer's full range of standard colors.
- 8. Service Sinks:
 - a. American Standard.
 - b. Kohler Co.
 - c. Stern-Williams Serviceptor.

- d. Florestone.
- e. Acorn.
- 9. Stainless Steel Sinks:
 - a. Elkay Mfg. Co.
 - b. Just Mfg. Co.
 - c. Haws Corporation.
- 10. Fixture Carriers:
 - a. Josam Mfg. Co.
 - b. J. R. Smith.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Industries; Hydromechanics Div.
 - e. Mifab, Inc.

2.5 FLUSH VALVE REQUIREMENTS

- A. Metering flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered bypass and be chloramine resistant synthetic rubber with internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable.
- B. Electronic flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered by pass and be chloramine and resistant synthetic rubber with rubber and internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable. All flush valve solenoids and sensors shall be UL listed.

2.6 FIXTURE CONNECTIONS

- A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.
- B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Dearborn Brass, Commercial series with brass nuts.
 - b. Delta Commercial.
 - c. McGuire Manufacturing Co., Inc.
- C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.
- D. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.7 WATER SUPPLIES AND STOPS

- A. Provide 85 percent IPS threaded red brass nipple, conforming to the lead-free requirements of California Health and Safety Code Section 116875, securely anchored to building construction, for each connection to stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.
- B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.
- C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.
- D. Provide cast brass escutcheon.
- E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 1. McGuire Manufacturing Company, Inc., model LFH2167LK.
 2. T & S Brass and Bronze Works, Inc., model B-1305.

2.8 PLUMBING FIXTURE HANGERS AND SUPPORTS

- A. Residential type fixture supports are not acceptable.

- B. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.
- C. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.
- D. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
 - 1. Wall hung lavatories.
 - 2. Wall mounted urinals.
 - 3. Drinking fountains.
 - 4. Electric water coolers.

2.9 PLUMBING FIXTURES

- A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.
- B. Special Requirements For Accessible Fixtures:
 - 1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.
 - 2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded "closed-cell" vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.
- C. Refrigerator Ice Maker Outlet Boxes:
 - 1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

Guy Gray.

Water-Tite.

D. Dishwasher Air Gap Fittings:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Zurn Industries, LLC.
 - b. Dearborn Brass.

E. Solids Interceptors:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

J.R. Smith Mfg. Co.

F. Washing Machine Hose/Supply Boxes:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

Acorn Engineering Co.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING AND PROTECTION

- A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.2 PREPARATORY PROVISIONS

- A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.3 INSPECTION AND PREPARATION

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other

unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.
- E. Refer to Division 26 for wiring for electronic flush valves.

3.4 FAUCET INSTALLATION

- A. Provide 85 percent IPS red brass pipe, conforming to lead-free requirements of California Health and Safety Code Section 116875, securely anchored to building construction, for each connection to faucets, stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.
- B. Adjust metering faucets to run for 10 to 15 seconds.

3.5 CLEAN AND PROTECT

- A. Clean plumbing fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.
- C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.6 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.7 EXTRA STOCK

- A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units.

END OF SECTION

SECTION 22 50 00 PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Commercial electric water heaters.
2. Instantaneous electric water heaters.
3. Gas fired water heaters.
4. Expansion tanks.
5. In-line domestic hot water recirculation pumps.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, capacity and ratings, with selection points clearly indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.5 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Trade names or catalog numbers stated herein indicates grade or quality of materials desired.
- C. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.
- D. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.
- E. CEC Compliance: Comply with California Electrical Code (Title 24, Part 3) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.
- F. ANSI Compliance: Comply with ANSI Z223.1 (NFPA 54) "National Fuel Gas Code", as applicable to installation of gas-fired water heaters.
- G. CSA/UL Labels:
 - 1. Provide gas-fired water heaters that have been listed and labeled by CSA International or Underwriters Laboratories, certifying design according to ANSI Z21.10.1-CSA 4.1 standards governing storage-type water heaters with input ratings of 75,000 BTU/hr. or less.
 - 2. Provide gas-fired water heaters that have been listed and labeled by CSA International or Underwriters Laboratories, certifying design according to ANSI Z21.10.3-CSA 4.3 standards governing storage-type water heaters with input ratings of greater than 75,000 BTU/hr.
- H. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.
- I. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME Code symbol:
 - 1. Water Heaters 200 MBH and greater.
- J. California Energy Commission Compliance: Provide written confirmation of listing of all water heaters in the "Appliance Efficiency Database."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.
- B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 COMMERCIAL ELECTRIC WATER HEATERS

- A. General: Provide commercial electric water heaters of size, capacity, and electrical characteristics indicated on Drawings. Comply with ASHRAE 90.1 for energy efficiency. Provide UL listing. Relief valve dip tube shall extend to within 3 inches of tank.
- B. Heater: Working pressure of 150 psi, magnesium anode rod; glass lining on internal surfaces exposed to water.
- C. Heating Elements: Heavy-duty, medium watt density, with incoloy sheath or zinc plated copper, thermostat stepped through magnetic contactor.
- D. Safety Controls: Double-pole, manual-reset, high-limit, probe type electric water low water cutoff; both factory wired.
- E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin resistant polyurethane or glass fiber insulation. Provide outer steel jacket with bonderized undercoat and baked enamel finish.
- F. Warranty: Furnish three-year minimum warranty on tank leakage.
- G. Provide the following accessories:
 - 1. Brass drain valve.
 - 2. 3/4 inch temperature and pressure relief valve.
 - 3. Thermometer.
- H. Provide equal flow manifold for piping entering and leaving the water heaters. Manifold shall be provided as a standard option for the heaters proposed.
- I. Controls: Adjustable immersion thermostat or surface mounted therm-o-disc; power circuit fusing.
- J. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Bradford White Corporation.
2. Lochinvar Corporation.
3. PVI Industries, LLC.
4. Rheem Manufacturing Company.
5. Smith, A.O. Water Products Co.; a division of A.O. Smith Corporation.

2.3 INSTANTANEOUS ELECTRIC WATER HEATERS

- A. General: Wall mounted, microprocessor-controlled, electric heating style.
- B. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
- C. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 1. Connections: ASME B1.20.1 pipe thread.
 2. Pressure Rating: 150 psig .
 3. Heating Element: Resistance heating system.
 4. Temperature Control: Flow-control fitting. Thermostat.
 5. Safety Control: High-temperature-limit cutoff device or system
 6. Jacket: Aluminum or steel with enameled finish or plastic.
- D. Support: Bracket for wall mounting.
- E. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 1. Chronomite Laboratories, Inc.
 2. Eemax, Inc.

2.4 GAS FIRED WATER HEATERS

General: All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

- B. Atmospheric Gas Fired Water Heaters:
 1. General: Provide commercial atmospheric gas-fired water heater of size, capacity, and electrical characteristics indicated on Drawings. Comply with ASHRAE 90.1 for energy efficiency. Provide UL or CSA International listing.

2. Heater: Working pressure of 150 psi, rigidly supported magnesium anode rod, glass lining on internal surfaces exposed to water. Provide gas pressure regulator, adjusted for operation on natural gas, with pressure rating to suit heater listing. Provide hand-hole cleanout through tank and jacket.
3. Jacket: Insulate tank with rigid polyurethane foam or fiberglass insulation. Provide heavy-gauge steel jacket and baked enamel finish.
4. Warranty: Furnish three year minimum limited warranty on tank.
5. Accessories: Provide brass drain valve and 3/4 inch temperature and pressure relief valve. Provide thermometer, installed in the top 1/3 of the tank or at hot water discharge at the tank.
6. Controls: Adjustable immersion thermostat with safety shutoff.
7. Vent: Furnish and install "Metalbestos", Selkirk, or equal, Type B vent, UL listed. Furnish complete with roof support, flashing, Briedert Type L, Metalbestos, or equal stainless stack cap, and all supports and accessories required for a complete installation.
8. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. PVI Industries, LLC.
 - d. Rheem Manufacturing Company.
 - e. Smith, A.O. Water Products Co.; a division of A.O. Smith Corporation.

2.5 EXPANSION TANKS

- A. Provide thermal expansion tanks of size and number as indicated on Drawings, conforming to lead-free requirements of California Health and Safety Code Section 116875. Construct tank of welded steel for working pressure of 125 psi. Provide specially compounded flexible diaphragm securely sealed into tank to permanently separate air charge from system water, to maintain design expansion capacity.
 1. Tanks shall be IAPMO approved and listed for use with domestic water systems.

- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Amtrol, Inc.
 - 2. A.O. Smith Water Products Company.
 - 3. Watts Water Technologies, Inc.

2.6 IN-LINE DOMESTIC HOT WATER RECIRCULATION PUMPS

- A. Provide lead-free in-line domestic water recirculation pumps where indicated on Drawings and of capacities as scheduled on Drawings. Pumps shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.
- B. Pumps shall be of the centrifugal type with non-overloading characteristics and shall not overload the motor above its nameplate horsepower rating under any operating condition. No allowance for service factor shall be used in pump selection. Motor horsepower shown is minimum; furnish larger motors if necessary to meet the non-overloading requirements.
- C. Type: Horizontal, designed for 125 thru 150 psi maximum working pressure and 225 degrees F continuous water temperature.
- D. Construction: Bronze casing, non-metallic impeller.
- E. Shaft: Ceramic, supported by carbon bearings. Bearings shall be lubricated by the pumped water.
- F. Motors shall have permanently lubricated ball bearings. Motors shall meet NEMA specifications. Motors shall have built-in thermal overload or impedance protection.
- G. Provide control wiring between field-installed controls, indicating devices, and pump control panels as work of this section, complying with requirements of Division 26 sections:
 - 1. Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.
- H. Wire pumps to mechanical control circuits to shut down pump when building is not occupied. Where no control system is installed, furnish pump manufacturers standard timer to automatically turn off circulating pump when hot water is not required.
- I. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Grundfos Pumps Corporation.
2. Bell & Gossett, ITT Corporation.
3. Taco Incorporated.
4. Armstrong Pumps, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section and shall not proceed until all unsatisfactory conditions have been corrected. Commencing work shall be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.2 ELECTRIC WATER HEATER INSTALLATION

- A. Install electric water heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.
- B. Furnish wiring diagram to Electrical Installer. Refer to Division 26 for wiring of units, not work of this section.
- C. Connect to hot and cold water lines with shutoff valve, check valve, and dielectric union in the cold water line, and ASME standard pressure and temperature relief valve and dielectric union in the hot water line. Connect drain and relief piping as noted on Drawings.
- D. Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.
- E. After installation has been completed, seal bottom of heaters without feet to floor with silicone sealer.

3.3 GAS-FIRED WATER HEATER INSTALLATION

- A. Install gas-fired water heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.
- B. Furnish wiring diagram to Electrical Installer. Refer to Division 26 for wiring of units, not work of this section.
- C. Connect to hot and cold water lines with shutoff valves and dielectric unions. Install ASME standard pressure and temperature relief valve. Connect drain and relief piping as noted on Drawings.

- D. Start-up, test, and adjust water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.
- E. Install thermometer, in the top 1/3 of the tank or at hot water discharge at the tank.
- F. Confirm that water heater proposed is suitably equipped to be brought into the building through building openings provided, and that heater may be installed and removed through building openings provided.

3.4 PUMP INSTALLATION

- A. Install pumps where indicated, in accordance with manufacturer's published instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.
- B. Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.
- C. Install in-line pumps with support from overhead structure on each side of pump, or as indicated on Drawings.
- D. Support piping from the building structure so as to prevent any strain on the pump casings. Provide a final check for perfect alignment of the piping connections after pump has been secured to its base. Provide valves, accessories, gauges, flexible connections, and supports as indicated.
- E. Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
- F. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is complete and correct.
- G. Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer.
- H. Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.
- I. Increase piping immediately at pump suction and discharge; flexible couplings and all valves shall be full line size.
- J. Trim pump impeller to obtain the desired water flow after installation, without cost to Owner.
- K. Pumps shall not be connected to piping before piping is thoroughly flushed and cleaned of all dirt and grit. After piping connections have been made, systems shall be filled before starting pumps. Pumps shall not be run dry under any circumstances.

3.5 DEMONSTRATION AND TRAINING

- A. Provide a minimum of 4 hours of training and orientation of Owners staff in proper care and operation of Plumbing Equipment.

3.6 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.7 OPERATIONAL TESTS

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.8 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 23 00 50

BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric motors.
 - 2. Motor starters.
 - 3. Thermometers.
 - 4. Access Doors.
 - 5. Expansion loops.
 - 6. Flexible joints.
 - 7. Motors.
 - 8. Access doors.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 23 Section.

1.3 ADDITIONAL REQUIREMENTS

- A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.
- C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.4 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. AABC - Associated Air Balance Council
2. AFBMA - Anti Friction Bearing Manufacturer's Association
3. AMCA - Air Moving and Control Association Inc.
 - a. Standard 210 - Laboratory Methods of Testing Fans
4. ANSI - American National Standards Institute
5. ARI - Air-Conditioning and Refrigeration Institute
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. CCR - California Code of Regulations
 - a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
10. CSA – Canadian Standards Association International
11. CSFM - California State Fire Marshal
12. NCPWB - National Certified Pipe Welding Bureau
13. NIST - National Institute of Standards and Technology
14. NEMA - National Electrical Manufacturers' Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Act
17. SMACNA - Duct Manuals
18. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2019.
 - b. California Electrical Code, 2019.
 - c. California Energy Code, 2019.

- d. California Fire Code, 2019.
 - e. California Green Building Standards Code, 2019.
 - f. California Mechanical Code, 2019.
 - g. California Plumbing Code, 2019.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - l. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.
 - n. Other applicable state laws.
2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

- A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
 - 2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
 4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

- A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.
- C. Coordination:
1. General:
 - a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.
 2. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.
 3. Electrical Coordination:
 - a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.

- 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.
4. Mechanical Coordination:
 - a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
 - b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
 - c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 - d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.
- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
 1. Partial or incomplete submittals will not be considered.
 2. Quantities are Contractor's responsibility and will not be reviewed.
 3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.

5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 6. Organize submittals in same sequence as in Specification Sections.
 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.
1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.
- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
- D. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, restraints, and vibration isolators shall utilize criteria indicated in Structural Contract Documents.
 - 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 - 3. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.
 - b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting

calculations and legible details sealed by a California registered structural engineer, in accordance with 2019 California Building Code

4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

- A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.
- B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.
- C. Check, Test, and Start forms, from equipment manufacturers.
- D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - 3) Record Drawings.
 - 4) Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
 - 6) Copies of guarantees/warranties for each item of equipment or systems.
 - 7) Test data and system balancing reports.

- 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
 - 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) Temperature control diagrams and literature.
 - 11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
 - 12) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
 - 13) Commissioning and Preliminary Operation Tests required as part of the Work.
2. Post service telephone numbers and addresses in an appropriate place designated by Architect.
- B. Record Drawings:
1. Refer to Division 01 for additional requirements.
 2. Upon completion of the Work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.
- G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.
- C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.
- D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.
- B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS

- A. No material installed as part of this Work shall contain asbestos.

- B. California Green Building Code Compliance:
 - 1. HVAC and refrigeration equipment shall not contain CFCs.
 - 2. HVAC and refrigeration equipment shall not contain Halons.

2.3 ELECTRIC MOTORS

- A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. U.S. Motors.
 - b. Century Electric.
 - c. General Electric.
 - d. Lincoln.
 - e. Gould.
- B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
 - 1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.
- C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
 - 1. Multispeed motors shall have separate windings for each speed.
- D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
 2. Motors Used with Variable Frequency Controllers:
 - a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - f. Each motor shall be provided with a shaft grounding device for stray current protection.
 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- E. Single-Phase Motors:
1. Select motors with service factor of 1.15.
 2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
 3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:
 - a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.
 - 1) Exceptions:

- a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.
 - b) Motors installed in space conditioning equipment certified under 2019 California Energy Code Section 110.1 or 110.2.
- 4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.
- 5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- 6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- 7. Motors 1/20 HP and Smaller: Shaded-pole type.
- 8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

- A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.
- B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
 - 1. All starters shall have the following:
 - a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
 - b. Ambient compensated thermal overload.
 - c. Fused control transformer (for 120 or 24 volt service).
 - d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
 - 2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.

3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
4. Provide OSHA label indicating the device starts automatically.

2.5 THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
 1. Provide extension for insulation.
 2. Provide thermometers with steel bulb chambers and brass separable sockets.
 3. Thermometers for air temperature shall have 8 inch minimum stem.
- B. Provide Ventlock, Durodyne, or equal thermometer test holes at each air conditioning unit, furnace, and make-up air unit, in mixed air and supply air, and at all locations shown or scheduled on the Drawings. Provide two portable thermometers, with sensing connection arranged to suit test connections.
- C. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.6 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.
- D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.
- E. Provide insulated doors where located in internally insulated ducts or casings.

- F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.7 EXPANSION LOOPS

- A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide assembly selected for 4 inches of movement.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Metraflex Inc., Metraloop series.
 - 2. Unisource Manufacturing, Inc., V series.

2.8 FLEXIBLE JOINTS

- A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

2.9 PIPE GUIDES

- A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.10 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.11 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legend and flow arrow shall conform to ASME A13.1.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS:

- A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.
- B. Removed materials which will not be re-installed and which are not claimed by Owner shall become the property of Contractor and shall be removed from the Project site. Consult Owner before removing any material from the Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.
- C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from the premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

3.2 FRAMING, CUTTING, AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.
- C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.
- D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

- E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 MECHANICAL DEMOLITION

- A. Refer to Division 01 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.
 - 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 to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap 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: Drain down and cap remaining 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.

3.4 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment

shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

- A. Drawing plans, schematic 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.

3.6 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.
 - 2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.

3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 PIPING AND DUCT SYSTEMS INSTALLATION

A. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping, conduit, or ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes, conduits, or ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, all duct and other related air distribution component opening shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.
8. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
9. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
10. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
11. Install horizontal valves with valve stem above horizontal.
12. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
13. Verify final equipment locations for roughing-in.

14. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

B. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

C. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

D. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

E. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with CBC requirements.
3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. All above Firestopping systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

F. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues, ducts, and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Elmdor/Stoneman Model 1540.
 - c. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.
2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4.

G. Hangers and Supports:

1. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping or ductwork with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping and ductwork support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.
 - a. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - 1) Provide copper-plated or felt-lined hangers for use on copper tubing.
 - b. Materials and design for ductwork support shall be per SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
3. Riser clamps: B-line model B3373, or equal.
4. Pipe Hanger and Support Placement and Spacing:
 - a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded</u> (Note 3)	<u>Copper Brazed or Soldered</u> (Notes 3, 4)	<u>CPVC & PVC</u> (Note 2)
1/2 - 1"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- 1) Note 1: Provide mid-story guides.
 - 2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - 3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
 - 4) Note 4: Includes refrigerant piping, including vapor and hot gas pipes.
- b. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded (Note 2)</u>	<u>Copper Brazed or Soldered (Notes 2, 3)</u>	<u>CPVC & PVC (Note 1)</u>
1/2 - 1"	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	4 ft.

- 1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- 2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- 3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

5. Suspended Piping:

- a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

<u>Pipe Size</u>	<u>Rod Size Diameter</u>
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

- b. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturers' published load ratings. No deflection to exceed 1/180 of a span.
- c. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
- d. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.
- e. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
- f. Above Roof: H frame made from Uni-Strut hot-dipped galvanized 1-5/8 inch single or double channel with P-2072A or P-2073A foot secured to roof and surrounded with waterproof roofed-in sleeper. Secure to sleeper with lag screws, and secure sleeper to blocking under roof.
- g. Steel Connectors: Beam clamps with retainers.
6. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
7. Support to Structure:
- a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.

- 1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062 MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

- 2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
 - 3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.
- b. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.
8. Rubber Neoprene Pipe Isolators:
- a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.
 - b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
 - c. Acceptable Suppliers:
 - 1) Vertical runs: Acousto-Plumb or equal.
 - 2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
9. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
10. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.

11. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
12. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
13. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.
14. On chilled or combination hot and chilled water or refrigerant pipes, install the hangers on the outside of the pipe covering and not in contact with the pipe. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.

3.8 UNION AND FLANGE INSTALLATION

- A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.
- B. Install unions in piping NPS 2" and smaller 3 or flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.
- C. Locate the unions for easy removal of the equipment, tank, or valve.
- D. Do not install unions or flanges in refrigerant piping systems.

3.9 ACCESS DOOR INSTALLATION

- A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.10 CONCRETE WORK

- A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.
- B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.11 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
 - 1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Royston Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Royston Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 - 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-10 or V-20", "Scotchwrap 50", Slipknot 100, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. holiday detector, or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.
 - 1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.
- E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.12 PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.
- B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval

of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

- C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.
- D. Apply the markings after painting and cleaning of piping and insulation is completed.

3.13 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Refer to Structural Drawings.

3.14 PIPING SYSTEM PRESSURE TESTING

- A. General:
 - 1. Perform operational tests under simulated or actual service conditions.
 - 2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- B. Piping Systems: Test the installations in accordance with the following requirements and applicable codes:
 - 1. Notify the Architect at least seven days in advance of testing.
 - 2. Authority having jurisdiction shall witness tests of piping systems.
 - 3. Piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.
 - 4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
 - 5. Isolate from system equipment that may be damaged by test pressure.
 - 6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.
 - a. Authority having jurisdiction shall witness final connection to system.
- C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

<u>System Tested</u>	<u>Test Pressure PSI</u>	<u>Test With</u>
All Hot, Chilled, Combination, Condenser Water Piping	Greater of 1-1/2 x WP or 100 psi	Water

- D. Testing, Evacuating, Charging and Lubrication of Refrigeration Systems:
1. Pressurize with dry nitrogen and/or refrigerant to 300 psig and test all joints with an electronic detector or halide torch. Release the pressure and attach a high vacuum pump. Evacuate to 4 mm (4000 microns) and hold for 30 minutes. Break to 5 psig with dry nitrogen and allow to remain in the system for ten minutes. Evacuate to 2 mm (2000 microns) and hold for 30 minutes. Use a mercury manometer or electronic vacuum gauge. Do not start timing until recommended vacuum range is reached.
 2. At the end of the evacuation, if the system has been proved leak-free, charge with refrigerant and fill the crankcase to the oil level specified by the manufacturer. All refrigerant oil shall be delivered to the location in sealed containers.
 3. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

3.15 OPERATION OF SYSTEMS

- A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:
1. Complete all requirements listed under "Check, Test and Start Requirements."
 2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 3. Filters, strainers etc. are in place.
 4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 5. Equipment has been run under observation, and is operating in a satisfactory manner.
- B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.
- C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.16 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may

be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 4. When work has been completed, provide copies of reports for review, prior to final observation of work.
- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.17 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
 2. Correct rotation of motors and ratings of overload heaters are verified.
 3. Specified filters are installed and spare filters have been turned over to Owner.
 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 5. All equipment has been cleaned, and damaged painted finishes touched up.

6. Damaged fins on heat exchangers have been combed out.
 7. Missing or damaged parts have been replaced.
 8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
 10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 11. Preliminary test and balance work is complete, and reports have been forwarded for review.
 12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
 2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
 3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
 4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
 5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.
- C. Before handing over the system to Owner replace all filters with complete new set of filters.
- D. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.
- E. Test Logs:
1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.
- F. Preliminary Operation:
1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.
- G. Operational Tests:
1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
 2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
 3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
 4. Control systems shall be completely operable with settings properly calibrated and adjusted.
 5. Rotating equipment shall be in dynamic balance and alignment.
 6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

3.18 CERTIFICATES OF INSTALLATION

- A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.19 ACCEPTANCE REQUIREMENTS

- A. Contractor shall complete the applicable Acceptance Requirements for Code Compliance contained in the California Building Energy Efficiency Standards. Refer to T-24 compliance forms on Drawings for systems having Acceptance testing requirements. Contractor shall perform Acceptance tests and complete the appropriate "Certificates of Acceptance." Submit certificates to the authorities having jurisdiction for approval and issuance of final occupancy permit. Contractor shall engage certified HERS Rater to verify duct leakage rate for duct systems indicated on T-24 compliance forms on Drawings as requiring duct leakage rate testing. For additional duct leak testing requirements, refer to Section 238000, "Heating, Ventilating, and Air Conditioning," Article, "Ductwork Sealing and Leak Testing."
- 1. Covered Processes: In addition to systems listed on T-24 compliance forms on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:
 - a. Parking garage ventilation systems.
 - b. Compressed air systems.
 - c. Type 1 Kitchen exhaust systems.

3.20 DEMONSTRATION AND TRAINING

- A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
- 1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
- 2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
- 3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
 - a. Listing of Owner-designated personnel completing training, by name and title.
 - b. Name and title of training instructor.
 - c. Date(s) of training.

- d. List of topics covered in training sessions.
- 4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Balancing Domestic Water Piping Systems.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCES AND STANDARDS

- A. Associated Air Balance Council (AABC)
 - 1. National Standards for Total System Balance, latest edition.
- B. National Environmental Balancing Bureau (NEBB)
 - 1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.4 DEFINITIONS

- A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.
- B. Similar Terms: The following table is provided for clarification only:

<u>Similar Terms</u>		
Contract Term	AABC Term	NEBB Term

TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

- C. AABC: Associated Air Balance Council.
- D. NEBB: National Environmental Balancing Bureau.
- E. TAB: Testing, adjusting, and balancing.
- F. TAB Organization: Body governing practices of TAB Specialists.
- G. TAB Specialist: An entity engaged to perform TAB Work.

1.5 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

1.6 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
 - 1. Provide list of similar projects completed by proposed TAB field supervisor.
 - 2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.
- C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
 - 1. Submit examinations report with qualifications data.

- D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.
- F. Certified TAB reports.
 - 1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.
 - a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.7 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.8 QUALITY ASSURANCE

- A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - 1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.

- B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:
1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.
 - a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.
 2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.
 - a. TAB technician shall have minimum 4 years TAB field experience.
- C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.
- D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.
- E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.
1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.
- F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.
- G. TAB Standard:
1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:
 - a. AABC National Standards for Total System Balance, or
 - b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.

3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.
- H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect.
 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, including protocol for resolution tracking and documentation.
 2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.
- I. 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.
- J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.
- K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.9 PROJECT CONDITIONS

1.10 WARRANTY

- A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:
 1. AABC Performance Guarantee.
 2. NEBB Quality Assurance Program.
- B. Refer to Division 01 Specifications for additional requirements.

1.11 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.
- C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contract Documents Examination Report:
 - 1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:
 - a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
 - b. Proposed corrective action necessary for proper system operation.
- 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 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.

- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. 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.
- I. Examine operating safety interlocks and controls on HVAC equipment.
- J. Report conditions requiring correction discovered before and during performance of TAB procedures.
- K. 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. TAB plan shall be specific to Project and include the following:
 - 1. General description of each air system and sequence(s) of operation.
 - 2. Complete list of measurements to be performed.
 - 3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
 - 4. Qualifications of personnel assigned to Project.
 - 5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc).
 - 6. Air terminal correction factors for the following:
 - a. Air terminal configuration.
 - b. Flow direction (supply or return/exhaust).
 - c. Effective area of each size and type of air terminal.
 - d. Air density.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.

4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. 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" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 238000 Heating, Ventilating, and Air Conditioning."
- 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. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.
- C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.

1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
 2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.
- D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.
 - E. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
 - F. 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.
 - G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 - H. Verify that motor starters are equipped with properly sized thermal protection.
 - I. Check dampers for proper position to achieve desired airflow path.
 - J. Check for airflow blockages.
 - K. Check condensate drains for proper connections and functioning.
 - L. Check for proper sealing of air-handling-unit components.
 - M. Verify that air duct system is sealed as specified in Section 238000 "Heating, Ventilating, and Air Conditioning."
 - N. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.
 - O. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

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. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts,

coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.

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.
 - 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. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.

- C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.
- D. 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.
- E. Measure air outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.
- F. 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, if included.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.
- G. Do not overpressurize ducts.

3.6 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 manufacturer's name, model number, size, type, and thermal-protection-element rating.
 - a. Starter strip heater size, type, and rating.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- A. 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.

3.9 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

- A. Measure pressure drop across each backflow preventer assembly at design flows.
- B. 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 225000 "Plumbing Equipment

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 range given in article, Tolerances.
- C. Set calibrated balancing valves, if installed, at calculated presettings.
- D. 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.
- E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- F. 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.
- G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- I. Check settings and operation of each safety valve. Record settings.

3.10 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 10 percent and minus 0 percent .
 2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent .
 3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for "Air Outlets and Inlets".
 - a. Room shall be balanced to create pressure relationship (positive, negative, or neutral) with adjacent spaces as indicated on Drawings. Maintain airflow differentials between supply, return, and exhaust indicated on Drawings.
 4. Heating-Water Flow Rate: .
 5. Cooling-Water Flow Rate: .
- B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.11 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
 2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
 3. 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 specialist.
 3. Project name.
 4. Project location.
 5. Project Performance Guaranty
 6. Architect's name and address.
 7. Engineer's name and address.
 8. Contractor's name and address.
 9. Report date.
 10. Signature of TAB supervisor who certifies the report.
 11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 12. 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.
 13. Nomenclature sheets for each item of equipment.

14. 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. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. 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. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Balancing stations.
 5. Position of balancing devices.
- E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.
- F. Test Reports – General:
 1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.
- G. 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. Refrigerant expansion valve and refrigerant types.
- H. 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.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.

- d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, 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.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
- a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - 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.

K. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft.

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.

- 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.

3.13 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 specialist'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 10 percent, 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 contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
 3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.
- D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

- A. 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 09 23

ENERGY MANAGEMENT SYSTEM FOR HVAC (EMS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes equipment and performance criteria for furnishing all labor and materials for the installation and programming for Energy Management System for HVAC Systems utilizing wireless communication with cloud based servers.

1.2 RELATED SECTIONS:

- A. Division 01: General Requirements
- B. Section 23: Heating, Ventilating, and Air-Conditioning (HVAC)

1.3 SUBMITTALS:

- A. Shop Drawings and product data in accordance with the specifications.
- B. All shop drawings shall be prepared in AutoCAD 2000 or newer. In addition, Contractor shall provide drawings in electronic format with x-ref and layer information to other trades as required.
- C. All submittals shall be bound or in a three ring binder with a table of contents and related section tabs. Five (5) copies shall be submitted to the Architect or engineer for distribution and review.
- D. Shop drawings shall include basic floor plans depicting locations of all equipment and wiring, installed by others, to be controlled by system and locations of thermostats, gateways and other equipment provided under this section. Drawings shall also show location of electrical power, low voltage wiring and data ports, provided by others, required for proper installation of systems of this section.
- E. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification.
- F. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all documents for accuracy.
- G. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

1.4 SCOPE OF WORK

- A. Except as otherwise noted, the control system shall consist of all thermostats, and gateways to fill the intent of the specification and provide for a complete and operable system.
- B. The EMS Contractor shall review and study existing building/site conditions where applicable and all new construction drawings for the project including HVAC drawings and the entire project specifications to familiarize themselves with the equipment and system operation prior to bidding and submittal of a bid/price and notify the owner immediately of any conflicts between the project and the scope of work of this section, including work to be completed by others.
- C. All equipment and installation of control devices associated with the equipment listed below shall be provided under this Contractor.
- D. When the EMS system is fully installed and operational, the EMS Contractor will make themselves available to meet with the designated representatives of the owner to review the as-installed condition of the system. At that time, the EMS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.
- E. The Contractor shall furnish and install a complete EMS control system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification. Provide and Install EMS controls for the HVAC Equipment as noted on the drawings:
- F. Provide technical support necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and the owner's team.
- G. Contractor shall provide one training session in the operation of the system, for owner's personnel.
- H. All work performed under this section of the specifications will be in compliance with all codes and regulations as mandated by the authority having jurisdiction.

1.5 SYSTEM DESCRIPTION

- A. The Energy Management System (EMS) shall consist of thermostats, gateways and related accessories as indicated below and all related programming for a complete and fully operational web based management system using a cloud server program complying with the following specifications.
- B. The entire Energy Management Solution (EMS) shall include a network of commercial Internet programmable thermostats which use IEEE 802.15.4 mesh wireless communication protocol to reach a Wireless Gateway (WG). The WG must connect to the owner's wide area network (WAN) over a TCP/IP connection. Access and control of EMS is through a web based management

tool which sits on a cloud server and must be accessible either locally or remotely via the Internet.

1.6 WORK BY OTHERS

- A. The EMS Contractor shall coordinate with other contractors prior to performing the work on this project and cooperate as necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work prior to fabrication and installation. The owner's representative shall be immediately notified if an area of conflict occurs between trades prior to fabrication and installation. EMS Contractor shall provide field supervision to the Mechanical Contractor for pre-installation of control components.
- B. Low voltage thermostat wiring between equipment and thermostat locations shall be furnished and installed by the Mechanical Contractor. Unless noted otherwise all new low voltage wiring shall be multiple conductor thermostat wiring (wire count as indicated in Thermostat Manufacturer's installation instructions) installed per owner's specifications. (Wiring in existing installations shall be minimum 3 conductor / 24 gauge wires per EMS manufacturer's standard specifications, multiple c conductor/24 gauge thermostat wiring preferred - see Installation Instructions for specific conductor counts depending on heating and cooling modes of existing equipment.)
- C. Related work provided by others:
 - 1. 110 V outlets shall be provided within 5 feet of each gateway location.
 - 2. 1 Data port shall be provided within 10 feet of each gateway location.
- D. Equipment start-up and servicing

1.7 CODE COMPLIANCE

- A. Provide EMS components and ancillary equipment which are code compliant.
- B. All wiring shall conform to the National Electrical Code.
- C. All products of the EMS shall reside with the following agency approvals.
 - 1. California 2019 Title 24 Compliant.
 - 2. California Energy Commission Occupant Control Smart Thermostat (OCST) certified.
 - 3. OpenADR2.0 certified.

1.8 SYSTEM STARTUP AND COMMISSIONING

- A. Each EMS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the EMS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.
- B. The EMS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The EMS Contractor shall have a trained technician available on request during the balancing of the systems. The EMS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to EMS.

1.9 TRAINING

- A. The EMS Contractor shall provide training for two (2) owner's representatives and/or maintenance personnel. The EMS Contractor shall provide on-site training to the District's representative(s) and maintenance personnel per the following description:
- B. On-site training shall consist of a minimum of (1) hours, as indicated above of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include
 - 1. System Overview
 - 2. System Software and Operation
 - 3. System access
 - 4. Software features overview
 - 5. Changing set points and other attributes
 - 6. Scheduling
 - 7. Editing programmed variables
 - 8. Displaying color graphics
 - 9. Running reports
 - 10. Workstation maintenance
 - 11. Application programming

12. Operational sequences including start-up, shutdown, adjusting and balancing.
13. Equipment maintenance

1.10 OPERATING AND MAINTENANCE MANUALS

- A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire EMS. This documentation shall include specific part numbers.
- B. Following project completion and testing, the EMS contractor will submit as-built documentation reflecting the exact installation of the system.

1.11 WARRANTY

- A. The EMS Contractor shall warrant the system for 12 months after system acceptance and beneficial use by the District. During the warranty period, the EMS Contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. EMS equipment shall be warranted for a period of 5 years from the time of system acceptance.
- B. Warranty of equipment is limited to replacement of defective products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Unless noted otherwise, all products shall be of a single manufacturer. The standard of design and quality shall be products as manufactured by Pelican Wireless Systems,
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional requirements of the specified product. A request for Architect/Engineer's approval must be submitted with complete technical data to allow for proper evaluation. All materials for evaluation must be received by Project Manager at least 10 days prior to bid due date.

2.2 WIRELESS GATEWAY (WG)

- A. A single WG shall be capable of providing communication between a dedicated cloud server using TCP/IP and the on-site Internet Programmable Thermostats using the IEEE 802.15.4 wireless communication protocol. Additional WGs can

be used for a single site, but each WG must meet or exceed these requirements

- B. The WG must provide the following hardware features as a minimum:
 - 1. Single Ethernet Port.
 - 2. One micro-USB 5VDC power input.
 - 3. 2.4 GHz IEEE std. 802.15.4 built-in communication processor.
- C. The WG shall provide the communication link between the entire system and a cloud based server. Communication with cloud server shall be secured using AES (Advanced Encryption Standard).
- D. The WG shall be able to support 2000 Internet Programmable Thermostats.

2.3 INTERNET PROGRAMMABLE THERMOSTAT (IPT)

- A. Internet Programmable Thermostat shall be a wireless communicating commercial programmable thermostat that uses IEEE 802.15.4 for networking communication and a wiring terminal block for controlling a single zone HVAC unit.
- B. The IPT shall provide a keypad for setting:
 - 1. Temperature Set points.
 - 2. System Mode (Heat, Cool, Auto, Off).
 - 3. Fan Mode (Auto, On).
 - 4. Light Button.
- C. The IPT shall include a wiring terminal for controlling a single zone HVAC unit. The wiring terminal must be able to be removed from the IPT for installations where only 3-wires exist or are available between where the IPT will be placed and its connection with the HVAC unit it will be controlling. Over these 3-wires the thermostat must still be able to control the HVAC unit based on these specifications.
- D. The IPT must be configurable using a Web Based App. No thermostat configuration, other than setting the IPT to Conventional, Heat Pump - O, or Heat Pump -B, shall be done at the thermostat. Web based Configuration Setting options shall include:
 - 1. Naming the thermostat
 - 2. Grouping multiple thermostats.
 - 3. Heat Pump or Conventional system setting.

4. If Heat Pump; reversing valve O or B setting.
 5. Cycles Per Hour (1 - 6).
 6. Anticipation Degrees (0°F - 0.5°F)
 7. Calibration Degrees (2.0°F - -2.0°F)
 8. Heat Stages (0 - 2)
 9. If Heat Pump; Aux Heat (Disabled and/or Enabled Option)
 10. Cool Stages (0 - 2)
 11. Fan Stages (1 - 2)
 12. Fan Circulation Minutes Per Hour.
 13. Temperature Display (Fahrenheit or Celsius)
 14. Heat Range Temperature Setting Limitation
 15. Cool Range Temperature Setting Limitation
 16. Ability to disable and enable Keypad Control through schedule.
 17. Heat consumption (kw, btu, ton, or watt)
 18. Cool consumption (kw, btu, ton, or watt)
 19. Notification Sensitivity (High, Medium, Low)
 20. Alarm of exceeding temperature based on a Safe Range
 21. Schedule set times (2, 3, 4, or Variable).
- E. IPT settings and control through the Web Base App shall be in real-time and include:
1. Space Temperature
 2. System Mode (Heat, Cool, Auto, Off).
 3. Fan Mode (Auto, On).
 4. Current set point.
 5. Relay status (Heat/Cool and Fan).
 6. Historical Trend Graphs.
 7. Scheduling

8. Lock and Unlock Entire Thermostat's Keypad
9. Lock and Unlock the Thermostat's Fan Mode setting Only

2.4 WEB BASED GRAPHICAL USER INTERFACE

- A. The Web Based App (WBA) shall be able to run on any PC that uses Safari, Chrome, Firefox, or any other web browser that meets these browsers' functionality.
- B. The WBA Platform shall be able to run on any Internet Accessible Smartphone and/or Tablet that has a Web Browser compatible with HTML5.
- C. The WBA shall allow up to a minimum of 100 simultaneous users/clients to access the Energy Management System.
- D. The Web Based client shall support at a minimum, the following functions:
 1. User log-on identification and password shall be required.
 2. HTML programming shall not be required to display any graphics or data on the Web page.
 3. Storage of data shall reside within the cloud server and shall not sit within the client's computer or device. EMS that requires data storage on a client computer or an on-site server is not acceptable.
 4. Users shall have administrator and user definable access privileges.
 5. OpenAPI interface with XML data output.
- E. Schedules:
 1. The WBA shall provide user with access to setting Internet Programmable Thermostat (IPT) schedules. Up to 12 schedule periods per day shall be available for each IPT.
 2. Schedules shall be available as Weekly (7-day), Daily, or Weekday/Weekend (5-2).
 3. The WBA shall provide the user the ability to:
 - a. View Schedules.
 - b. Add/Modify Schedules.
 - c. Assign Thermostat to a Group Schedule.
 - d. Delete Schedules.

F. Trending

1. The WBA shall provide real-time trend information on:
 - a. Each IPT's space temperature.
 - b. Each IPT's temperature set points.
 - c. Each IPT's current call; heat, cool, and/or fan.
 - d. Each IEE's call for economization
2. The WBA shall be able to record and provide at least two years of past trend data for every thermostat in the wireless network. Trend data shall include:
 - a. space temperature; with resolution of every 1/10th of a degree Fahrenheit.
 - b. IPT's temperature set points.
 - c. indication of whether the thermostat was calling for; heat, cool, and/or fan.
3. Trend data shall be viewable on the WBS

G. Alarm Notifications

1. The WBA shall provide automatic alarming functionally based on real-time monitoring of at least:
 - a. space temperature and temperature change.
 - b. IPT's temperature set points.
 - c. IPT's current call; heat, cool, and/or fan.
2. The WBA shall be able to provide a user with the ability to:
 - a. View Alarms.
 - b. Set Alarm Notification sensitivity level to High, Medium, or Low.
 - c. Delete Alarms.
3. Alarms shall be able to be sent via email and/or text message to up to 100 or more clients.

H. Consumption Usage

1. The WBA shall be able to calculate and graphically display the consumption of running a single zone HVAC unit based on a user defined

HVAC unit heat and/or cool consumption rate multiplied by the thermostat heat/cool call time.

2. The WBA shall be able to calculate and graphically display the cost of consumption of running a single zone HVAC unit based on taking a user defined HVAC unit heat and/or cool consumption and multiplying that by the client defined cost per kw and/or therm.
3. The WBA shall be able to display consumption usage for a single thermostat, multiple thermostats at a single time, or all the thermostats in the EMS.
4. The WBA shall be able to record and display up to at least two years of consumption usage information.

2.5 WIRED REMOTE TEMPERATURE SENSORS AND DIGITAL ALARM INPUT

A. Input Temperature Sensor (ITS).

1. The ITS shall connect to the Internet Programmable Thermostat over 3-wires.
2. ITS shall provide at least one external 10K Type II thermistor temperature sensor input.
3. Web Based App shall be able to record and provide at least two years of past temperature data for ITS.
4. The trend data shall be viewable on the WBA.
5. ITS must be accurate to $\pm 1.0^{\circ}\text{F}$
6. ITS must be able to be installed up to 500' away from IPT using standard thermostat wiring.

2.6 INTERNET ENABLED ECONOMIZER (IEE)

- A. The IEE shall connect to the Internet Programmable Thermostat (ITS) with ONLY 3-wires. No additional wiring must be required between the IEE and the ITS to gain complete Title 24 compliant economization control.
- B. IEE shall provide up to three 10K Type II external thermistor temperature sensor input.
- C. Web Based App shall be able to record and provide at least two years of past data for IEE. Data must represent historical representations of:
 1. Calls for Economization
 2. Outside Air Damper Position

3. Supply and Outside Air Temperature

- D. The trend data shall be viewable on the WBA.
- E. IEE must be able to send California Title 24 Fault and Diagnostics codes to the WBA, email addresses, and or text messages.
- F. IEE must be able to be installed up to 500' away from IPT using standard thermostat wiring.
- G. IEE must have a settable 0-10VDC output for Outside Air Damper Actuator control.
- H. IEE must have a settable 0-10VDC output for Variable Frequency Drive (VFD) control.
 - 1. IEE must be configurable for different VFD speeds based on calls for cold, heat, and ventilation.
- I. IEE must have a 0-10VDC input for Outside Air Damper Position Feedback.

2.7 WIRELESS PROXIMITY SENSORS

- A. Wireless Proximity Sensor (WPS).
 - 1. The WPS shall connect with the Internet Programmable Thermostat over the 802.15.4 wireless network.
 - 2. WPS shall be powered by 2 AA batteries or equivalent.
 - 3. WPS must be able to be used for either:
 - a. Accepting a motion sensor's 2-wire dry contact output.
 - 1) The WPS shall be able to notify an Internet Programmable Thermostat if a motion sensor's dry contact is in either the open or closed position.
 - 2) Dry contact open positions will indicate that the space is occupied and the IPT must be able to automatically setback its temperature setting by a range of 0F - 10F or OFF.
 - 3) Dry contact closed position will indicate that the space is unoccupied and set the temperature to a comfort setting when the space is occupied.
 - 4) Setback settings and comfort settings must be settable through the Internet Programmable Thermostat's schedule through the Web Based App (cannot be settable at thermostat).

- 5) Web Based App must be able to display when a space is “Unoccupied”.
- b. Detecting if a Window OR Door is Opened or Closed.
 - 1) The WPS must have a built-in magnetic sensor and come with a magnet that can be installed on a door OR window.
 - 2) The WPS must be able to notify an Internet Programmable Thermostat if the door is open and the IPT must automatically turn to the OFF position.
 - 3) The WPS must be able to notify an Internet Programmable Thermostat if the door is closed and the IPT must automatically return to its last temperature and system settings.
 - 4) Web Based App must be able to display when the Door OR Window is Open and must be able to be set to indicate “Door” or “Window”.
4. Web Based App shall be able to notify if the WPS batteries are low and record and provide at least two years of past history on occupancy and/or door/window status for each space a WPS is installed in.
5. The trend data shall be viewable on the Web Based App.
6. Internet Programmable Thermostat must be able to connect with at least 8 WPS, each WPS must have a unique serial number and each WPS shall be settable, through the Web Based App, as either a motion sensor input or as a door/window sensor.

PART 3 - EXECUTION

3.1 CONTRACTOR RESPONSIBILITIES

A. General

1. Installation of the Energy Management System shall be performed by an approved Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor without prior written approval of the owner.

B. Demolition

1. Remove controls which do not remain as part of the Energy Management System. The Owner will inform the Contractor of any equipment which is

to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

C. Access to Site

1. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the District or the District's Representative.

D. Code Compliance

1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations.

E. Cleanup

1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.2 WIRING, CONDUIT, AND CABLE

- A. All control wires between HVAC units and thermostat locations to be furnished and installed by the Mechanical Contractor. The EMS Contractor shall not begin work on this contract until all wiring is installed to the satisfaction of the EMS Contractor. The EMS Contractor shall provide wiring between remote temperature sensors, TA1 and thermostats as required, unless noted otherwise in drawings or specifications.

3.3 HARDWARE INSTALLATION

A. Installation Practices for Devices

1. All devices are to be mounted level/plumb and per the manufacturer's installation documentation.

B. Identification

1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
2. All field enclosures, other than controllers, shall be identified with a back lite nameplate. The lettering shall be in white against a black or blue background.
3. Junction box covers will be marked to indicate that they are a part of the EMS system.
4. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.

5. All I/O field devices inside FIP's shall be labeled.
- C. Existing Controls.
 1. Existing controls are not to be reused. All EMS devices will be new.
- D. Control System Switch-over
 1. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.
- E. Location
 1. The location of sensors is per mechanical and architectural drawings.
 2. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
 3. If Input Temperature Sensor(s) (ITS) is used as Outdoor air sensor, outdoor air sensors will be mounted on the north building face directly in the outside air. Install sensors such that the effects of heat radiated from the building or sunlight is minimized.
 4. If any line voltage electrical control is being installed, field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.4 SYSTEM PROGRAMMING

- A. General.
 1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software.
 2. Contractor shall work with owner's representative to determine programming parameters including but not limited to hours of operation, set points, system variables, thermostat naming, and site naming. Thermostat & Site naming shall be performed by the Contractor. Naming convention (equipment # or name, or space served) shall be provided by or agreed upon with the Owner.

3.5 Commissioning and System Startup

- A. EMS device functional testing.
 1. Each system for which a EMS device has been installed shall be tested for proper installation and functional operation. Test shall include on-site control test to verify each wireless device is responding to signals sent

from cloud based servers and responding in accordance with manufacture's specifications.

2. Please contact Tom Hardy of RSD-Total Control for project quotation @ 916-600-3027.

END OF SECTION

SECTION 23 80 00
HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Split system air conditioning units.
 - 2. High efficiency furnace units.
 - 3. Air cooled condensing units.
 - 4. Cooling coils.
 - 5. Refrigeration piping and fittings.
 - 6. Fans.
 - 7. Relief and intake vents.
 - 8. Air inlets and outlets.
 - 9. Filters.
 - 10. Dampers.
 - 11. Ductwork.
 - 12. Insulation.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 23 00 50, Basic HVAC Materials and Methods.
- C. 23 05 93, Testing, Adjusting, and Balancing for HVAC.
- D. Section 23 09 23, Direct Digital Control (DDC) System for HVAC.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meetings:
 - 1. Variable Refrigerant Flow System Conference: Installing contractor's foreman shall attend conference at Project site with design Engineer and

equipment manufacturer's representative, to comply with requirements of this Section and manufacturer's installation requirements including but not limited to, the following:

- a. Proposed deviations from system as shown and described in Contract Documents, including location of system components and impacts to refrigerant pipe sizing.
 - 1) Provide Coordinated Layouts as required by this Section for use in discussion.
- b. Refrigerant piping assembly practices.
- c. General discussion, question and answer period.
- d. Walk site with equipment manufacturer's representative to identify conditions affecting installation of system as designed.

1.4 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.
 - 1. Upon approval of submittal, provide manufacturer's installation and operating instructions to the Project inspector for the following:
 - a. Fire dampers, smoke dampers, and combination smoke-fire dampers.
- C. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.5 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract

Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.

- C. Economizer Fault Detection and Diagnostics (FDD) System Data: For all air-cooled unitary direct-expansion units equipped with an economizer, provide data for third-party supplied California Energy Commission certified FDD controller, documenting compliance with the requirements of California Building Energy Efficiency Standards. Provide evidence of certification.
- D. Record of pre-installation meeting.
- E. Training Certificates of Completion: Submit certificate from equipment manufacturer, indicating attendance and successful completion of manufacturer's training program for variable refrigerant flow systems installation and service. Training shall include manufacturer's preferred methods for assembling and insulating refrigerant piping and accessories.
- F. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.6 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.
- C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

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(s) for each belt-driven unit.
 - 2. Provide one complete set(s) of filters for each filter bank.

1.8 COORDINATED LAYOUT

- A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.
- B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other

disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.

1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

B.O.D. = 9'-0"

OFFSET UP 6"

B.O.D. = 9'-6"

3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.
- C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.
- D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.9 QUALITY ASSURANCE

A. Design Criteria:

1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.
2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
3. All items of a given type shall be products of the same manufacturer.
4. Scheduled equipment performance is minimum capacity required.
5. Scheduled electrical capacity shall be considered as maximum available.

6. Scheduled gas BTU input shall be considered as maximum available.

1.10 FIELD CONDITIONS

- A. Interruption of Existing Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of services.
 2. Do not interrupt services without Architect's written permission.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 GAS FIRED EQUIPMENT

- A. All gas-fired equipment shall be listed for use as a gas appliance.
- B. All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

2.3 SPLIT SYSTEM AC UNIT

- A. General: Furnish and install split system air conditioner, with R410A refrigerant, and complete with automatic controls. Equipment shall be shipped factory assembled, wired, tested, and ready for field connections.
- B. Quality Assurance:
 1. Unit shall be ETL or UL listed and labeled.
 2. Unit shall be manufactured in a facility registered to ISO 9001:2000.
 3. Unit shall be rated in accordance with ARI standard 210.
- C. Delivery, Storage and Handling: Follow manufacturer's recommendations.
- D. Cooling System: The total certified cooling capacity shall not be less than scheduled. The compressor power input shall not exceed that of the unit specified.

- E. Indoor Section: Wall mounted, ceiling surface mounted, or ceiling recessed mounted, as indicated on Drawings.
1. Cabinet:
 - a. Wall mounted: Molded white high strength plastic.
 - 1) Provide wall mounted unit with factory mounting plate.
 - b. Ceiling surface mounted: Molded white high strength plastic with provision for outside air duct connection.
 - c. Ceiling recessed mounted: galvanized steel with provision for outside air duct connection.
 2. Fans: Double inlet, forward curved, statically and dynamically balanced.
 3. Fan Motor: Direct drive, permanently lubricated, with two or 4 speed operation for unit size scheduled on Drawings.
 - a. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.
 4. Air Outlet: With motorized horizontal and vertical vanes.
 - a. Wall and ceiling surface mounted units: Horizontal vane shall close air outlet upon unit shut-down.
 5. Evaporator Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested.
 6. Insulation: Interior surfaces exposed to the airstream shall be fully insulated.
- F. Outdoor Section:
1. Casing: Galvanized steel plate, powder coated with acrylic or polyester.
 2. Condenser Fan Grille: ABS plastic.
 3. Fan and fan motor: Direct drive, totally enclosed, propeller type, permanently lubricated, horizontal discharge.
 4. Compressor: Variable speed rotary type, with crankcase heater and accumulator. Compressor shall be capable of operating at 0 degrees F. Compressor mounted on vibration isolator pads.
 5. Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested. Provide coil with integral metal guard.

- G. Controls: Hard wired, microprocessor based, wall mounted controller with LCD display shall provide the following functions, as a minimum:
1. 7-day programmable timer.
 2. Test and check functions.
 3. Diagnostic functions.
 4. Vane position control.
 5. Fan speed adjustment.
 6. Temperature adjustment.
 7. Automatic restart.
 8. Mode selection, including cool/dry/fan.
 - a. Provide lockable enclosure for wall mounted controller.
- H. Safeties: Shall include the following, as a minimum:
1. Five minute compressor anti-recycle timer.
 2. High pressure protection.
 3. Current and temperature sensing motor overload protection.
- I. Filters: Provide 1 inch thick fiberglass throwaway filters with cardboard holding frames for indoor unit. Provide sufficient filters for four complete changes for each unit.
- J. Service Access: All components, wiring, and inspection areas shall be completely accessible through removable panels.
- K. Refrigerant Piping:
1. Provide factory pre-charged and sealed line set piping, length to suit the location of equipment. Tubing sizes shall be in accordance with manufacturers written instructions.
 2. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.
- L. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Mitsubishi Electric Corporation.
 2. Carrier Corporation.

3. Sanyo Electric Co., Ltd.

M. Owner Training: Manufacturer shall provide one on-site 2-hour training session for Owners' maintenance personnel.

2.4 HIGH EFFICIENCY FURNACE UNIT

A. Provide high efficiency multiple-speed condensing furnace/blower unit for upflow, downflow or horizontal application as indicated on the Drawings. Design unit to conform to the following:

1. California Air Quality Management District emission requirements.
2. ANSI Z 21.47/CSA 2.3 design standard for gas-fired central furnaces.

B. Furnace unit shall have the following certifications:

1. Third party certification by CSA International to current ANSI Z 21.47/CSA 2.3 design standard for gas-fired central furnaces.
2. CSA Blue Star® and Blue Flame® labeled.
3. Efficiency testing per current DOE test procedure as listed in the Federal Register.
4. Federal Trade Commission Energy Guide efficiency labeled.
5. GAMA Consumers' Directory of Certified Efficiency Ratings listed.

C. Unit shall be manufactured in a facility registered to ISO 9001:2000.

D. Warranties:

1. Heat exchangers shall have a 20 year warranty.
2. Entire unit shall have a 5 year warranty.

E. Cabinet:

1. Pre-painted galvanized steel, minimum .030 inches thickness.
2. Acoustically insulated blower section.
3. Removable bottom closure panel for bottom return air configuration.

F. Fans and Motors:

1. Centrifugal supply air blower shall be constructed of galvanized steel, statically and dynamically balanced.
2. Blower motor shall be direct drive variable speed ECM type, with sealed permanently lubricated ball bearings.

3. Inducer motor shall be direct drive variable speed ECM type, with sealed permanently lubricated ball bearings.
- G. Heating Section:
1. Primary heat exchanger shall be 20 gauge corrosion resistant aluminized steel of fold-and-crimp sectional design, with Monoport inshot burners and redundant gas valve.
 2. Secondary heat exchanger shall be polypropylene laminated steel of fold-and-crimp design.
 3. Heat exchanger section shall be insulated with foil-faced insulation.
 4. Line voltage ignitor.
 5. Sealed combustion system.
- H. Filters:
1. Standard filter section shall accommodate 1 inch deep filters. Filters shall conform to the "Air Filters" Article in this Specification Section.
 2. When Drawings indicate contractor-fabricated plenum containing filters, plenum shall accommodate 2 inch deep filters. Filters shall conform to the "Air Filters" Article in this Specification Section.
 3. Filter section shall use standard size filters.
- I. Controls:
1. Fused microprocessor based control board with diagnostic LED and self-test capability.
 2. Unit blower shall operate at continuous speed only, adjust to achieve the airflow scheduled on the Drawings. Other blower speed settings shall be locked out.
- J. Safeties:
1. Provide pressure switch for proving flow of flue products and manual reset over-temperature switch.
 2. Provide with blower access panel safety interlock switch.
- K. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Carrier Corporation.
 2. Trane Inc.

- L. Provide with mixed air plenum with filter rack and return and outside air dampers, arranged as indicated on Drawings.
 - 1. Where economizer operation is indicated on Drawings, provide differential dry-bulb economizer control system, certified as meeting the requirements for Fault Detection and Diagnostics (FDD) in the California Building Energy and Efficiency Standards.
- M. Provide condensate pump, arranged as indicated on Drawings, for removal of condensate from furnace units.
- N. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.5 AIR COOLED CONDENSING UNIT

- A. Provide outdoor-mounted, factory assembled, single piece, air-cooled, split-system air conditioner unit suitable for ground or rooftop installation, rated in accordance with ARI Standard 210, and UL or ETL listed and labeled. Provide refrigerant charge R-410A, all internal wiring, piping, controls, compressor, and special features required prior to field start-up. Design unit to conform to the following:
 - 1. ANSI/ASHRAE latest edition.
 - 2. NEC latest edition.
 - 3. Unit cabinet to be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hr salt spray test.
 - 4. Unit shall be constructed in accordance with UL standards.
- B. Unit shall be certified for capacity and efficiency, and listed in the latest ARI directory.
- C. Unit shall be manufactured in a facility registered to ISO 9001:2000.
- D. Unit shall be Energy Star Qualified.
- E. Provide unit with 5 year limited parts warranty.
- F. Cabinet:
 - 1. Unit cabinet constructed of galvanized steel, bonderized, and coated with powder coat paint.
- G. Fans:
 - 1. Direct-drive propeller type condenser fan, discharging air vertically.

2. Totally enclosed condenser fan motors, 1-phase type with Class B insulation and permanently lubricated bearings, and corrosion resistant shafts.
 3. Condenser fan openings equipped with PVC-coated steel wire safety guards.
 4. Statically and dynamically balanced fan blades.
- H. Compressor:
1. Hermetically sealed compressor mounted on rubber vibration isolators.
 2. Compressor with sound insulator.
 3. Provide unit with 5 year limited compressor warranty.
- I. Refrigeration Components:
1. Refrigerant circuit to include liquid and vapor line shut-off valves with sweat connections.
 2. System charge of R-410A refrigerant and compressor oil.
 3. Unit to be equipped with factory-supplied high-pressure switch, low pressure switch, and filter drier.
 4. Provide unit with manufacturer's refrigerant line set.
 5. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.
- J. Condenser Coil:
1. Air-cooled condenser coil constructed of aluminum fins mechanically bonded to copper tubes.
 2. Coils shall be leak and pressure tested.
- K. Electrical Requirements:
1. Unit shall have single point power connection.
 2. Provide unit with 24V control circuit.
- L. Operating Characteristics:
1. Unit shall be capable of starting and running a 115 degrees F ambient outdoor temperature per maximum load criteria of ARI Standard 210.
 2. Compressor with standard controls shall be capable of operation down to 55 degrees F ambient outdoor temperature.

- M. Provide the following additional components and features:
1. Provide evaporator freeze thermostat, winter start control, compressor start assist capacitor and relay, low ambient controller, and ball bearing fan motor.
 2. Provide expanded metal coil guard for all sides of the air cooled condensing unit. Coil guard shall be as manufactured by MicroMetl, Can-Fab, or equal.
- N. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Carrier Corporation.
 2. Trane Inc.
- O. Owner Training: Manufacturer shall provide one on-site 1-hour training sessions for Owners' maintenance personnel.

2.6 COOLING COIL

- A. Provide direct expansion encased cooling coil.
1. Install encased coil to operate properly in vertical or horizontal position as required. Construct coil with aluminum plate fins mechanically bonded in non-ferrous tubing with all joints brazed ultrasonically. Coil shall have factory-installed refrigerant metering device, refrigerant line fittings which permit mechanical connections, and condensate pan with primary and auxiliary drain connections.
 2. Construct casings of galvanized steel, bonderize, insulate, and finish with baked enamel.

2.7 REFRIGERATION PIPE AND FITTINGS

- A. Refrigeration gas and liquid piping shall be type ACR hard drawn copper tubing, cleaned and capped in accordance with ASTM B280, with wrought copper fittings. All joints shall be brazed with Sil-fos under nitrogen purge. Relief valve discharge piping shall be full size of relief discharge port.
1. Manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping may be utilized at Contractor's discretion.
 - a. VRF Systems: Use of manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping between outdoor condensing units and indoor heat recovery controllers, or distribution headers and tees is not allowed. When system manufacturer's installation instructions allow use of refrigerant line-set piping between indoor heat recovery controllers, or distribution headers and tees, and air

terminal devices, follow instructions for allowable pipe size range and support to avoid forming traps in the piping.

B. Variable Refrigerant Flow Heat Pump Systems Fittings:

1. For systems manufacturers requiring engineered, pre-assembled headers and branch fittings, Contractor shall obtain such fittings from system manufacturer. Fittings shall be suitable for system type and configuration.
2. For systems manufacturers not requiring engineered, pre-assembled headers and branch fittings, Contractor shall furnish fittings complying with manufacturer's requirements.

C. Refrigeration Piping Specialties: Furnish and install Superior, Sporlan, Alco, Henry, or equal, stop valves, solenoid valves, adjustable thermal expansion valves, sight glass, flexible connection, charging valve, and drier with valve bypass in the liquid lines and Superior DFN shell and cartridge suction line filter sized 2-1/2 times tonnage.

1. Install only those refrigeration piping specialties recommended by manufacturer of specific installed equipment.

2.8 REFRIGERANT ACCESS VALVE LOCKING CAPS

A. Each refrigerant circuit access valve located outside buildings, including valves located on roofs, shall be provided with a locking cap. Caps shall be of metal construction, with threaded brass inserts. Caps shall be color-coded according to ASHRAE standards for R22 and R410A refrigerant gasses, universal color for other refrigerant gasses. Caps shall be removable only with cap manufacturer's handheld tool.

1. Provide minimum of two (2) cap removal tools for every ten (10) air conditioning units or other systems containing refrigerant installed under this Project.

2.9 FANS

A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.

B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.

C. Provide variable speed switch for all direct drive fans.

D. Roof Mounted:

1. Direct or V-belt Drive: Provide one-piece heavy-duty ventilator housings, one piece heavy gauge spun aluminum construction, with weatherproof assembly and integral weather shield. Mount ventilators on curbs furnished by the fan manufacturer. Install with fan assembly level.

2. Fan wheels shall be centrifugal design, statically and dynamically balanced. Tip speed, rpm and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.
3. Fans shall have integral factory formed base and one piece spinning without welding. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have capacity, speeds and motor sizes as shown.
4. Provide the following accessories:
 - a. Gravity backdraft dampers.
 - b. Aluminum bird screen with a minimum of 85 percent free area.
 - c. Adjustable motor pulley.

E. In-Line Centrifugal Fans:

1. Centrifugal fan with airfoil blades, aluminum or steel housing, externally mounted belt-drive motor, external lube tubes, integral support brackets.
2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

F. Ceiling Mounted Fans:

1. Acoustic lined cabinet, built-in back draft damper, vibration isolated fan and motor, variable speed switch.
2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

G. Fan Drives:

1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.
3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.

H. Motors:

1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.
2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

I. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.

J. Belts:

1. All belts shall be furnished in matched sets.
2. Belts shall be within 1 degree 30 minutes of true alignment in all cases.

K. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.
4. American Coolair Corporation.

L. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.10 RELIEF AND INTAKE VENTS

A. Galvanized steel housing with 1/2 inch mesh screen, counterbalanced backdraft damper and matching prefabricated curb. Omit backdraft damper on intake vents. Provide pitched roof curb for relief vents, and install with backdraft damper level.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Greenheck Fan Corporation.
2. Lauren Cook Company.
3. PennBarry.

4. American Coolair Corporation.

2.11 AIR INLETS AND OUTLETS

- A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.
- C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.12 AIR FILTERS

- A. Provide MERV 13 disposable pleated media type. Refer to specific equipment Articles for filter depth and for exceptions to this specification. Filters shall conform to the following:
 - 1. Standards:
 - a. ASHRAE Standard 52.2-2007.
 - b. Underwriters Laboratories: U.L. 900, Class 2.
 - 2. Construction:
 - a. Media: Synthetic or cotton-synthetic blend with radial pleats.
 - b. Media Frame: High wet-strength beverage board.
 - c. Media Support: Welded wire or expanded metal grid bonded to air leaving side of the media.
 - 3. Performance: 2" deep filter shall have a maximum initial air resistance of 0.31 inches w.g.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Camfil Farr, Inc., model 30/30.
 - 2. Flanders Corporation, model 40 LPD.
- C. Temporary (Construction Period) Filters:

1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner.
2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

D. Spare Filters:

1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance). Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.13 DAMPERS

- A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.
- B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.

1. Rectangular Ductwork:

- a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
- b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
- c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.

2. Round Ductwork:

- a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.

- b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches diameter. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.
- 3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

C. Fire Dampers and Combination Fire/Smoke Dampers:

- 1. Fire dampers and combination fire/smoke dampers shall be listed and approved by the California State Fire Marshal. Installation shall conform to the manufacturer's UL approved installation instructions.
 - a. Fire dampers shall be UL 555 classified and labeled as dynamic fire dampers approved for wall and floor installation. They shall ship from the manufacturer as an assembly with a minimum 20-gauge factory installed sleeve. Sleeve length shall suit the requirements of the wall construction. Each dynamic fire damper/sleeve assembly shall ship complete with factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dynamic fire dampers for vertical installation must consist of a single section on sizes up to 33" x 36" and a single section on sizes up to 24" x 24" for horizontal installation. 1-1/2 hour dynamic fire dampers shall be Ruskin DIBD20, Pottorff, or equal. 3 hour dynamic fire dampers shall be Ruskin DIBD230, Pottorff, or equal.
 - b. Fire dampers for ceiling installation shall be UL 555C classified and labeled as ceiling dampers. They shall be provided with a thermal insulating blanket to fit the inlet or outlet condition if required by the application. Ceiling dampers shall be Ruskin CFD 2, 3, 4 or 5. Ceiling dampers for ceilings constructed of wood shall have UL tested in design L501 and shall be Ruskin CFD7, Pottorff, or equal.
 - c. Combination fire/smoke dampers. Dampers shall be UL classified and labeled as Leakage Class I Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment. Damper/actuator assembly shall be tested to full open and full close at minimum 2000 fpm 250° F heated air and 4" w.g. with airflow in both directions. (Specified select: 250° / 350°, 2000 fpm/3000 fpm). Each damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage resulting from instantaneous damper closure. Release device shall be EFL type and shall allow reset from outside the sleeve after moderate temperature exposure. (Replacement type fusible links not acceptable.)

- d. Two position combination fire smoke dampers shall be equipped with one or more factory installed, direct coupled, 120 volt, single phase, electric actuator for energize open – fail close operation. Dampers with multiple actuators shall be factory wired with single point connection at the EFL heat release device for connection to posier. Damper actuator shall include minimum one-year energized hold open (no cycles) and spring return (fail) close reliability. Damper/actuator shall include minimum 20,000 full open-full close cycle performances.
- e. Modulating combination fire smoke dampers shall be equipped with one or more factory installed contact for modulating signal connection. Damper/actuator shall include minimum 100,000 full open-full close cycle performances with spring return (fail) close on loss of power.
- f. Round combination fire smoke dampers up to 24” diameter shall be true round type with minimum 20 gauge galvanized steel designed for lowest pressure drop and noise performance. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade seals shall be silicone edge designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17 inches minimum length and factory “roll formed” one-piece angles with pre-punched holes. Dampers shall be Ruskin FSDR25, Pottorff, or equal.
- g. Round (larger than 24” diameter) or rectangular combination fire smoke dampers shall include roll-formed structural hat channel frame, reinforced at the corners, formed from a single piece of minimum 16 gauge equivalent thickness formed from single piece galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17” minimum length and factory “roll formed” one-piece angles with pre-punched holes for easy installation. Dampers shall be Ruskin FSD60, Pottorff, or equal.
- h. 3-hour rated combination fire smoke dampers shall be Ruskin model FSD60-3, Pottorff, or equal.
- i. All FSD60 type dampers shall be AMCA licensed and shall bear the AMCA Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03” w.g. at a face velocity of 1,000 fpm on a 24” x 24” damper.
- j. Wall type fire/smoke damper:

- 1) Combination fire/smoke dampers for use in the wall of exit corridors shall be classified and labeled as Leakage Class II Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall meet the requirements for combination fire/smoke dampers in paragraph 3 above except AMCA certified testing shall verify pressure drop does not exceed .07" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper and blades shall be single skin galvanized steel 10 gauge minimum with 3 longitudinal grooves for reinforcement. Dampers shall be Ruskin FSD36, Pottorff, or equal.
 - 2) Front access combination fire/smoke dampers shall meet all the requirements for combination fire/smoke dampers in paragraph 3 above except pressure drop requirement. In addition the dampers shall be constructed so that actuators and all accessories are accessible from the grille side. Actuators and accessories shall be housed within an integral cabinet on the side of the damper frame and shall not be installed in the air stream in front of the damper. The damper sleeve shall be minimum 14" and flanged to accept a steel framed grille. The sleeve shall be covered with fire resistant material. Dampers shall be Ruskin FSD60FA, Pottorff, or equal.
- k. Ceiling type fire/smoke damper for tunnel type corridor construction: Combination fire/smoke dampers for use in the corridor ceiling of tunnel type corridor construction shall be UL classified and labeled as Corridor Damper. Dampers shall meet the requirements of paragraph 4a above except pressure drop testing does not require AMCA certification. Dampers shall be Ruskin FSD36C, Pottorff, or equal.
- l. Fusible links shall have temperature rating approximately 50° F above normal maximum operating temperature of the heat producing appliance.
- 1) If project requires re-openable fire/smoke dampers, provide Ruskin 165 ° F / 350° F TS150, NCA or equal. The TS150 firestat replaces the EFL and allows the damper to be re-opened from remote location up to 350 ° F. TS150 shall include full open and full closed damper position contacts for interface with remote position indication panel.
 - 2) Each fire/smoke damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage. Release device shall allow easy reset after moderate temperature rise outside the sleeve. Heat release device shall be the Ruskin EFL, NCA or equal.

- 3) Unless the system is using a validation control system, each fire/smoke damper shall be equipped with a control panel including blade position indicator lights and a key operated switch. The panel cover shall be oversized for flush mount into the wall or ceiling and shall have a brushed look. Control panel shall be Ruskin MCP2, Pottorff, or equal.
2. All actuators used for smoke dampers or combination fire/smoke dampers shall have a cycle time requirement of not more than every twelve months and shall be rated for continuous "On" duty and shall be provided with internal spring return. Actuators shall be equipped with pilot light, remote key test switch, end switch and circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper. Electric motors shall be Invensys MA-250, MA-253, Honeywell H2000, or equal.

2.14 DUCTWORK

- A. Construct and install all sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.
 1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.
 2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.
 3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.
 4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.
 5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.
 - a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.
 - b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide

continuous metal clip at top and sides of duct, with 1 inch overhang for top side.

B. Design and installation standards:

1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.
2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
3. California Mechanical Code.

C. Fabricate all ductwork with sheet metal. Fiberglass ductwork will not be accepted for use on this project.

D. Duct sizes indicated are external sizes.

E. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

1. Provide mill certification for galvanized material at request of the Project Inspector.

F. Duct Sealants:

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Design Polymerics, model DP1010.
 - 2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.
 - 3) McGill Airseal, LLC.

G. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.

H. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.

I. Rectangular Duct Fabrication:

1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.
 - a. SMACNA HVAC Duct Construction Standards
 - b. California Mechanical Code
2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

<u>Table A</u>		
<u>Duct Dimension</u>	<u>Minimum Gauge</u>	<u>Joint Reinforcement Per CMC</u>
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2
Over 96"	18	K/2

3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.

4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph "DAMPERS" for damper requirements.
 5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
 6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.
- J. Shop-Fabricated, Insulated, Rectangular, Double-Wall Ductwork for Outdoor Applications:
1. Provide insulated, double-wall ductwork for ducts conveying conditioned air, without internal lining, located outdoors.
 2. Inner Ducts: Fabricate ducts as specified for single-wall ducts, in gauges and with joint reinforcements given in Table A for 2-inch pressure class or comply with gauges and reinforcements given in SMACNA HVAC Duct Construction Standards (Metal and Flexible) for 4-inch pressure class, as applicable.
 3. Outer Ducts: Fabricate as described for inner ducts, except use gauges for the next higher duct size category.
 4. Reinforcement of Interstitial Space: Provide 18-gauge galvanized steel intermediate bracing at 24-inch intervals similar to that shown in 2005 (Third Edition) SMACNA HVAC Duct Construction Standards (Metal and Flexible), Figure 9-11. Attach bracing to inner and outer ducts with No. 8 sheet metal screws, 3 inches from corners, 6 inches on center.
 5. Interstitial Insulation: Fibrous glass insulation board is specified in article, Insulation Materials. Insulation board shall be minimum R-13 at 3 inches thick. Spot-adhere boards to inner ducts with adhesive recommended by insulation board manufacturer. Butt boards square at corners. Seal joints between insulation boards with pressure-sensitive tape recommended by insulation manufacturer.
 - a. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1) Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

- a) Childers Brand; H. B. Fuller Construction Products.
 - b) Eagle Bridges - Marathon Industries.
 - c) Foster Brand; H. B. Fuller Construction Products.
 - d) Mon-Eco Industries, Inc.
- 2) Fiberglass 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 testing and product requirements of South Coast Air Quality Management District, Rule 1168.
- b. Provide cross-broken ductwork. Ensure that the ductwork will shed water.
 - 1) Ducts with horizontal dimension 12 inches and greater: Slope duct downward from longitudinal midpoint in two directions at 1/4 inch per foot. Duct slope shall not reduce duct airflow free area. Cross-breaking may be omitted for sloped duct surfaces.

K. Rectangular Internally Insulated Duct Fabrication:

- 1. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Line all transfer ducts.
 - a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.
 - b. Where ductwork is within the building insulation envelope, lining shall be 1" thick, 1-1/2 pound density, with R-value of 4.2 minimum.
 - c. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 - d. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).
 - e. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive, including longitudinal liner edges.
 - f. Provide metal nosing at all locations where liner is preceded by unlined metal.

- g. Provide sheet metal weld pins and washers or clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.
 - 1) Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.
 - 2) Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.
- h. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
- i. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

<u>Manufacturer:</u>	<u>Product:</u>
Johns Manville	Linacoustic RC
CertainTeed Corporation	ToughGard
Fosters Adhesive	85-62
Swifts Adhesive	7336

L. Round and Oval Ductwork Fabrication:

- 1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.
 - a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.

- 1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.
- 2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.
2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.
3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

<u>Diameter</u>	<u>Minimum Gauge</u>	<u>Method of Manufacture</u>
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.
5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

<u>Diameter</u>	<u>Minimum Gauge</u>
3" to 36"	20
38" to 50"	18
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.
- M. Round Internally Insulated Duct and Fittings: Where ductwork is exposed to weather or outside the building insulation envelope, construct with outer pressure shell, 2 inch thick (Minimum R-value = R-8) insulation layer, and perforated inner liner. Where ductwork is within the building insulation envelope, construct with outer pressure shell, 1 inch thick (minimum R-value = R4.2) insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM A 653, of spiral lockseam construction (use longitudinal seam for over 59 inches), in minimum gauges listed in table below. Where installed exposed in the conditioned space: duct and fitting outer pressure shell shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value = R-4.2), and perforated inner liner.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" TO 12"	26 gauge	24 gauge
13" TO 24"	24 gauge	24 gauge
25" to 34"	22 gauge	24 gauge
35" to 48"	20 gauge	24 gauge
49" to 58"	18 gauge	24 gauge
Over 59"	16 gauge	20 gauge

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell at exposed ducts. Provide spot weld bonded seams at concealed ducts.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" to 34"	20 gauge	24 gauge
36" to 48"	18 gauge	24 gauge
Over 48"	16 gauge	24 gauge

2. Inner Liner: Perforate with 3/32 inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.

3. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
4. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).
5. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
6. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Sheet Metal Div., McGill AirFlow, LLC., Acousti-k27
 - b. Semco Duct and Acoustical Products, Inc.
 - c. Air Systems Manufacturing, Inc. - Las Vegas

N. Duct Access Doors:

1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.
2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.

O. Flexible Air Ducts:

1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.
 - 2) ThermaFlex model M KC.

2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.
3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.
4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.
5. Duct Access Panels:
 - a. Provide duct access panel assembly of the same material and gauge used for the duct. Duct access panels shall conform to the following:
 - 1) Fasteners: Black steel or stainless steel to match material used for the duct. Panel fasteners shall not penetrate duct wall.
 - 2) Gasket: Comply with NFPA 96, grease-tight, high temperature ceramic fiber, rated for minimum 1500 °F.
- P. Provide Ventlon, or equal, flexible connections on inlet and outlet of AC Unit, air handler and exhaust fans. Provide galvanized weather hood over flexible connections exposed to the weather.

2.15 PIPE JOINING MATERIALS

- A. Refer to Division 22 and 23 piping sections for special joining materials not listed below.
- B. Brazing Filler Metals:
 1. General Duty: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
 2. Refrigerant Piping:
 - a. Joining copper to copper: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
 - b. Joining copper to bronze or steel: AWS A5.8, Bag-1, silver alloy unless otherwise indicated.

2.16 VALVES

A. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.
2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.

2.17 INSULATION MATERIALS

A. General:

1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. 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.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Insulation Materials:

1. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Aeroflex USA, Inc.

- 2) Armacell LLC.
 - 3) K-Flex USA.
2. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Johns Manville; a Berkshire Hathaway company.
 - 2) Knauf Insulation.
 - 3) Manson Insulation Inc.
 - 4) Owens Corning.
 - b. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.
3. 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. Provide 2-inch wide stapling and taping flange.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) CertainTeed Corporation.
 - 2) Johns Manville.
 - 3) Knauf Insulation.
 - 4) Owens Corning.

2.18 FIELD APPLIED JACKETS:

- A. PVC Jacket and Factory Fabricated Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 2. Johns Manville, model Zeston, with Zeston 2000 fitting covers.
 3. Proto Corporation, model LoSmoke.

- B. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. ITW Insulation Systems; Illinois Tool Works, Inc.
 - c. RPR Products, Inc.
 - 2. Finish and thickness are indicated in field-applied jacket schedules.
 - 3. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
 - 4. Factory-Fabricated Fitting Covers:
 - a. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - b. Tee covers.
 - c. Flange and union covers.
 - d. End caps.
 - e. Beveled collars.
 - f. Valve covers.
 - g. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.19 TEMPERATURE CONTROL SYSTEM

- A. Refer to Section 23 09 23, Direct Digital Control System for HVAC.

PART 3 - EXECUTION

3.1 ROOF MOUNTED EQUIPMENT INSTALLATION

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.
- B. Examine rough-in for roof mounted equipment to verify actual locations of piping and duct connections prior to final equipment installation.
- C. Verify that piping to be installed adjacent to roof mounted equipment allows service and maintenance.

- D. Verify that gas piping will be installed with sufficient clearance for burner removal and service.
- E. Install ducts to termination at top of roof curb and install heavy duty rubber gaskets on supply and return openings and on full perimeter of curb, or as required for an airtight installation, prior to setting unit on curb.
- F. Cover roof inside each roof mounted air conditioning unit, heat pump unit, and heating and ventilating unit roof curb with 2 inch thick, 3 pound density fiberglass insulation board.
- G. Connect supply and return air ducts to horizontal discharge roof mounted equipment with flexible duct connectors specified elsewhere in these Specifications.
- H. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3.2 SPLIT SYSTEM INSTALLATION

- A. General:
 - 1. Install units level and plumb.
 - 2. Install evaporator-fan components as detailed on Drawings.
 - 3. Install ground or roof- mounted condensing units as detailed on Drawings.
 - 4. Install seismic restraints as required by applicable codes. Refer to Article, Submittals, in Section 23 00 50, Basic HVAC Materials and Methods, for delegated design requirements for seismic restraints.
 - 5. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit.
 - 6. Install cooling coil condensate primary drain pan piping, and overflow, if provided, and run to nearest code-compliant receptacle, or as indicated on Drawings. Install secondary drain pan for units installed over permanent and suspended-tile ceilings. Install secondary drain pan piping and terminate 1/2 inch below ceiling, with escutcheon, in a readily visible location or as shown on Drawings.
 - 7. Install air filters at each indoor unit. Install washable, permanent filters at indoor units designed to accept washable, permanent filters. Refer to Drawings schedule, and Article, Air Filters, in this Section, for filter requirements for ducted, above-ceiling units incorporating mixing boxes.
 - 8. Duct Connections: Duct installation requirements are specified in Article, Ductwork, in this Section. 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 Article, Ductwork, in this Section.

3.3 HIGH EFFICIENCY FURNACE UNIT INSTALLATION

- A. Install vent and combustion air piping in strict compliance with manufacturer's installation guidelines. Pipe and fittings shall comply with manufacturer's instructions, flash through roof or wall as specified for piping. Refer to Drawings for special conditions.
 - 1. Provide concentric flue system with single roof or wall penetration. Install in accordance with manufacturer's requirements.
 - 2.
- B. Mount horizontally or vertically as indicated on Drawings. Comply with manufacturer's installation requirements specific to mounting orientation.
- C. Install cooling coil overflow drain piping and run to nearest receptacle, or as indicated on Drawings.

3.4 REFRIGERANT PIPING INSTALLATION

- A. General:
 - 1. Install refrigerant piping according to ASHRAE 15. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit.
 - 2. Install piping straight and free of kinks, restrictions or traps.
 - 3. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
 - 4. Slope horizontal suction piping 1 inch/10 feet towards compressor.
 - 5. Install fittings for changes in direction and branch connections.
 - 6. Piping under raised floors shall be kept 6 inches minimum above ground; excavate as necessary.
 - 7. Install locking caps on refrigerant access valves located outside building, including valves located on roofs.
 - 8. Insulate refrigerant piping, including liquid and hot gas pipes when required by system manufacturer, and including headers, branches, and other components as detailed in unit manufacturers' literature.
- B. Factory Pre-charged and sealed line set piping:
 - 1. Keep the entire system clean and dry during installation.

2. All tubing shall be evacuated and sealed at the factory. The seal must not be broken until ready for assembly.
3. If there is any evidence of dust, moisture, or corrosion, the tubing must be cleaned out by drawing a swab soaked with methyl alcohol through the tubing as many times as necessary to thoroughly clean the tubing.
4. Where line set piping is exposed mounted at grade, on walls, and on roof, enclose in 16 gage galvanized steel enclosure.
 - a. In other locations, enclose line set piping in iron or steel piping and fittings or in EMT conduit

C. Field Assembled Refrigerant Piping:

1. Select system components with pressure rating equal to or greater than system operating pressure.
2. Where subject to mechanical injury, enclose refrigerant piping in EMT conduit.
3. Where field assembled refrigerant piping is exposed mounted at grade, on walls, and on roof, enclose in 16 gage galvanized steel enclosure.
4. 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.

3.5 FAN INSTALLATION

- A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.
- B. Provide access doors for fans or motors mounted in ductwork.
- C. Mount all fans as detailed on Drawings and in compliance with CBC standards.
- D. Fan motors mounted in air-stream to be totally enclosed.
- E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.
- F. Roof fans shall be mounted level.
- G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.

3.6 RELIEF VENT INSTALLATION

- A. Install relief vents to provide a level mounting for backdraft damper.

3.7 AIR INLETS AND OUTLETS INSTALLATION

- A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
- B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.
- C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
 - 1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
 - 2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
 - 3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.
- D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.
- E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.8 FILTER HOUSING INSTALLATION

- A. Mount filters in airtight galvanized steel housings furnished by the filter manufacturer, or shop-fabricated. Housings shall incorporate integral tracks to accommodate filters, and flanges for connection to duct or casing system.
 - 1. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.
 - 2. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking latch handle devices.
- B. Air filters shall be accessible for cleaning or replacement.

- C. Identify each filter access door with 1/2 inch high minimum stenciled letters.

3.9 TEMPORARY FILTERS

- A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.
 - 1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.10 DAMPER INSTALLATION

- A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.
- B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.
- C. Install fusible link fire dampers full size of duct at points where shown or required.
- D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.
 - 1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.11 DUCTWORK INSTALLATION

- A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.

- B. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealer shall be fire retardant. Sheet metal screw for joints shall be minimum #10 size galvanized.
- C. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

- D. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

- E. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
- F. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.
- G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.
- H. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.
1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.
 2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.

I. Installation of Flexible Ductwork:

1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.
 - a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).
 - b. Make bends to maintain R/W-1.5.
2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.
3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

3.12 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Copper Pipe and Tubing: All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except pneumatic control piping, and hydronic piping having grooved-end fittings and couplings.

C. Flexible Connections:

1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, except fan coil units under 2000 cfm, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
2. Flexible connections in refrigerant lines; Flexonic, Anaconda or equal, metal hose, full size.
3. Anchor piping securely on the system side of each flexible connection.

3.13 INSULATION AND FIELD-APPLIED JACKET INSTALLATION

A. General:

1. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.
2. Test insulation, jackets, and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723, ASTM E84, or NFPA 255.
3. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
4. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, ductwork, and equipment.
5. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
6. 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.
7. Install insulation with longitudinal seams at top and bottom of horizontal runs.
8. Install multiple layers of insulation with longitudinal and end seams staggered.
9. Keep insulation materials dry during application and finishing.
10. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
11. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
12. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
13. For piping, ductwork, and equipment, with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
14. Repair all damage to existing pipe, duct and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.
15. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.
 - b. 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.
 - c. 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.
 - d. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

B. Piping Insulation Installation:

1. General:

- a. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
- b. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of Glasfab saturated in Foster's Sealfas 30-36, 3M, or equal, carried 3 inches over the adjoining pipe insulation. Finish with a coat of Foster's Sealfas 30-36, 3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers.
- c. Provide removable insulation covers for items requiring periodic service or inspection.
- d. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation.
- e. Provide pre-formed PVC valve and fitting covers for indoor piping.
- f. Provide factory-fabricated aluminum valve and fitting covers for outdoor piping.
- g. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

2. Below-Ambient Services Including Chilled Water Supply and Return and Refrigerant Piping:

- a. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of woven glass fiber cloth saturated in Foster Sealfas 30-36, 3M, or equal, extending 3 inches over the adjoining pipe insulation. Finish with a coat of Foster Sealfas 30-36, 3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers.
- b. Variable refrigerant flow (VRF) heat pump systems: Insulation for VRF system refrigerant piping shall be installed according to VRF unit manufacturer's instructions.

3. PVC Jacket Installation:

- a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 - 1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

4. Aluminum Jacket Installation:

- a. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing 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. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

C. Duct Insulation Installation:

1. General:

- a. Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.
- b. Duct insulation applied to the exterior surface of ducts installed outside the building insulation envelope shall meet minimum R-value of R-8 at 3 inches thickness and 3/4 pound per cubic foot density.
- c. Duct insulation applied to the exterior surface of ducts installed within the building insulation envelope shall meet minimum R-value of R-4.2 at 1-1/2 inches thickness and 3/4 pound per cubic foot density.

2. Mineral Fiber Blanket Installation:

- a. Insulate all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.

3. PVC Jacket Installation:

- a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

- 1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.14 DUCTWORK SEALING AND LEAK TESTING

- A. All ductwork shall receive a Class A seal.
- B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.
- C. Leakage Classes:

<u>Pressure Class</u>	<u>Leakage Class</u>	
	<u>Round Duct</u>	<u>Rectangular Duct</u>
2"W.G. or less	8	16
4"W.G. or greater	2	4

- D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA's "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 230050, "Basic HVAC Materials and Methods," Article, "Acceptance Requirements."

3.15 TEMPERATURE CONTROL SYSTEM INSTALLATION

- A. Provide thermostats where indicated on drawings. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

3.16 EQUIPMENT START-UP

- A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.
- B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.
- C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.
- D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.

- E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.17 TESTING AND BALANCING

- A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.18 CLEANING AND PROTECTION

- A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.
- B. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.
- C. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.19 EQUIPMENT MOUNTING

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

3.20 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Piping:
 - 1. All pipe sizes: Insulation shall be one of the following:
 - a. Suction piping smaller than 1-1/2 inches diameter:
 - 1) Flexible Elastomeric: 1/2 inch thick.
 - 2) Mineral-Fiber, Preformed Pipe: 1/2 inch thick.
 - b. Suction piping 1-1/2 inches diameter and larger:
 - 1) Flexible Elastomeric: 1 inch thick.
 - 2) Mineral-Fiber, Preformed Pipe: 1 inch thick.
 - c. Suction piping for heat pump applications smaller than 1 inch diameter:
 - 1) Flexible Elastomeric: 1 inch thick.
 - 2) Mineral-Fiber, Preformed Pipe: 1 inch thick.

- d. Suction piping for heat pump applications 1 inch and larger:
 - 1) Flexible Elastomeric: 1-1/2 inches thick.
 - 2) Mineral-Fiber, Preformed Pipe: 1-1/2 inches thick.
- 2. When equipment manufacturers' instructions indicate that refrigerant liquid and hot-gas gas piping be insulated, insulation thickness shall be equal to, and applied as described herein for refrigerant suction piping.

3.21 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
- 2. When equipment manufacturers' instructions indicate that refrigerant liquid piping be insulated, insulation thickness shall be equal to, and applied as described herein for refrigerant suction piping.

3.22 INDOOR FIELD-APPLIED PIPING JACKET SCHEDULE

- A. Piping, concealed: None.
- B. Piping, exposed: PVC, 20 mils thick.

3.23 OUTDOOR FIELD-APPLIED PIPING JACKET SCHEDULE

A. All Piping: Aluminum, Stucco Embossed: Thickness as follows:

Outer Insulation Diameter (Inches)	Minimum Aluminum Jacket Thickness (Inch)	
	Rigid Insulation	Non-Rigid Insulation (1)
8 and Smaller	0.024	0.024
Larger Than 8 Thru 11	0.024	0.024
Larger Than 11 Thru 24	0.024	0.024
Larger Than 24 Thru 36	0.024	0.032
Larger Than 36	0.024	0.040

(1) Non-rigid Insulation is defined as having a compressive strength of less than 15 psi.

3.24 INDOOR DUCT INSULATION SCHEDULE

- A. Minimum R-Value = R-4.2.

- B. Supply and Return Ducts: Mineral Fiber Blanket, 1-1/2 inches thick, 0.75 lb/cu. ft.

3.25 OUTDOOR DUCT INSULATION SCHEDULE.

- A. Refer to article, Ductwork, for internal duct lining. Provide 2 inches thick internal duct lining where indicated on Drawings.
- B. Refer to article, Ductwork, for double-wall ductwork with interstitial insulation.

3.26 INDOOR FIELD-APPLIED DUCT JACKET SCHEDULE

- A. Insulated ducts in concealed spaces: None.
- B. Insulated ducts in exposed unconditioned spaces: PVC, 20 mils thick.

END OF SECTION

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of the General Conditions and Division 1, General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Related Work in Other Sections, but not limited to the following:
 - 1. Motors, motor controls and low voltage control wiring that are an integral part of equipment assemblies and heating and ventilation controls.
 - 2. Painting of exposed electrical work.
 - 3. Plumbing controls and low voltage wiring.
 - 4. Fire alarm system and devices.
 - 5. Data network and distribution.
 - 6. Intercom system and equipment.
- B. Work Included in Contract
 - 1. Provide and install new 120/208V, 3 phase, 4 wire electrical distribution system as detailed on drawings.
 - 2. Provide new lighting and control systems as shown on drawings and specified under Division 26.
 - 3. Grounding and bonding per NEC.
 - 4. Provide complete telephone/data system per District standards as shown on drawings and specified under Division 27.
 - 5. Provide a complete paging/intercom/clock system and connect to existing VOIP system per District standards as shown on drawings and specified under Division 27.
 - 6. Provide wiring and hookup of all electrical equipment specified under other specification sections, such as technology systems, mechanical and plumbing equipment.

7. Provide new fire alarm system devices and connect to new voice evacuation automatic addressable fire alarm system per District standards as detailed on drawings and specified under Division 28.

1.3 CODES AND STANDARDS

- A. In addition to Codes and Standards - Division 1, the following shall apply to this Division:

National Electrical Code with California amendments
California Admin. Code, Titles 17, 19, 24, Part 3.
U.L. Electrical Construction Materials List
Codes, rules and regulations as specified hereinafter
Local city and county agencies

1.4 SUBMITTALS

- A. Submittals shall be made in conformance with the General Conditions. The list shall include, for each item, the manufacturer, manufacturer's catalog number, type of class, the rating, capacity, size, etc. Submittals shall include:

1. Conduit & Fittings
2. Boxes & Covers
3. Fuses
4. Wire & Cable
5. Wiring Devices
6. Lighting
7. Disconnect Switches
8. Panelboards
9. Paging/Intercom/Clock System
10. Telephone/Data Networking System
11. Fire Alarm System

- B. Shop Drawings: Submit for approval, detailed construction drawings for each item of fabricated equipment required for the electrical installation. All drawings shall be to scale, fully dimensioned, and provide sufficient detail to clearly indicate the arrangement of the equipment and its component parts. Construction of the equipment shown shall be revised to comply with the drawings and specifications as required by the Architect after review of the shop drawings, and the drawings

submitted when requested by the Architect. Shop drawings shall be submitted for the following:

1. Lighting Control Systems
2. Paging/Intercom/Clock System
3. Telephone/Data Networking System
4. Fire Alarm System

C. Substitution: Provide substitutions as outlined.

1.5 SUPERVISION OF ELECTRICAL WORK

- A. Contractor shall personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, keep same foreman and workmen throughout the project duration. Work shall be subject to inspection and approval by Architect. Promptly furnish related information when so requested by Architect.

1.6 EQUIPMENT AND SYSTEMS IDENTIFICATION

- A. Name Plates: Provide permanent identification of circuit breakers in switchboards, panels, transformers, disconnects for mechanical and plumbing roof-top equipment and other cabinet enclosed apparatus. Use black bakelite plates, not less than ½" X 3", with engraved white letters, secured with adhesive. Provide voltage along with panel name. Provide red with white letters on FACP, FATC, etc.
- B. Stencil Work: Identify all motors and operating apparatus in electrical equipment rooms or semi-concealed spaces, with black or white lacquer lettering, not less than ½" high, placed where readily visible upon inspection.
- C. Directories: Provide for power circuits, typewritten, neatly arranged in numerical order, and permanently fixed inside or adjacent to appropriate panel.
- D. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.
- E. Provide service description etched on cover of all underground pull boxes.
- F. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.
- G. Provide lamecoid label on all blank cover plates indicating circuit number or low voltage system (i.e. future data, intrusion, etc.).
- H. Provide lamecoid label on all fire alarm device covers indicating complete device number.

1.7 OPERATING INSTRUCTIONS ON-SITE

- A. At time of occupancy, arrange for manufacturer's representatives to instruct building operating and maintenance personnel in use of any equipment requiring operating and maintenance. Arrange for all personnel to be instructed at one time. Pay all costs for such service (minimum of 4 hours).

1.8 ADJACENT WORK

- A. Coordinate work and complete with others in furnishing and placing this work.
- B. Work to approved shop drawings for work by others and to field measurements as necessary to properly fit the work.
- C. Project adjacent work as necessary; adjacent construction or exposed surfaces or surfaces damaged by use of materials or operations under this Section shall be repaired or replaced as directed by Architect
- D.

1.9 DRAWINGS

- A. The electrical drawings, which constitute an integral part of this contract, shall serve as the working drawings. They indicate diagrammatically the general layout of the complete electrical system, including the arrangement of feeders, circuits, panelboards, service equipment, and other work. Field verifications of scale dimensions taken from the drawings are directed since actual field locations, distances and elevations will be governed by actual field conditions. Review architectural, structural, mechanical and plumbing drawings and adjust work to conform to all conditions indicated thereon. Discrepancies shown on different plans or between plans and actual field conditions, or between plans and specifications, shall promptly be brought to the attention of the Architect for a decision.

1.10 COORDINATION AND COOPERATION

- A. Drawings and specifications are both supplementary and complementary. Taken together, they are intended to define complete working installations of the systems represented, in accordance with approved practice in the trade, and in conformity with all applicable requirements of local jurisdictional offices and officers and codes and enforcing bodies.
- B. It shall be presumed that any bid offered under this Division of the Specifications is based on a careful examination of the job site, and of the plans and specifications; that the person(s) or firm(s) awarded a contract hereunder is/are experienced and qualified in the type of work represented; that every effort has been made to prepare complete, accurate and correct plans and specifications; and that reasonable diligence will be exercised in planning and scheduling the work to anticipate conflicts and/or detect errors or omissions. All such shall be immediately reported, and proper resolution agreed on between concerned parties before the work affected is performed. If due to lack of diligence, or to incompetence, failure to anticipate such problems shall not create a valid claim for extra costs or charges.

- C. Requirements of other trades, of utility companies, and of fire departments, protective services, communication systems, or other facilities of a utility nature, shall be determined prior to installation of systems, equipment, devices or materials affected by or dependent on such requirements.
- D. Unapproved deviations or changes based on a presumption of error or code violation, or work not suitable for its intended function, may not be accepted.
- E. Nothing herein shall act to prevent or discourage the contractor from suggesting or discussing possible changes in the work where such might be beneficial to the contractor or the owner, or might facilitate the work of this or other trades.
- F. Any work resulting in a claim for a change in the contract price must be approved and fully documented.

1.11 VISIT TO SITE

- A. Visit the project site, take requisite measurements, and verify exact location of buildings, utilities, and other facilities, and obtain such other information as is necessary for an intelligent bid. No allowance will subsequently be made by the Architect or Owner for any error or omission on the part of the bidder in this connection.

1.12 RECORD DRAWINGS

- A. Record of Job Progress: Keep an accurate dimensional record of the "as-built" locations and of all work; all as required. This record shall be kept up-to-date on blue-line prints as the job progresses and shall be available for inspection at all times. It shall be reviewed by inspector prior to each monthly application for payment.
- B. Record of Installation: Refer to Supplementary General Conditions.
- C. Include on "as-built" drawings:
 - 1. Routing of all buried or concealed electrical feeders and conduits.
- D. Upon completion of the work, a completed set of as-built reproducible vellums and electronic file (ACAD 2004) on Cd/DVD disk(s) shall be delivered to the Architect.

1.13 GUARANTEE

- A. All work shall be guaranteed for a minimum period of one year from either the official date of completion or from the date of acceptance by the Owner, whichever is the later date. The guarantee period for certain items shall be longer, as indicated in the specification for those items.
- B. Should any trouble develop during the guarantee time due to defective material, faulty workmanship, or non-compliance with plans, specifications, codes or directions of the Owner, Architect, Engineer or Inspector, the Contractor shall furnish all necessary labor and materials to correct the trouble without additional charges.

1.14 COMMISSIONING

- A. Electrical systems including lighting and lighting controls, occupancy sensors, daylight controls, switching systems, exterior lighting controls and uninterruptible power supplies will be commissioned per the requirements specified in Commissioning Requirements.”

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Electrical identification.
 - 2. Concrete equipment bases.
 - 3. Electrical demolition.
 - 4. Cutting and patching for electrical construction.

1.2 SUBMITTALS

- A. Product Data: For utility company electricity-metering components.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.
- C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating.

- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs. Strength rating to suit structural loading.
- D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.
 - 1. Materials: Same as channels and angles, except metal items may be stainless steel.
- E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- H. Expansion Anchors: Carbon-steel wedge or sleeve type.
- I. Toggle Bolts: All-steel springhead type.
- J. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

- A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.
- C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- E. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Embedded continuous metallic strip or core.
 - 3. Printed legend that indicates type of underground line.

- F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
 - G. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.
 - 1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.
 - 2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch, galvanized-steel backing. 1/4-inch grommets in corners for mounting.
 - H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- 2.3 CONCRETE BASES
- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
 - B. Concrete: 3000-psi, 28-day compressive strength.
- 2.4 CONCRETE BOXES
- A. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

- B. Dry Locations: Steel materials.
- C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb minimum design load for each support element.

3.3 SUPPORT INSTALLATION

- A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.
- C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:
 - 1. Wood: Wood screws or screw-type nails.
 - 2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.
 - 3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.
 - 4. New Concrete: Concrete inserts with machine screws and bolts.
 - 5. Existing Concrete: Expansion bolts.
 - 6. Structural Steel: Spring-tension clamps.
 - a. Comply with AWS D1.1 for field welding.
 - 7. Light Steel Framing: Sheet metal screws.
 - 8. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.
 - 9. Light Steel: Sheet-metal screws.
 - 10. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.
- F. Install warning, caution, and instruction signs where required to comply with 29 CFR 1910.145, Chapter XVII, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Indoors install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- G. Install, where applicable, engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- H. Provide service description etched on cover of all underground pull boxes.

3.5 FIRESTOPPING

- A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies. Firestopping installation is specified in Division 7 Section "Through-Penetration Firestop Systems."

3.6 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.7 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION

SECTION 26 05 19 CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

- A. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

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 the manufacturers specified.

2.2 CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. Alcan Aluminum Corporation; Alcan Cable Div.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

- D. Conductor Insulation Types: Type THW, THHN-THWN or XHHW complying with NEMA WC 5 or 7.

2.3 CONNECTORS AND SPLICES

- A. Manufacturers:
 - 1. AMP Incorporated/Tyco International.
 - 2. Hubbell/Anderson.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway .
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- I. Fire Alarm Circuits: Type THHN-THWN, in raceway.
- J. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- K. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed feeders parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26.
- F. Seal around cables penetrating fire-rated elements according to Section "Through-Penetration Firestop Systems."
- G. Identify and color-code conductors and cables according to Division 26 Section "Basic Electrical Materials and Methods."
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26 GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

- A. Product Data: For ground rods.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Boggs, Inc.
 - 2. Copperweld Corp.
 - 3. Dossert Corp.
 - 4. Erico Inc.; Electrical Products Group.
 - 5. Galvan Industries, Inc.
 - 6. Harger Lightning Protection, Inc.
 - 7. Hastings Fiber Glass Products, Inc.
 - 8. Heary Brothers Lightning Protection Co.
 - 9. ILSCO.
 - 10. Kearney/Cooper Power Systems.
 - 11. Korns, C. C. Co.; Division of Robroy Industries.
 - 12. Lightning Master Corp.

13. Lyncole XIT Grounding.
14. O-Z/Gedney Co.; a business of the EGS Electrical Group.
15. Robbins Lightning, Inc.
16. Salisbury, W. H. & Co.
17. Superior Grounding Systems, Inc.
18. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare, Solid-Copper Conductors: ASTM B 3.
- G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.
- H. Bare, Tinned-Copper Conductors: ASTM B 33.
- I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
- J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.
- M. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Exothermic-welded type, in kit form, selected per manufacturer's written instructions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
 1. Size: 3/4 inches in diameter by 120 inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.
- E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
 - 1. Install insulated equipment grounding conductors in feeders.
 - 2. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 - 3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
 - 4. Air-Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
 - 5. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an insulated equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
 - 6. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location and per Division 27.

- a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus per Division 27.
 - b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- 7. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing an insulated equipment grounding conductor with supply branch-circuit conductors.
- G. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- H. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- I. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- J. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- K. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- L. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- M. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
 7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
 8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
 9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
 10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
 11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.
- N. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- O. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.2 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance 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.
 3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Nominal maximum values are as follows:
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. Manhole Grounds: 10 ohms.

END OF SECTION

SECTION 26 05 29

SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It applies to and complements optional seismic-restraint requirements in the various electrical component Sections of these Specifications.

1.2 DEFINITIONS

- A. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
- B. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independently of other structural elements during an earthquake.

1.3 SUBMITTALS

- A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic-restraint component used. Include documentation of evaluation and approval of components by agencies acceptable to authorities having jurisdiction.
- B. Shop Drawings: For components, physical arrangements, and installation details not defined by Drawings. Indicate materials and show calculations, design analysis, details, and layouts, signed and sealed by a professional engineer.
- C. Pre-approval and Evaluation Documentation: By an agency approved by authorities having jurisdiction, showing maximum ratings of restraints.
- D. Qualification data.
- E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in California Building Code, unless requirements in this Section are more stringent.
- B. Testing Agency Qualifications: An independent testing and inspection agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the inspection indicated.

1.5 PROJECT CONDITIONS

- A. Project Seismic Zone and Zone Factor as Defined in CBC.

1.6 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structure, architectural features, and mechanical, fire-protection, electrical, and other building systems.
- B. Coordinate concrete bases with building structural system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. B-Line Systems, Inc.
 - 3. Erico, Inc.
 - 4. GS Metals Corp.
 - 5. Loos & Company, Inc.
 - 6. Mason Industries, Inc,
 - 7. Powerstrut.
 - 8. Thomas & Betts Corp.
 - 9. Unistrut Corporation.

2.2 MATERIALS

- A. Use the following materials for restraints:
 - 1. Indoor Dry Locations: Steel, zinc plated.
 - 2. Outdoors and Damp Locations: Galvanized steel.
 - 3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Strength in tension and shear of components shall be at least twice the maximum seismic forces for which they are required to be designed.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC-BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 570, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Hanger Rod Stiffeners: Slotted steel channels, installed vertically, with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.
- B. Install structural attachments as follows:
 - 1. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

2. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
3. Attachments to Existing Concrete: Use expansion anchors.
4. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
5. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
6. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
7. Attachments to Wood Structural Members: Install bolts through members.
8. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

C. Install electrical equipment anchorage as follows:

1. Anchor panelboards, motor-control centers, motor controls, switchboards, transformers, fused power-circuit devices, control, and distribution units as follows:
 - a. Anchor equipment rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
 - b. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
 - c. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
 - d. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
 - e. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

D. Install seismic bracing as follows:

1. Install bracing according to spacings and strengths indicated by approved analysis.
2. Expansion and Contraction: Install to allow for thermal movement of braced components.
3. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

Accommodation of Differential Seismic Motion: Make flexible connections in raceways, cables, wireway, cable trays, and busway where they cross expansion- and seismic-control joints, where adjacent sections or branches are supported by different structural

elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.
- B. Testing Agency: Engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.
- C. Reinspection: Correct deficiencies and verify by reinspection that work complies with requirements.
- D. Provide written report of tests and inspections.

END OF SECTION

SECTION 26 13 00 RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets indicated.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

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 the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 4. Electri-Flex Co.
 - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 6. LTV Steel Tubular Products Company.
 - 7. Manhattan/CDT/Cole-Flex.

- 8. O-Z Gedney; Unit of General Signal.
- 9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Compression type.
- F. FMC: Aluminum.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers:
 - 1. American International.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corp.
 - 4. Cantex Inc.
 - 5. Certainteed Corp.; Pipe & Plastics Group.
 - 6. Condux International.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; Division of Hubbell, Inc.
 - 12. Spiralduct, Inc./AFC Cable Systems, Inc.
 - 13. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
 - 1. Manufacturers:
 - a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).
 - b. Thomas & Betts Corporation.
 - c. Walker Systems, Inc.; Wiremold Company (The).
 - d. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
 - 1. Manufacturers:
 - a. Butler Manufacturing Co.; Walker Division.
 - b. Enduro Composite Systems.
 - c. Hubbell, Inc.; Wiring Device Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.
- C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Emerson/General Signal; Appleton Electric Company.
 - 3. Erickson Electrical Equipment Co.
 - 4. Hoffman.
 - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - 6. O-Z/Gedney; Unit of General Signal.
 - 7. RACO; Division of Hubbell, Inc.
 - 8. Robroy Industries, Inc.; Enclosure Division.

- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.
- I. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

2.6 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components provide manufacturer's standard prime-coat finish ready for field painting.

2.7 FIRESTOPPING FOR LOW VOLTAGE SLEEVES

- A. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows.
- B. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.
 - 2. Specified Technologies Inc. (STI) Mini EZ-PATH™ Fire Rated Pathway.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors:
 - 1. Exposed: Rigid steel or IMC.

2. Concealed: Rigid steel or IMC.
 3. Underground, Single Run: RNC.
 4. Underground, Grouped: RNC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Boxes and Enclosures: NEMA 250, Type 3R.
 7. Underground duct bank conduit spacers.
 8. Backfill materials per civil site requirements.
- B. Indoors:
1. Exposed: EMT.
 2. Concealed: EMT.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
 4. Damp or Wet Locations: Rigid steel conduit.
 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
 3. For Outdoor Use – conduit hub, NEMA 4 for conduit connection/terminating to cabinet/panel/boxes.
 4. All connectors to be steel. Die cast connectors are not acceptable.
- E. Do not install aluminum conduits embedded in or in contact with concrete.
- 3.2 INSTALLATION
- A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
 - B. Complete raceway installation before starting conductor installation.

- C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors on all raceways 2" and larger.
- K. Tighten set screws of threadless fittings with suitable tools.
- L. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- S. Set floor boxes level and flush with finished floor surface.
- T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 22 00 FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Cartridge fuses rated 600 V and less for use in switches controllers and motor-control centers.

1.2 SUBMITTALS

- A. Product Data: For each fuse type indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA FU 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Service Entrance: Class L, fast acting or J, fast acting.
- B. Motor Branch Circuits: Class RK5, time delay.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

SECTION 26 24 20 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
 - 3. Field quality-control test reports.
 - 4. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D.

2.2 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- B. Phase and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- C. Conductor Connectors: Suitable for use with conductor material.
 - 1. Ground Lugs and Bus Configured Terminators: Compression type.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. Provide 20% space in all panelboards
- F. Panelboard Short-Circuit Rating:
 - 1. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.3 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch Overcurrent Protective Devices:
 - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. No tie-handle allowed for multi-pole breakers.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
 3. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - a. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components for all NEMA 3R panelboards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."

- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- H. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- I. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding."
- K. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles, ground-fault circuit interrupters.
 - 2. Single- and double-pole snap switches and dimmer switches.
 - 3. Device wall plates.
 - 4. Floor service outlets, poke-through assemblies and multioutlet assemblies.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc./Hubbell Subsidiary.
 - b. Eagle Electric Manufacturing Co., Inc.
 - c. Hubbell Incorporated; Wiring Device-Kellems.
 - d. Leviton Mfg. Company Inc.
 - e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Multioutlet Assemblies:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Wiremold Company (The).
3. Poke-Through, Floor Service Outlets and Telephone/Power Poles:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Pass & Seymour/Legrand; Wiring Devices Div.
 - c. Square D/Groupe Schneider NA.
 - d. Thomas & Betts Corporation.
 - e. Wiremold Company (The).

2.2 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: Heavy-Duty grade.
- B. Straight-Blade Receptacles: Hospital grade.
- C. GFCI Receptacles: Straight blade, non-feed-through type, Hospital or Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

2.3 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- B. Snap Switches: Heavy-Duty grade, quiet type.
- C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
 1. Switch: 20 A, 120/277-V ac.
 2. Receptacle: NEMA WD 6, Configuration 5-20R.
- D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
 1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
 2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.

3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.4 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces:
 - a. Steel with white baked enamel, suitable for field painting
 - b. 0.035-inch thick, satin-finished stainless steel (above counters and in restrooms)
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Wet Locations: Cast aluminum with spring-loaded, lockable, lift cover, and listed and labeled for use in "wet locations."

2.5 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: See telecommunication specifications for requirements.
- F. Wiremold RFB4-4DB series complete with brackets, devices, corresponding covers and hardware.

2.6 POKE-THROUGH ASSEMBLIES

- A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
 1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
 2. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.

3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of four, 4-pair, Category 6 voice and data communication cables.

2.7 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: PVC.
- C. Wire: No. 12 AWG.

2.8 FINISHES

- A. Color:
 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Install wall dimmers to achieve indicated rating after derating for ganging.
- C. Install unshared neutral conductors on line and load side of dimmers.
- D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods."
 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Submit same for approval.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Enclosures.

1.2 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

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 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Division.

3. Siemens Energy & Automation, Inc.
 4. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open (required for all disconnects located downstream of Variable frequency Drives)

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Siemens Energy & Automation, Inc.
 4. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 4. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 1. Outdoor Locations: NEMA 250, Type 3R.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Basic Electrical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.
- C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- E. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Work."
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 1. Inspect mechanical and electrical connections.
 2. Verify switch and relay type and labeling verification.

3. Verify rating of installed fuses.
- B. Perform the following field tests and inspections and prepare test reports:
1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

SECTION 26 51 00 INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures with lamps and ballasts.
 - 2. Lighting fixtures mounted on exterior building surfaces.
 - 3. Emergency lighting units.
 - 4. Exit signs.
 - 5. Accessories, including fluorescent fixture dimmers, occupancy sensors and lighting fixture retrofitting.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, and finishes. Clearly identify ballast(s) and lamp(s) for each lighting fixture.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

PART 2 - PRODUCTS

2.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures with lamps and ballasts.
 - 2. Lighting fixtures mounted on exterior building surfaces.
 - 3. Emergency lighting units.
 - 4. Exit signs.

5. Accessories, including fluorescent fixture dimmers, occupancy sensors and lighting fixture retrofitting.

2.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, and finishes. Clearly identify ballast(s) and lamp(s) for each lighting fixture.

Operation and maintenance data.

2.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.
- D. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified.

2.4 FIXTURES AND COMPONENTS, GENERAL

- A. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."
 1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
 2. Heat Removal Units: Air path leads through lamp cavity.
 3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.
 4. Dampers: Operable from outside fixture for control of return-air volume.
 5. Static Fixtures: Air supply slots are blanked off, and fixture appearance matches active units.

2.5 LIGHTING FIXTURES

- A. Fixture : See drawings.

2.6 LAMP BALLASTS

- A. Description: Include the following features, unless otherwise indicated:

1. Designed for type and quantity of lamps indicated at full light output except for emergency lamps powered by in-fixture battery-packs.
 2. Externally fused with slow-blow type rated between 2.65 and 3.0 times the line current.
 3. Warranted for 5 years to include replacement ballasts and labor cost, plus lamp warranty for at least 2 years for lamps used with ballast.
- B. LED lamps shall include following features:
1. L.E.D. 3000K/3500K - Philips, CREE or approved equal..
 2. Comply with NEMA C82.11.
 3. Normal Light Output (NLO) BF 0.87.
 4. Sound Rating: A.
 5. Total harmonic distortion rating of less than 20 percent according to NEMA C82.11.
 6. Transient Voltage Protection: IEEE C62.41, Category A.
 7. Listed class P automatic reset thermal protection.
 8. Lamp Current Crest Factor: Less than 1.7
- C. Ballasts for dimmer-controlled fixtures shall comply with general and fixture-related requirements above for electronic ballasts and the following features:
1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 3. Compatibility: Certified by manufacturer for use with specific dimming system indicated.

2.7 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.8 EMERGENCY LIGHTING UNITS

A. General: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.
5. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.9 EMERGENCY LIGHTING FIXTURES

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Emergency Connection: Operate one lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
3. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.

Charger: Fully automatic, solid-state, constant-current type.

2.10 LED LAMPS

A. L.E.D. 3000K/3500K - Philips, CREE or approved equal..

2.11 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch.

- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.
- E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 LIGHTING CONTROL DEVICES

- A. Dimming Ballast Controls: Sliding-handle type with on/off control; compatible with ballast and having light output and energy input over the full dimming range.
- B. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change.
 - 1. Sensor Capacity: At least 40 electronic dimming ballasts.
 - 2. Adjustable Ambient Detection Range: 10 to 100 fc minimum
- C. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.
 - 1. Device Color:
 - a. Wall Mounted: White.
 - b. Ceiling Mounted: White.
 - 2. Occupancy detection indicator.
 - 3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
 - 4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.

Combination Sensors: Ultrasonic and infrared sensors combined.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging. Pendant fixtures shall be free to swing a minimum of 45 degrees from the vertical in all directions without contacting any obstructions. Otherwise, seismic restraints are required.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Continuous Rows: Suspend from cable.

D. Air-Handling Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable fixtures to provide required light intensities.

F. Occupancy sensor and daylighting sensor placement review by factory representative is required before installing sensors.

3.2 COMMISSIONING

- A. All electrical power and lighting controls will be commissioned per the requirements of Section 01810, Commissioning Requirements. Contractor is to provide a factory representative to start-up, test and commission all lighting controls.

END OF SECTION

SECTION 26 51 01 LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Lighting Controls
2. Relay Panels
3. Emergency Lighting Control (if applicable)

B. Related Sections:

1. Section 26 27 26 - Wiring Devices
2. Section 26 51 00 – Interior Lighting
3. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section
4. Electrical Sections, including wiring devices, apply to the work of this Section.

C. Control Intent – Control Intent includes, but is not limited to:

1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zones
3. Initial time switch settings
4. Task lighting and receptacle controls
5. Emergency Lighting control (if applicable)

1.2 REFERENCES

- A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
- B. International Electrotechnical Commission (IEC)
- C. International Organization for Standardization (ISO)

- D. National Electrical Manufacturers Association (NEMA)
- E. WD1 (R2005) - General Color Requirements for Wiring Devices.
- F. Underwriters Laboratories, Inc. (UL)
 - 1. 20 – Plug Load Controls
 - 2. 508– Industrial Controls
 - 3. 916 – Energy Management Equipment.
 - 4. 924 – Emergency Lighting

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:

- 1. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
- 2. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
- 3. Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.
- 4. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.
- 5. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
- 6. Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
- 7. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings.

8. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
9. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control.
10. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
11. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
12. Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
13. LMCP Digital Lighting Management Relay Panel – provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
14. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

1.4 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
 1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
 2. Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used.

3. Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
4. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
 - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
 - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
5. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

1.5 SUBMITTALS

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
- B. Shop Drawings:
 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
 2. Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans.)

3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.
2. Prove that the sensor is suitable for the proposed application.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.

1.7 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).
2. Relative humidity: Maximum 90 percent, non-condensing.

1.8 WARRANTY

A. Provide a five year limited manufacturer's warranty on all room control devices and panels.

1.9 MAINTENANCE

A. Spare Parts:

1. Provide 10% spares of each product to be used for maintenance for wall switches, dimmer switches and controllers.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. WattStopper

- a. System: Digital Lighting Management (DLM)
 - 2. Basis of design product: WattStopper Digital Lighting Management (DLM).
- B. Substitutions: [If Permitted]
- 1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
 - 2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval prior to rough-in.

2.2 DIGITAL LIGHTING CONTROLS

- A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

2.3 DIGITAL WALL SWITCH OCCUPANCY SENSORS

- A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
 - 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 2. Programmable control functionality including:

- a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - a) Ultrasonic and Passive Infrared
 - b) Ultrasonic or Passive Infrared
 - c) Ultrasonic only
 - d) Passive Infrared only
 - 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - 4. Two RJ-45 ports for connection to DLM local network.
 - 5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
 - 6. Device Status LEDs including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - 8. Assignment of local buttons to specific loads within the room without wiring or special tools
 - 9. Manual override of controlled loads.
 - 10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- c. BACnet object information shall be available for the following objects:

1. Detection state
 2. Occupancy sensor time delay
 3. Occupancy sensor sensitivity, PIR and Ultrasonic
 4. Button state
 5. Switch lock control
 6. Switch lock status
- D. Units shall not have any dip switches or potentiometers for field settings.
- E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
1. Left button
 - a. Press and release - Turn load on
 - b. Press and hold - Raise dimming load
 2. Right button
 - a. Press and release - Turn load off
 - b. Press and hold - Lower dimming load
- G. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.
 - c. Individual scenes may be locked to prevent unauthorized change.

- d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - e. Ramp rate may be adjusted for each dimmer switch.
 - f. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
- H. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 - 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 2. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - i Ultrasonic and Passive Infrared

- ii Ultrasonic or Passive Infrared
 - iii Ultrasonic only
 - iv Passive Infrared only
 - 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - 4. One or two RJ-45 port(s) for connection to DLM local network.
 - 5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 - 6. Device Status LEDs, which may be disabled for selected applications, including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - 8. Manual override of controlled loads.
 - 9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
- 1. Detection state
 - 2. Occupancy sensor time delay
 - 3. Occupancy sensor sensitivity, PIR and Ultrasonic
- C. Units shall not have any dip switches or potentiometers for field settings.
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 3. Configuration LED on each switch that blinks to indicate data transmission.
 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 6. Programmable control functionality including:
 - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
 - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
 7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
1. Button state
 2. Switch lock control
 3. Switch lock status
- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
- E. The following switch attributes may be changed or selected using a wireless configuration tool:
1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 2. Individual button function may be configured to Toggle, On only or Off only.

3. Individual scenes may be locked to prevent unauthorized change.
 4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 5. Ramp rate may be adjusted for each dimmer switch.
 6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
- F. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 HANDHELD REMOTE CONTROLS

- A. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
 2. LED on each button confirms button press.
 3. Load buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
 4. Inactivity timeout to save battery life.
- B. A wall mount holster and mounting hardware shall be included with each remote control
- C. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.7 DIGITAL PARTITION CONTROLS

- A. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.
- B. Four-button low voltage pushbutton switch for manual control.
1. Two-way infrared (IR) transceiver for use with configuration remote control.
 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Configuration LED on each switch that blinks to indicate data transmission.
 4. Each button represents one wall; Green button LED indicates status.
 5. Two RJ-45 ports for connection to DLM local network.
 6. WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.
- C. Contact closure interface for automatic control via input from limit switches on movable walls (by others).
1. Operates on Class 2 power supplied by DLM local network.
 2. Includes 24VDC output and four input terminals for maintained third party contact closure inputs.
 - a. Input max. sink/source current: 1-5mA
 - b. Logic input signal voltage High: >18VDC
 - c. Logic input signal voltage Low: <2VDC
 3. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
 4. Two RJ-45 ports for connection to DLM local network.
 5. WattStopper part number: LMIO-102

2.8 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
 3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
- B. Digital daylighting sensors shall include the following features:
1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a

sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

2. Sensor light level range shall be from 1-6,553 footcandles (fc).
3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
 - a. Light level
 - b. Day and night setpoints
 - c. Off time delay
 - d. On and off setpoints
 - e. Up to three zone setpoints
 - f. Operating mode – on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile,

skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500, LMLS-500-L.

E. Dual loop digital photosensors shall include the following additional features:

1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.9 DIGITAL ROOM CONTROLLERS AND PLUG-LOAD CONTROLLERS

- A. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
 1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
 2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
 3. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
 4. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power

- c. Status for each load
 - d. Configuration status
- 5. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
- 6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - a. Turn on to 100%
 - b. Remain off
 - c. Turn on to last level
- 7. Each load shall be configurable to operate in the following sequences based on occupancy:
 - a. Auto-on/Auto-off (Follow on and off)
 - b. Manual-on/Auto-off (Follow off only)
- 8. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
- 9. BACnet object information shall be available for the following objects:
 - a. Load status
 - b. Electrical current
 - c. Total watts per controller
 - d. Schedule state – normal or after-hours
 - e. Demand response control and cap level
 - f. Room occupancy status
 - g. Total room lighting and plug loads watts
 - h. Total room watts/sq ft
 - i. Force on/off all loads
- 10. UL 2043 plenum rated
- 11. Manual override and LED indication for each load
- 12. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
- 13. Zero cross circuitry for each load

14. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. On/Off Room Controllers shall include:

1. One or two relay configuration
2. Efficient 150 mA switching power supply
3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
4. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/Dimming enhanced Room Controllers shall include:

1. Real time current monitoring
2. Multiple relay configurations
 - a. One, two or three relays (LMRC-21x series)
 - b. One or two relays (LMRC-22x series)
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports with integral strain relief and dust cover
5. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
 - b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
 - c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
 - d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
 - e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
 - f. Calibration and trim levels must be set per output channel.

- g. Devices that set calibration or trim levels per controller are not acceptable.
 - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
 7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
 8. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - a. Establish preset level for each load from 0-100%
 - b. Set high and low trim for each load
 - c. Set lamp burn in time for each load up to 100 hours
 9. Override button for each load provides the following functions:
 - a. Press and release for on/off control
 - b. Press and hold for dimming control
 10. WattStopper product numbers: LMRC-211, LMRC-212, LMRC-213, LMRC-221, LMRC-222

D. Plug Load Room Controllers shall include:

1. One relay configuration with additional connection for unswitched load
2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
3. Factory default operation is Auto-on/Auto-off, based on occupancy
4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
5. Efficient switching power supply
 - a. 150mA (LMPL-101)
 - b. 250mA (LMPL-201)
6. RJ-45 DLM local network ports
 - a. Three RJ-45 ports (LMPL-101)
 - b. Four RJ-45 ports (LMPL-201)
7. WattStopper product numbers: LMPL-101, LMPL-201.

2.10 DLM LOCAL NETWORK (Room Network)

- A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
- B. Features of the DLM local network include:
 - 1. Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 - 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
 - 3. Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 - 4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
- D. If manufacture's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.
- E. WattStopper Product Number: LMRJ-Series

2.11 DLM SEGMENT NETWORK (Room to Room Network)

- A. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
 - 1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
 - 2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.

3. The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
4. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
5. Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERs, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

B. WattStopper Product Number: LM-MSTP, LM-MSTP-DB

2.12 CONFIGURATION TOOLS

- A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
 4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
 5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.13 NETWORK BRIDGE

- A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
 2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
 3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - a. Read/write the normal or after hours schedule state for the room
 - b. Read the detection state of each occupancy sensor
 - c. Read the aggregate occupancy state of the room
 - d. Read/write the On/Off state of loads
 - e. Read/write the dimmed light level of loads
 - f. Read the button states of switches
 - g. Read total current in amps, and total power in watts through the room controller
 - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
 - i. Activate a preset scene for the room

- j. Read/write daylight sensor fade time and day and night setpoints
- k. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- l. Set daylight sensor operating mode
- m. Read/write wall switch lock status
- n. Read watts per square foot for the entire controlled room
- o. Write maximum light level per load for demand response mode
- p. Read/write activation of demand response mode for the room
- q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.13 SEGMENT MANAGER

- A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).
- B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.
- C. Operational features of the Segment Manager shall include the following:
 - 1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
 - 2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC.
 - 3. Log in security capable of restricting some users to view-only or other limited operations.
 - 4. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
 - 5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
7. Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules.
8. Ability to group rooms and loads for common control by schedules, switches or network commands.
9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
10. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control.
11. The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager shall support multiple DLM rooms as follows:

1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).

E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.14 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected

via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

1. Additional parameters exposed through this method include but are not limited to:
 - a. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 - b. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
 - c. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 - d. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 - e. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
 - f. Load control polarity reversal so that on events turn loads off and vice versa.
 - g. Per-load DR (demand response) shed level in units of percent.
 - h. Load output pulse mode in increments of 1second.
 - i. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
2. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
 - a. Device list report: All devices in a project listed by type.
 - b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
 - c. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
 - d. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.

- e. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
 - f. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
 - g. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.
3. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
- a. Set, copy/paste an entire project site of sensor time delays.
 - b. Set, copy/paste an entire project site of sensor sensitivity settings.
 - c. Search based on room name and text labels.
 - d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 - e. Filter by parameter value to search for product with specific configurations.
4. Network-wide firmware upgrading remotely via the BACnet/IP network.
- a. Mass firmware update of entire rooms.
 - b. Mass firmware update of specifically selected rooms or areas.
 - c. Mass firmware upgrade of specific products.

B. WattStopper Product Number: LMCS-100, LMCI-100

2.15 LMCP LIGHTING CONTROL PANELS

- A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:
- 1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
 - 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 - 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction

shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:

- a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
- b. Individual terminal block, override pushbutton, and LED status light for each relay.
- c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
- d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
- e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
- f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
- g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
- h. Relay group status shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
- i. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
 - a) Electrical:
 - b) 30 amp ballast at 277V
 - c) 20 amp ballast at 347V
 - d) 20amp tungsten at 120V

- e) 30 amp resistive at 347V
- f) 1.5 HP motor at 120V
- g) 14,000 amp short circuit current rating (SCCR) at 347V
- h) Relays shall be specifically UL 20 listed for control of plug-loads
- b) Mechanical:
 - i) Replaceable, ½" KO mounting with removable Class 2 wire harness.
 - j) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
 - k) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
 - l) Tested to 300,000 mechanical on/off cycles.
- 4. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- 5. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
- 6. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
- 7. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
 - i. Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
 - j. The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.

- k. The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
 - l. The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - b) Scheduled ON / OFF
 - c) Manual ON / Scheduled OFF
 - d) Astro ON / OFF (or Photo ON / OFF)
 - e) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
 - m. The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
 - n. The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
 - o. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
8. The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
9. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol.
- a. The panel shall have provision for an individual BACnet device ID and shall support the full 2^{22} range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
 - b. The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
 - c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay

shall be readable and writable by the BAS via the object present value property.

- d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.
- e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
- f. Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
 - b) Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.
 - c) Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.
 - d) Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.
 - e) Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
- g. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
- h. The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
- i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
- j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

10. WattStopper Product Number: LMCP8, LMCP24 or LMCP48

B. USER INTERFACE

Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:

1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.
8. WattStopper Product Number: LMCT-100

2.16 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button

3. Auxiliary contact for remote test or fire alarm system interface
- B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION MEETING

- A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
 1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
 2. Review the specifications for low voltage control wiring and termination.
 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
 4. Discuss requirements for integration with other trades.

3.2 CONTRACTOR INSTALLATION AND SERVICES

- A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.
- B. Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.
- C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.
- D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
 1. Adjust time delay so that controlled area remains lighted while occupied.

- E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - 3. Load Parameters (e.g. blink warning, etc.)
- F. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.3 FACTORY SERVICES

- A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.
- B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.
- C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.4 COMMISSIONING SUPPORT SERVICES

- A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
- B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

END OF SECTION

SECTION 26 56 00 EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts, but not mounted on exterior surfaces of buildings.
 - 2. Luminaire-mounted photoelectric switches.

1.2 SUBMITTALS

- A. Product Data: For each luminaire, arranged in the order of lighting unit designation. Include data on features, accessories, finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 1. Include wiring diagrams.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 EXTERIOR LUMINAIRES, GENERAL

- A. Comply with UL 1598 and listed for installation in wet locations.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- I. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.02 LAMPS

- A. LED, 4000 kelvin.
- B. Turn over job with all lamps in new and operating condition.

2.3 CONTROLS

- A. Exterior lighting shall be controlled by new timeclock, Tork DLC400BP, and setup as follows:
 - 1. All poles shall have a minimum of two circuits alternating fixtures.
 - 2. Contractor shall coordinate with district for required timeclock scheduling.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lamps in each fixture.
- B. Luminaire Attachment: Fasten to indicated structural supports.
- C. Adjust luminaires that require field adjustment or aiming.

3.2 COMMISSIONING

- A. Exterior lighting and lighting control systems will be commissioned per the requirements specified in Commissioning Requirements.

END OF SECTION

SECTION 27 05 26

TELECOMMUNICATIONS GROUNDING PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, sections included under Divisions 1, 26, and 27 are included as part of this section as though bound herein.
- B. Section 27 01 00 General Requirements
- C. Section 27 15 00 – Horizontal Cabling

1.2 SUMMARY

- A. This Section specifies the minimum materials and performance standards for grounding and bonding installed specifically for telecommunication systems in West Contra Costa Unified School District new construction and remodels.
 - 1. Sections include:
 - a. Grounding electrodes and conductors.
 - b. Grounding electrodes.
 - c. Equipment grounding conductors.
 - d. Bonding.

1.3 REFERENCES

- A. American National Standards Institute (ANSI) Publication C2-97 – National Electrical Safety Code; ANSI/IEEE Std. 1100-1999 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems; ANSI/NFPA 780 – Lightning Protection Code Electronic Industries Association and Telecommunication Industries Association (EIA/TIA) Publications:
 - 1. EIA/TIA 568B – Commercial Building Telecommunications Wiring Standard.
 - 2. EIA/TIA 569 – Commercial Building Standard for Telecommunications Pathways.
 - 3. EIA/TIA 607 – Grounding and Bonding for Communications.
- B. Institute of Electrical and Electronic Engineers (IEEE) Publication 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- C. National Fire Protection Association (NFPA) Publication:
 - 1. 70 – National Electrical Code (NEC).
 - 2. 780 – Lightning Protection Code.
- D. Underwriters Laboratories, Inc. (U.L.) Publication:

1. 83 - Thermoplastic Insulated Wires.
2. 467 - Grounding and Bonding Equipment.
3. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.4 REGULATORY REQUIREMENTS

- A. The Contractor shall conform to requirements of the National Electrical Code Article 250, California Electrical Code, and requirements for EIA/TIA 607.
- B. The Contractor shall furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the SDUSD as suitable for purpose specified and shown.

1.5 PERFORMANCE REQUIREMENTS

- A. Grounding system resistance shall be 5 ohms or less unless otherwise indicated.
- B. A telecommunications ground in the form of telecommunication main ground busbar (TMGB) shall be installed in the Main Distribution Frame (MDF) cabinet. It will be directly attached and effectively bonded to the closest point in the building's electrical service grounding electrode system.
- C. In the event the building's service grounding electrode system is not in close proximity of the TMGB, install a driven ground rod for the telecommunication grounding system.
- D. Each Building Distribution Frame (BDF) shall be effectively bonded with the TMGB in the MDF. Each BDF ground shall be a separate grounding conductor between the BDF and the MDF.

1.6 SUBMITTALS:

- A. The following information shall be submitted for review and approval in accordance with Section 26 01 00, "General Electrical Requirements".
 1. Catalog Cut:
 - a. Ground Rod.
 - b. Ground Connectors
 - c. Telecommunications Main Grounding Busbar.
 2. Ground resistance from each major piece of equipment to the ground electrode. Equipment shall include, but not be limited to the following:
 - a. Main Distribution Frame (MDF).
 - b. Building Distribution Frame (BDF).

1.7 WARRANTY

- A. Warranty shall comply with the provisions of Section 26 01 00, "General Electrical Requirements".

PART 2 - PRODUCTS

2.1 Telecommunication Main Grounding Bus Bar (TMGB):

- A. Provide 2" wide x 3/16" thick copper ground bus, (length as necessary to accommodate all MDF/BDF/IDF ground connections).

2.2 GROUND RODS:

- A. Provide copper clad steel with adequate diameter to permit driving it full length of the rod in the earth but not less than 3/4-inch. Length shall be 10-feet unless otherwise indicated.

2.3 GROUNDING AND BONDING CONDUCTORS

- A. Grounding and bonding conductors shall be sized in accordance with Table for equipment grounding conductors, NEC. 250, ANSI/TIA/EIA – 607.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Make mechanical and electrical contact at all MDFs and BDFs. Permanently and effectively ground all equipment as required by all applicable codes, regulations and standards.
- B. Drive ground rods full length in a depression at least six (6)-inches below finished grade.
 - 1. Provide minimum No. 4/0 AWG, insulated, stranded copper grounding conductor between TMGB in MDF and electrical system ground
 - 2. Provide minimum No. 6 AWG, insulated, stranded copper grounding conductor between individual BDFs and the MDF TMGB.

3.2 TESTS

- A. All testing shall be performed by the technology contractor and shall be witnessed by the Architect and/or the District's designated representative.
- B. As an exception to requirements that may be stated elsewhere in the contract, the Consultant shall be given five (5) working days notice prior to each test.
- C. The testing equipment and devices used in performing the required tests shall have a calibration sticker affixed to the device stating the date when calibrated, date due for re-calibration, and the signature of the individual who did the calibration. In addition to the sticker, a certificate shall also contain the brand name and the serial number of the device.

- D. Ground Rod Test: Test ground rods for ground resistance value before any wire is connected. A portable testing megger shall be used to test each ground or group of grounds. The auxiliary or reference ground rods shall be $\frac{3}{4}$ -inch copper clad steel, not less than 4-feet in length and driven 3-1/2 feet deep, and shall be installed in a straight line from the ground being tested. Number 14 AWG stranded wire leads with at least 600 volt rubber insulation shall be connected to binding post on the instrument.
 - 1. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one (1) copy of the megger manufacturer's directions for use of the ground megger indicating the methods to be used.
- E. Test Report (Submit four (4) copies in writing):
 - 1. Grounding electrodes and systems (identifying electrodes and systems, each test).

END OF SECTION

SECTION 27 16 50 DATA NETWORKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Scope: Data, Telephone/Voice
- C. Industry Guidelines and Standards
- D. Submittals

1.2 GENERAL REQUIREMENTS

- A. Manufacturer: The term “manufacturer” shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) years experience in manufacturing products of this type and shall be ISO 9001 Certified.
- B. Contractor: The term “contractor” shall be defined as the company, or group of companies, that actually installs the product. The contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.
 - 1. The contractor shall hold a valid State of California C-7 Or C-10 Contractor’s license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least three (3) years and capable of being bonded to assure the Owner’s Project Manager of performance and satisfactory service during the guarantee period.
 - 2. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
 - 3. All work shall be performed under the supervision of a company accredited by the manufacturer and such accreditation must be presented.
 - 4. The contractor shall be a manufacturer’s authorized distributor and warrantee station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The contractor shall maintain a spare set of all major parts for the system at all times.
 - 5. The contractor selected for this Project must adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and

distribution channels in provisioning this Project.

6. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and Category 6A metallic premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
7. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the installing contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.
8. All communication system supplied shall be listed by Underwriter's Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

C. Responsible Person for Contractor: Submit name of the individual authorized to receive construction change documents, and who is responsible for informing others in Contractor's employ or subcontractors of changes in the Work.

1.3 SCOPE OF WORK

A. DATA: The work shall include, but not be limited to the following objectives:

1. Connect new and relocated IDF's as shown on plans. Contractor shall coordinate closely with District for required time to complete connection.
2. Only virgin materials shall be used in the construction of cabling.
3. Provide new fiber optic cable where shown on drawings and terminate all strands of fiber at each rack or wall mounted fiber enclosure. All cables shall be installed with service loops at ground boxes and MDF/IDF locations only. Fiber will be terminated using LC type connectors.
4. Installation of a new Category 6A UTP in rooms as required by the drawings or the scope of work. Category 6A terminations will be EIA/TIA standard 568B wiring configuration into RJ45 workstation data jacks (all jacks shall be orange in color for data and all cables shall be blue in color for data). All cables shall be installed with service loops at ground boxes and MDF/IDF locations only.
5. Furnish and install for each IDF a data cabinet, fiber patch panels, copper patch panels, UPS, and wire management hardware as required by the quantities shown drawings or

the scope of work.

6. Mount and install Switches as required by the drawings or the scope of work. Contractor shall notify the District in writing two weeks prior to the expected installation date of switches. Equipment shall be installed within Data Cabinets (provided by the contractor). Data Cabinets will be dual access and fully enclosed (See Materials List)
7. Testing of cables and connections to insure a complete and operable end-to-end data connection using EIA/TIA TSB-67 testing guidelines at level II accuracy for Category 6A, and EIA/TIA 455a for fiber.
8. All terminations into patch panel for connection to Switches using contractor supplied patch cords/station cables. For each data cable installed, the contractor shall supply one (1) 3' Category 6A patch cord for the patch panel location. In addition, the contractor shall supply 50% of 7' station cords and 50% of 10' station cords of the total number of data jacks installed. Station cords shall be delivered as directed by computer services in boxes clearly labeled with School name, quantity and size of station cords. Contractor to install patch cords from patch-panel to switches.
9. Set up a complete wire management system at each IDF, this includes wire management organizer(s). Contractor shall provide one horizontal wire manager for each new Category 6A patch panel and one horizontal wire manager for each switch installed.
10. Warranty:
 - a. Contractor shall warrant the installation and that all approved cabling components meet or exceed the requirements of TIA/EIA-568A, TIA/EIA-568A-A5, and ISO/IEC 11801.
 - b. Contractor will provide a minimum of a fifteen (15) year written warranty from the manufacturer(s) for both UTP basic link and fiber optic cable systems. This may require the contractor to certify their installers to the manufacturer's guidelines before the project begins.
 - c. The permanent link cabling system shall be warranted for a period of at least 25 years.
 - d. The contractor will provide a two (2) year written warranty covering workmanship and materials in compliance with District specifications. All repairs shall be made at no cost to District during the warranty period.
 - e. Contractor will provide to the District warranty information covering parts and materials used by the contractor.
 - f. Upon hookup of system and system start-up by District, if system troubles should indicate problems with the cables or terminations, it shall be the responsibility of

the cable installation contractor to repair any such problems free of charge to the District. The contractor shall start this repair work within a 48 hour period of time from initial notification by District.

B. INDUSTRY GUIDELINES AND STANDARDS

1. When Contract Documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge. Notify the District Representative of any discrepancies prior to commencement of construction. Obtain written clarification prior to proceeding with work.
2. Fiber optic cable, electrical cable, wire and connectors shall be installed as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended functions.
3. The National Fire Code (NFPA), National Electrical Code (NEC), California Electrical Code (CEC), California Building Code and Local Codes will be followed.
4. Applicable Standards
 - a) National Electrical Code (NEC), most recent edition.
 - b) ANSI/TIA/EIA-568-B -- Commercial Building Telecommunications Cabling Standard
ANSI/TIA/EIA-568-A-1 -- Propagation Delay and Delay Skew Specifications for 100 ohm 4-pair Cable.
 - c) ANSI/TIA/EIA-568-A-2 - Commercial Building Standards Updates
 - d) ANSI/TIA/EIA-569-A -- Commercial Building Standard for Telecommunications Pathways and Spaces.
 - e) ANSI/TIA/EIA-606 -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - f) ANSI/TIA/EIA-607 -- Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - g) ANSI/TIA/EIA TSB-67 -- Transmission Performance Specifications for Field-testing of Unshielded Twisted-Pair Cabling Systems.
 - h) ANSI/TIA/EIA TSB-75 -- Additional Horizontal Cabling Practices for Open Offices.
 - i) BICSI -- Telecommunications Distribution Methods Manual.
 - j) BICSI -- Cabling Installation Manual.
 - k) IEEE 802.3 "Carrier Sense Multiple Access with Collision Detection".
 - l) IEEE 802.3ab "Gigabit Ethernet transmission over unshielded twisted pair (UTP)"

- m) IEEE 802.z “1000Base-SX transmission over multi-mode fiber and 1000Base-LX transmission over single-mode fiber
- n) ISO/IEC DIS 11801, January 6, 1994.
- o) UL Cable Certification Program.
- p) ANSI X3T9.5 Requirements for UTP at 100 Mbps.
- q) EIA/TIA Technical Specification Bulletin 36. Technical Systems Bulletin additional Cable Specifications for Unshielded Twisted-Pair Cables.
- r) EIA/TIA Technical Specification Bulletin 40. Technical Systems Bulletin additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware.
- s) TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
- t) EIA/TIA-455-61 FOTP-61 Measurement of Fiber or Cable Attenuation Using an OTDR.
- u) ANSI/EIA/TIA-455-A-1991 Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components
- v) ANSI/ICEA S-83-596-1994, Fiber Optic Premises Distribution Cable.
- w) ANSI/ICEA S-87-640-2000, Fiber Optic Outside Plant Communications Cable.
- x) ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7.
- y) ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14A.
- z) ANSI/TIA/EIA-598-A-1995, Optical Fiber Cable Color Coding.
- aa) ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Connector Intermateability Standard.

1.4 SUBMITTALS

A. Pre-construction material submittals

1. Whenever in the Contract Documents any materials, products, processes or articles are indicated or specified by the name brand of the manufacturer, or by patent or proprietary names, such specifications shall be deemed to be a measure of quality and utility or a standard, and shall be deemed to be followed by the words, “or equal”. It is the intent of this article to comply with Public Contract Code Section 3400.

B. Proposed Product Substitutions

1. All proposed product substitutions shall be requested as per Section Product Substitution Procedures.

1.5 LOW VOLTAGE ENCLOSURES AND PATHWAYS

- A. Single channel surface raceway will be Wiremold 2300 or 2900 series or larger depending on fill ratio. All fittings made for an intended purpose of installation by the manufacturer shall be included as part of this material. Fill shall not exceed 40% and raceways shall be screw in type. Adhesive only raceways are not acceptable.
- B. Multi channel surface raceway will be Wiremold 5400, 5500 series depending on fill ratio. All fittings made for an intended purpose of installation by the manufacturer shall be included as part of this material. Fill shall not exceed 40% and raceways shall be screw in type. Adhesive only raceways are not acceptable.
- C. Mounting hardware and anchors recommended by the Manufacturer of any material that shall be mounted to the building or structure.
 - 1. Sheetrock/drywall/wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
 - 2. Concrete/cinder block/solid masonry: expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.
 - 3. Tile/Stucco/hollow masonry: toggle bolts or approved equal.
 - 4. Wood: lags, wood screws, or approved equal.
 - 5. Metal: clamp, or approved equal.
- D. Cover plates will be Belden. Blanks will be used to cover any unused ports.
- E. Nomenclature:
 - 1. IDF cabinets are cabinets/racks specified for intermediate distribution frames, typically at the head of a wing and feed one or more classrooms. Provided by district.
 - 2. MDF cabinets are cabinets/racks specified for main distribution frames. Typically 84" high.
 - 3. All equipment shall be mounted with Phillips screws, unless otherwise specified.

PART 2 – PRODUCTS

2.1 DATA

Product list as follows. No substitutions.

MANUFACTURER	Item Number	Description
BELDEN	AX102655	KeyConnect Faceplates 2-Port, w/ ID Windows, Single Gang, Flush

BELDEN	AX102652	KCONN SIDE ENTRY BOX 2-P WHI
BELDEN	AX103115	KCONN PATCH PANEL 48-P 2U BLK
BELDEN	OSP6AU	Category 6AA (500MHz), 4-Unbonded-Pair, Outside Plant Cable, 23 AWG Solid Bare Copper Conductors, PO Insulation, Patented X-spline Technology, Gel Flooded, Inner Polyolefin Jacket, EquiBlock Barrier Tape, Ripcord, Outer Polyolefin Jacket.
BELDEN	FPSSDSD001M	FX PATCH CORD, OS2, SC DUPLEX - SC DUPLEX, 1 M, OFNR, DUPLEX ZIP 3.0 MM, A-TO-B, YELLOW JACKET
BELDEN	AX105208-B25	SC Field Installable Connector, Singlemode, OS2, Blue Housing, 25/Pack, with support for 250 µm (using Breakout kit), 900 µm, 2 mm and 3 mm fiber (using jacketed boots). Includes 900µm boot, other accessories (Breakout Kit & jacketed boots) sold separately.
BELDEN	XWM-2320-GD	XWM Series Wall Mount Enclosure, 23"W x 39.25"H x 27.5"D, Plexiglass Door
BELDEN	FT3LC900FS01	FX FUSION SPLICE-ON CONNECTOR, OM3-4, LC SIMPLEX, 900UM TIGHT BUFFER, AQUA HOUSING, 1/PACK
BELDEN	FTSLC900FS01	FX FUSION SPLICE-ON CONNECTOR, OS2, LC SIMPLEX, 900UM TIGHT BUFFER, BLUE HOUSING, 1/PACK
BELDEN	FTSLB900FS01	FX FUSION SPLICE-ON CONNECTOR, OS2, LC/APC SIMPLEX, 900UM TIGHT BUFFER, GREEN HOUSING, 1/PACK
BELDEN	10GXS13	Category 6A Enhanced (625MHz), 4-Unbonded-Pair, Plenum-CMP, Premise Horizontal Cable, 23 AWG Solid Bare Copper Conductors, FEP Insulation, Patented EquiSpline™ & EquiBlock™ Technologies, Ripcord, Flamarrest® Jacket, Blue, Spool-in-Box
BELDEN	FDSD006P9	FiberExpress Distribution Cable, 6-Fiber, OS2 OFNP, Tight Buffer, Indoor & Outdoor Rated with UV Resistant Black Jacket, High flexibility for backbone and horizontal applications (formerly part number: B9W045T)
BELDEN	ECX-02U	FiberExpress ECX Patch Panel Housing 2U, holds 4 ECX adapter frames or cassettes
BELDEN	RVAMJKUEW-S1	REVConn 10GX Jack Elec White
BELDEN	RVAMJKUEW-B24	REVConn 10GX Jack Elec White (Bag of 24)
BELDEN	BHH192UC	19" 2U Horizontal Manager with cover
BELDEN	AX104271	FiberExpress Brilliance Precision Kit
BELDEN	FFSX06LD	FX ECX FRAME, OS2, 06 PORTS, LC DUPLEX, BLUE ADAPTERS
BELDEN	CA21109004	10GX Patch Cord, Bonded-Pair, 4-Pair, 24 AWG Solid, CMR, T568A/B-T568A/B, White, 4 ft. (1.2 m).

BELDEN	CA21109007	10GX Patch Cord, Bonded-Pair, 4-Pair, 24 AWG Solid, CMR, T568A/B-T568A/B, White, 7 ft. (2.1 m)
BELDEN	CA21109010	10GX Patch Cord, Bonded-Pair, 4-Pair, 24 AWG Solid, CMR, T568A/B-T568A/B, White, 10 ft. (3.0 m)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the Owner's Representative before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. Splices of conductors in underground pull boxes are not permitted.
- D. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner's Representative to engage in the installation and service of this system.
- E. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.
- F. The system must meet all local and other prevailing codes.
- G. All cabling installations shall be performed by qualified technicians.
- H. All cabling shall be splice free.
- I. In order to ensure the least amount of cable untwisting, it is required that all cables shall be

stripped using a special tool.

- J. The use of lubricants (i.e. Blue 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed.
- K. Under no circumstance are “channel locks” or other pliers to be used.
- L. Plenum rated cable may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The cable shall not be laid directly on the ciling panels. The use of cable ties shall be done in accordance with the cable manufacturer’s requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes.
- M. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of national Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits.
- N. Site Cleaning. Throughout the progress of the plant construction, the contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.
- O. Conduits. All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with ¼-inch pull rope during the course of his work. Contractor must seal all conduits with an approved sealing compound.
- P. Cabling and Termination Identifications. All new cabling shall be of the type specified herein. Any conflicts between cabling types specified and code or design requirements shall be submitted to Owner’s Representative for review and final disposition. All cabling shall be neatly laced, dressed and adequately supported. Cabling must be concealed to the fullest extent possible. In addition, a numbering and marking scheme must be used to

identify all cable and cabling terminations. All cables, regardless of length, shall be marked and/or numbered at both ends. Marking codes and methodologies shall correspond to the instructions in this specification.

- Q. Seismic Requirements. Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to the local, state and/or federal code. Contractor will notify Owner's Representative of such requirements and shall provide such bracing as required.
- R. Safety Requirements. Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.
- S. Owner or Owner's Representative may view work or testing in progress.

3.2 CABLE ROUTING

- A. The cables will be routed to their respective Main Distribution Frame (MDF), Intermediate Distribution Frame (IDF), or to service drop utilizing the shortest path possible.
- B. Cable shall not be exposed at any point in the cable path. Contractor is to use appropriate pathway for the situation (i.e. inside wall, conduit, or non metallic surface raceway). EXCEPTION: In MDF ROOM ONLY cables may be exposed and routed in contractor supplied D-rings every 4 feet.
- C. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install threaded IMC or rigid conduit with large fender washers, lock rings, and screw on protective bushings on both ends. The fire rating of the wall must be maintained during and after installation.
- D. At solid wall location such as plaster, brick, concrete, cinder block, tile, reinforced concrete, Contractor will provide and install surface mounted non-metallic raceways or equivalent. The use of different series raceways is required at locations where cable fill capacities are exceeded.
- E. Terminations on block walls will be accomplished with District approved surface mount boxes.
- F. Cables will be run vertically inside the wall and into the ceiling space. Terminations on stud

walls will be accomplished with cut-in type electrical boxes with a 1" conduit (flex or EMT) extended from the box within the wall to ceiling access space.

G. Service loops:

1. Fiber:

- a. Shall be a minimum of 10' at all MDF and IDF locations.
- b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

2. Category 6A (Data and Voice) and CATV/Broadband

- a. Shall be a minimum of 6' at all MDF and IDF locations.
- b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

3. Category 6A Voice Feeder Cables

- a. Shall be routed around the perimeter of the backboard in which it is terminated on.
- b. All ground boxes shall have a minimum of 6' service loop.

H. Cables shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables is unencumbered.

I. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.

J. Do not use pulling means, including fish tape, cable or rope, which can damage the Wiremold raceway.

K. Use pulling compound or lubricant that will not deteriorate cable or conduit.

L. Pulling compound shall be a water base pulling lubricant that will not deteriorate cable or conduit.

M. Cables shall not be pulled across sharp edges. If sharp edges are present a small sleeve, insuliner or grommet shall be installed to protect the cable.

N. Cables shall be pulled free of sharp bends or kinks.

O. Cables shall not be forced or jammed between metal parts, assemblies, etc.

P. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems shall be maintained.

Q. Manufacturer's specifications for pulling stress and minimum bend radius shall not be exceeded on any cable.

R. Do not use staples or drive rings.

3.3 CABLE INSTALLATION PARAMETERS

- A. Contractor is required to adhere to the following parameters in this section whether or not existing equipment has been placed by Contractor and/or others.
- B. Contractor will notify District of any of the following requirements that cannot be met prior to bid.
- C. Data UTP specifications.
 - 1. Data terminations shall be T568B configuration unless otherwise specified
 - 2. Category 6AA modular patch panels shall be installed in accordance with manufacturer's design and installation guidelines.
 - 3. Data UTP Testing
 - a. All data UTP cable shall be tested after installation according to the procedures and acceptability criteria described in EIA/TIA Standards for Category 6AA cable and connecting hardware. Test at level 11 compliance.
 - b. Data UTP cable shall meet or exceed requirements for 10 Gbps data transmission.
 - c. Network certification of all four (4) pair will meet testing criteria for a minimum of 1000BASE-TX
 - d. Printed test results (both printed copy and data file copy) shall be provided as documentation of the quality of installation procedures and as a baseline for future troubleshooting.
 - e. All UTP testing equipment shall have current calibration certification.
- D. Fiber Cable Specification
 - 1. Fiber cable will be Single Mode per Equipment List.
 - 2. Fiber Optics Cable Installation and Testing
 - a. All spare optical ports and connectors shall have a dust cap in place to protect from the environment.
 - b. Contractor shall provide and install blanks in unused spaces of the fiber enclosure.
 - c. If fiber is supplied to Contractor by the District it shall be tested before installation, while still on the shipping reel, using an optical time domain reflectometer (OTDR).
 - d. The test results shall be compared to the manufacturers test results. A discrepancy of more than 1 dB on any fiber in either window indicates possible shipping damage and the fiber shall be returned to the supplier.
 - e. The test results shall be maintained in a file for future reference.
 - f. All fiber shall be tested after installation according to the procedures and acceptability criteria described in EIA/TIA 455A (Aug 1991) and all applicable addenda after installation and an 1310/1550 nm power meter and stabilized light source for single mode fiber. OTDR testing is to be performed in any location where the fiber is not continuous, i.e. coupled LC connectors (soft splice), fusion splice and mechanical splice.
 - g. The results of these tests (printed OTDR result power meter attenuation results) shall be provided by the installer as documentation of the quality of installation and as a baseline for future troubleshooting, both printed copy and data file copy.
 - h. The results shall be compared to the pre-installation test results for significant changes.
 - i. All optical test equipment shall have current, traceable calibration certification.
 - k. The multi-mode cable shall comply with the following maximum individual fiber loss

(cabled): Attenuation 1310 nm, 2.00 dB end to end (basic link) 1550 nm, 1.00 dB end to end (basic link).

- I. Aerial fiber cable mounting hardware shall be matched to the all supporting (ADSS) fiber cable exactly and be installed in accordance with mounting hardware and cabling manufacturers specifications.
- E. A maximum fill capacity of 40% will be deemed acceptable for conduits and 75% of raceway and surface mold. Contractor shall inform Consultant in writing if this requirement cannot be met. If the Contractor fails to inform the Consultant any labor involved in rerouting cables in such conduit or raceways shall be the soul responsibility of the Contractor.
- F. Cable shall be identified with a machine-printed tag identifying the system type in all access points (i.e. junction boxes, ground boxes, MDF, IDF's, etc.) and as they enter or exit the conduit pathway.
- G. Contractor will assess whether or not the ceiling space is a plenum air return which shall dictate the use of the listed plenum type or PVC type cable required in the materials specification section. Any cable installations that shall be pulled through underground conduit will require Outside Plant (OSP) cable.
- H. All cabling shall be installed with proper stress relief and tied down.
- I. Manufacturer's specification for pulling stress and minimum bend radius shall not be exceeded on any fiber optic, data, voice, CATV, CCTV, IP Network Cameras, PA or any other cable.
- J. Power feeds of greater than 220 volts shall not be run parallel to the UTP cables. Parallel runs of greater than 20 feet require a minimum separation distance of 3 feet, or 18 inches if cables are contained in a metallic conduit, which is grounded.
- K. Multiple conduit runs of 110 volts power distribution shall not be run parallel to the UTP cables. Parallel runs of greater than 20 feet require a minimum separation distance of 18 inches.
- L. All power feeds crossing the path of the UTP cables at right angles shall be a minimum of 6 inches in distance from the UTP cables.
- M. There shall be an 18 inch separation between the cables and the fluorescent light fixtures. Contractor shall notify District representative in the event this requirement can not be met.
- N. All cable/cabling shall be kept 30 inches away from any heat source; i.e., HVAC ducting, steam valves, etc.
- O. Thin Ethernet or Fiber Optic cable/cables shall be identified with a tag as to the system and date, every 30 feet when installed in open trays or suspension systems in ceilings.
- P. Station Cable (UTP) or STP runs are not to exceed 295 feet for data and 1000 feet for voice.
- Q. Cable splicing at any point of a UTP or STP station cable or any cable installed by the

contractor is unacceptable without specific district approval.

- R. No cabling is allowed to rest on any ceiling tile or suspension system unless specifically authorized by District. Strapping or mounted to any existing wires (e.g., lighting, ceiling grid, etc.) is not permitted.
- S. Cables shall be securely supported to building structure (i.e. stud, beam, or other framing member) within 12 inches of any conduit or raceway entrance.
- T. Contractor will place all station cables in the ceiling area on Contractor supplied and installed wire hangers or in floor spaces and raceways.
- U. Insulation shall be removed to expose shielding and conductors/fibers to the exact length required by manufacturer for proper termination of plugs, pins and fiber terminations.
 - 1. Wires and shielding shall not be nicked or damaged in any way upon termination of pins and closure of plug assembly.
 - 2. Pins and plugs, upon termination, shall not be damaged in any way.

3.4 LABELING AND IDENTIFICATION

- A. All cable plant labeling and administration documentation shall conform to ANSI/TIA/EIA 606 Administration Standard.
- B. The cables within the rack or cabinets shall be numbered for identification.
- C. Equipment used for labeling shall be: Brother "P-Touch" model PT-1750. Label media shall be black typeface on white tape. Tape material shall be 1/2" wide.
- D. Components shall be marked where they are administrated (label at all punch down points, panels, blocks, outlets, etc.).
- E. Industry standard color fields should be used where applicable as described in the Standards.
- F. All pathways labeled (conduit, trays, etc.).
- G. Data UTP Labeling
 - 1. Wiring termination locations shall be labeled to corresponding pairs at the MDF, IDF, C IDF and at each workstation end.
 - 2. Cables shall be labeled no more than 3" back from each end of the termination point with a cable label that matches the faceplate labeling.
 - 3. Contractor will provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.
 - 4. Hand written labels are not acceptable.
 - 5. Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable pair.

6. Labeling Scheme:

- H. Workstation Labeling: The faceplate or surface block shall be labeled with the Room # of the IDF where the cable sources from, the Room # the cable terminates in, and the sequential workstation number (ex. B10(IDF)-B2(RJ45 jack)-09(Workstation number). Each room shall have a sequential workstation number starting with the number 01 (ex. B10-B2-01 through B10-B2-10 and B10-B3-01 through B10-B3-10). The labeling itself shall be in a white background with black lettering.
- I. Closet Labeling: Patch panel shall be labeled with the Room # the cable terminates in (RJ45 jack) and sequential workstation number only. The labeling itself shall be in a black background with white lettering.
- J. Data Fiber Optics Labeling
 - 1. Fiber termination locations shall be labeled to corresponding fiber strands pairs at the MDF, IDF, and CIDF.
 - 2. The labeling scheme will be provided by the District and will be specific up to and including instructions for the placement of labeling, tags, straps, and adhesive labels.
 - 3. Contractor is expected to provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.
 - 4. Hand written labels are not acceptable.
 - 5. Labeling Scheme:
 - i) Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable.
 - ii) Cables shall be labeled approximately 12 inches back from the point where the cable enters the fiber enclosure with a cable label that identifies the origin and destination of the cable.
 - iii) Closet labeling; each connection shall be labeled denoting each strands color, origin and destination with name of room or wing.
 - iv) The type (single-mode or multi-mode) of fiber optic cable used shall be clearly labeled on the fiber patch panel per drawn details.
 - v) Color-coding shall conform to EIA/TIA specifications.

3.5 TESTING OF THE CABLING PLANT

- A. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
- B. District reserves the right to be present during any or all of testing.
- C. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the District.
- D. 100% of the installed cabling must be tested. All tests must pass acceptance.
- E. Test equipment shall be fully charged prior to each day's testing.

- F. Test reports must be submitted in hardcopy or electronic format. Hand-written test reports are not acceptable.
- G. Hardcopy reports are to be submitted in labeled 3 ring binders with an attached affidavit verifying passing execution of all tests. For large installations electronic reports with hardcopy summaries are preferred. Hardcopy summary reports shall contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.
- H. Electronic reports are to be submitted on CD format. If proprietary software is used, CD shall contain any necessary software required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc. then software to read these files are not provided. Electronic reports must be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate must reference traceable circuit numbers that match the electronic record.
- I. Test reports shall include the following information for each cabling element tested:
 - 1. Wire map results that indicate the cabling has no shorts, opens, miswires, split, reversed, or crossed pairs, and end to end connectivity is achieved.
 - 2. For Category 6AA cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
 - 3. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
 - 4. Cable manufacturer, cable model number/type, and NVP
 - 5. Tester manufacturer, model, serial number, hardware version, and software version
 - 6. Circuit ID number and project name
 - 7. Auto-test specification used
 - 8. Overall pass/fail indication
 - 9. Date of test

10. Test reports shall be submitted within 7 business days of completion of testing.

3.6 TEST EQUIPMENT

- A. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.
- B. All test tools of a given type shall be from the same manufacturer, and have ompatible electronic results output.
- C. Test adapter cables must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
- D. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing.
- E. Test equipment must be capable of certifying Category 6A and 6 links.
- F. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.
- G. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
- H. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
- I. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto-tests. Individual tests increase productivity when diagnosing faults.
- J. Test equipment must include a library of cable types, sorted by major manufacturer.
- K. Test equipment must store at least 1000 Category 6A or 6 auto-tests in internal memory.
- L. Test equipment must be able to internally group auto-tests and cables in project folders for good records management.
- M. Test equipment must include DSP technology for support of advanced measurements.
- N. Test equipment must make swept frequency measurements in compliance with TIA standards.
- O. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.7 MDF/IDF/CIDF INSTALLATION PARAMETERS

- A. UTP cabling shall conform to a 6 foot separation requirement from main power panels,

Switch gear and/or starter motors adjacent to the IDF and termination locations.

- B. All data, voice and communications racks and cabinets shall be anchored in accordance with manufacturer specifications and drawn details, to walls and floors and grounded to building ground grid (not to water pipes, etc.). Individual or new ground points are acceptable.
- C. All floor mounted racks and cabinets shall have ladder racking from top of rack or cabinet to nearest wall as directed by consultant.
- D. Wall mounted racks and cabinets.
 - 1. Backboards shall be made of fire retardant or treated materials. Outside backboards shall be mounted squarely cut, with sanded edges, void free and painted. Backboards made from particle or pressed board materials are not acceptable. Backboards shall be a minimum size of $\frac{3}{4}$ " thick x 36" wide x the height of the rack or cabinet. Backboard shall be painted with white fire-retardant paint.
 - 2. Inside backboards shall be mounted squarely cut, with sanded edges and void free. Inside backboard shall match the inside dimensions of the installed cabinet. Inside backboard shall be a minimum thickness of $\frac{3}{4}$ ".
 - 3. All new racks and cabinets shall be securely mounted to wall studs in accordance with manufacturer specifications and drawn details.
- E. All new and existing racks and cabinets shall have a dedicated 110V/AC double duplex outlet installed per specification section, California Electrical Codes, and drawing details.

3.8 DOCUMENTATION AND DRAWINGS

- A. As a pre-requisite for the acceptance of the work, the Contractor shall provide all of the following information. The Contractor shall prepare and provide 2 copies of a complete Cable Book as documentation. This cable book shall consist of the following:
 - 1. Title of Project
 - 2. Index page detailing the following sections
 - 3. Site plans (as-built drawings)
 - 4. Drawings shall be professionally drafted (to scale, within a border similar to design drawings) and reproducible. Hand written drawings are not acceptable.
 - 5. The drawings shall depict, at a minimum, the following conditions:
 - a. The exact MDF/IDF/CIDF locations
 - b. Size and routing of backbone cable from each IDF to the MDF.
 - c. Station locations and their exact labeling ID(s) which shall match the physical label at the device.
 - d. New pathways, conduit, ground boxes, junction boxes, raceway, power poles and floor monuments.
 - e. Any other new conditions.
 - 6. Contractor shall provide 3 sets of as-built drawings, one of which shall be reproducible.
 - 7. In addition to the hard copy requirements, the as-builts, one of which shall be generated on Visio, and supplied to District. Media shall be recordable CD.
 - 8. The Contractor shall submit as-built drawings and media no later than 30 days after the installation date.
 - 9. Price list and contact information for emergency service work.
- B. Fiber backbone test results

1. In sequential order by IDF number
- C. Data station cable test results
 1. In sequential order by IDF and then drop number.
- D. Voice feeder test results.
 1. In sequential order by IDF number.
 2. Station/Feeder connectivity spread sheet (8-1/2" x 11" hard copy and electronic file, Microsoft Excel format).
- E. Voice station cable test results.
 1. In sequential order by IDF number.
 2. Station/Feeder connectivity spread sheet (8-1/2" x 11"hard copy and electronic file, Microsoft Excel format).
- F. Warranty certificates and documentation.

3.9 WARRANTY AND SUPPORT SERVICE

- A. The warranty shall commence from the date of final written acceptance by the Owner.
- B. All conditions for obtaining the manufacturer's Performance Warranty shall be the sole responsibility of the contractor.
- C. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.
- D. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.
- E. Extended Product Warranty and Application Assurance:
 1. The 25 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for fiber links/channels, for a twenty (20) year period. The warranty shall apply to all passive SCS components. The 20 Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20) year period.
 2. The 25 Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, up to 1000 Mbps parallel transmission schemes, by recognized standards or user forums that use the TIA/EIA-568A or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty (20) year period.
 3. Upon successful completion of the installation and subsequent inspection, the Owner's Project Manager shall be provided with a numbered certificate, from the manufacturing

company, registering the installation.

- F. One-Year Maintenance Service shall be provided as follows:
 - 1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
 - 2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
 - 3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
 - a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
 - b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
 - c. Defects significantly impairing any single attendant console.
 - d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any departments or groups fiber-based systems and/or stations.
 - e. Any pre-defined failure as submitted by Owner and agreed to by Contractor.
- G. Contractor shall provide extra service upon request on a 24 hour-a-day, 365 day-a-Year basis. Pricing for such service shall be described in the "Cable Book" Documentation.

3.10 FINAL ACCEPTANCE

- A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
- B. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. The review will take place within one week after the contractor notifies the owner.
- C. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the Owner's review.
- D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.
- E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.
- F. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.

END OF SECTION

SECTION 27 51 00
ASSISTED LISTENING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Related Sections
- B. Scope of Work
- C. Applicable Publications
- D. Design Criteria
- E. Materials
- F. Installation and Execution
- G. Testing
- H. Training
- I. Guarantees and Warranties

1.2 RELATED SECTIONS

- A. Specific Division 27 Sections relating to work identified in the Technology Sections including:
 - 1. Section 27 01 00 – General Technology Requirements

1.3 SCOPE OF WORK

- A. Scope of Work
 - 1. The following specification has been developed to address the installation of a stand-alone portable sound system. These systems will be for use in school cafeterias, cafeteriums, small auditoriums and outside learning environments. This document is not a stand-alone specification. The installing Contractor shall provide all equipment, labor, materials, and services required to install the complete, operating system. The installation is to be accomplished in accordance with these specifications and accompanying plans. Include with systems all necessary microphones, stands, and cables.

1.4 APPLICABLE PUBLICATIONS

- A. As defined in Section 27 01 00 – General Technology Requirements
- B. ANSI/ CEC 2016: 2019 California Electrical Code (CEC) Article 820

- C. Federal Communications Commission (FCC) Part 15 and Part 76

1.5 DESIGN CRITERIA

- A. Specifications of component equipment as set forth in these specifications are MINIMUM requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity or performance characteristics of items furnished in the system. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed specifications for that item of equipment.
- B. All equipment to be supplied under this specification shall be new and the current model of a standard product of a manufacturer of record. A manufacturer of record shall be defined as a company whose main occupation is the manufacture for sale items of equipment.
- C. The Contractor shall adhere to the following general design criteria:
 - 1. Any components and/or wiring and cabling that is determined to be operating below manufacturers specifications shall be removed and replaced at no additional cost.
 - 2. Equipment installations shall conform with the architectural design. The Contractor shall be responsible to notify the Owner, or the Owner's appointed representative of any potential conflict prior to bid.
 - 3. The Contractor shall review requirements stated and provide a formal design that will cost- effectively provide maximum coverage for the facility.

PART 2 - PRODUCTS

2.1 SOUND SYSTEM CABINET

- A. The site shall be equipped with a portable 36" high (46" total including casters), 19" wide cabinet with lockable casters used for housing the sound system equipment.
- B. The cabinet shall be constructed of the following materials:
 - 1. Top & bottom shall be 16 gauge steel.
 - 2. Sides shall be 16 gauge steel.
 - 3. Rack rail shall be 11 gauge steel, with tapped 10-32 holes in universal E.I.A. spacing.
 - 4. Rear door shall be of 18 gauge steel.
 - 5. Front door shall be of 16 gauge steel.
 - 6. Shall be of welded construction.

7. Shall be phosphate pre-treated and finished in a durable textured black powder coat.

C. OPTIONS

1. Rear rack rail - 10-32 threaded 11 gauge, in universal E.I.A. spacing. Part # PTRK-RR21
2. 19" rack mount drawer - Drawer base shall be 20- gauge steel, top and sides shall be 16-gauge steel. Drawer shall use full extension, ball bearing slides. Part # D4

- D. The portable cabinet shall be Middle Atlantic Products, part # PTRK-21 or approved equal.

1.2 AUDIO MIXER/PREAMPLIFIER

A. Mixer shall have the following features:

1. The mixer/power amplifier shall have eight mixer input ports and shall be capable of operation from a 110/120 V, 50/60 Hz line.
2. Each input port shall be usable with microphone, phono pickup or high-level devices.
3. Power output shall be +20dBm at less than 0.5% THD from 30 to 20,000Hz and +18dBm at less than 0.3% THD from 25 to 20,000Hz.
4. Frequency response shall be ± 1 dB from 20 to 20,000Hz.
5. Source impedance shall be 200/50k ohms with a microphone preamplifier, 50k ohms with a mag. phono preamplifier, 220k ohms with an auxiliary preamplifier, 10k ohms with a bridging transformer, 600 ohms with a line matching transformer and 600 ohms with a paging input.
6. Load impedance shall be 150 or 600 ohms (transformer-isolated output).
7. Equivalent input noise shall be -126dBm with a Lo-Z microphone preamplifier.
8. Output noise shall be 90dB below rated output when all gain controls are off.
9. TOA plug-in accessory modules designed for use with the M-900MK2 mixer preamplifier shall utilize the latest in surface mount component technology and include microphone, line, and special function models.
10. The mixer / preamplifier shall be rack mounted using the TOA MB-25B rack mounting bracket.
11. The mixer preamplifier shall be TOA model M-900MK2 with required modules or approved equal.

1.3 POWER AMPLIFIER

- A. The power amplifier shall be a solid-state two-channel model.
- B. The amplifier shall provide extensive protection and diagnostic capabilities, including output current limiting, DC protection, circuit breaker, and special thermal protection for the unit's transformers.
- C. The front-panel controls shall be two black detented level controls (one for each channel), a power switch, and a circuit breaker for overload protection.
- D. Front-mounted indicators shall be:
 - 1. Clip: one red LED per channel which illuminates when the channel's output signal is being overdriven
 - 2. Power: one green LED which indicates that the amplifier has been turned on and AC power is available
 - 3. Fault: one yellow LED which illuminates when amplifier is in protect mode and briefly during normal power-up when amplifier is first switched on.
- E. The recommended load impedance shall be 2 to 8 ohms per channel in Stereo, and 8 ohms in Bridge Mono. The amplifier shall be safe when driving any kind of load, including highly reactive ones.
- F. The rear-mounted output connectors shall be two four-pole Speakon® connectors and a pair of 5-way binding posts per channel. Rear-mounted input connectors shall be 3-pin balanced XLR connectors.
- G. The power amplifier shall meet or exceed the following performance criteria:
 - 1. Input sensitivity for rated output at 4 ohms: 0.725 V.
 - 2. Rated output with both channels driven with 0.5% THD (at 1 kHz) in Dual mode: 250 watts per channel into 2 ohms, 200 watts per channel into 4 ohms, and 145 watts per channel into 8 ohms.
 - 3. Rated output with 0.5% THD (at 1 kHz) in Bridge-Mono mode: 400 watts into 8 ohms and 500 watts into 4 ohms.
 - 4. Frequency Response at 1 watt, 20 Hz to 20 kHz: ± 0.75 dB.
 - 5. Phase Response at 1 watt: -10 degrees at 10 Hz, $+19$ degrees at 20 kHz.
 - 6. Signal to Noise Ratio below rated power (20 Hz to 20 kHz): greater than 100 dB A-weighted.
 - 7. Total Harmonic Distortion at full rated power, 1 kHz: less than 0.15%.
 - 8. Intermodulation Distortion (60 Hz and 7 kHz at 4:1, from full rated output to -40 dB: less than 0.3%.

- 9. Damping Factor (8 ohms): greater than 200 from 10 to 400 Hz.
- H. AC Line Voltages and Frequencies Available ($\pm 10\%$): 120 VAC/60Hz and 230 VAC/50 Hz.
- I. The amplifier chassis shall be constructed of steel with a durable black finish and shall be designed for flow-through ventilation from the front panel to the back panel. Internal heat sinks with forced-air cooling shall provide rapid, uniform heat dissipation.
- J. The dimensions of the amplifier shall allow for 19 inch (48.3 cm) EIA standard (RS-310-B) rack mounting.
- K. Power Amplifier (190 watts minimum) shall be Crown XLS 202 or approved equal.

1.4 AUDIO INPUT DEVICES

A. Audio Cassette player - Shall be STANDARD

- 1. Shall mount in any standard 19" rack and shall require no more than 4 rack units of vertical space.
- 2. Shall include dual audio record/play
- 3. Cassette player shall play all standard cassettes with exceptional fidelity (50Hz to 15KHz), with less than 0.15% WRMS WOW shall reverse automatically when it reaches its end.
- 4. Fast forward, fast rewind and eject buttons shall be provided.
- 5. There shall be separate visual indicators for cassette operation and stereo reception.

B. Audio CD player - Shall be STANDARD

- 1. Shall mount in any standard 19" rack and shall require no more than 4 rack units of vertical space.
- 2. 8-times over sampling minimum.
- 3. Next track, previous track, Fast forward, fast rewind and eject buttons shall be provided.
- 4. Program play with remote control.

1.5 FM WIRELESS MICROPHONE SYSTEM

- A. The wireless microphone system shall be of professional quality with an operating frequency range of 692 to 722 mhz with 64 selectable channels and simultaneous operation of up to sixteen systems. The system shall include the following:

B. Wireless Receiver

1. The wireless receiver shall have 64 selectable channels and a built-in scanner function to scan the RF environment and indicate available channels.
2. The receiving method shall be double super-heterodyne using antenna switching diversity.
3. shall include a S/N ratio of greater than 110 dB (A-weighted), harmonic distortion of less than 1% and frequency response of 100 Hz - 12 kHz, ± 3 dB.
4. The receiving sensitivity shall be greater than 80 dB with 20 dB μ V input and 40 kHz deviation. Squelch types shall be carrier, noise and tone key with a variable squelch sensitivity of 18 - 40 dB μ V and a 32.768 kHz tone key frequency.
5. The receiver shall have two antenna inputs, each with BNC-type connectors, 75 ohm impedance and 9 VDC, 30 mA, available for remote antennas.
6. The unit shall also have two antenna outputs, with BNC-type connectors, 75 ohm impedance, and 0 dB gain, to provide antenna distribution to a maximum of two additional receivers. The audio outputs shall be balanced type with XLR-M jack, and unbalanced type with 1/4" phone jack, both with an output impedance of 600 ohms and switchable sensitivity between MIC (-60 dBV / 1 mV and LINE (-20 dBV / 100 mV).
7. A Mix Input, unbalanced type with 1/4" phone jack with an input impedance of 10 kohms and sensitivity of -20 dBV / 100 mV shall allow the connection of the output of a second receiver or other audio source to be mixed with the main receiver output signal.
8. The front panel shall include an LCD for RF and AF metering as well as frequency setting and scanner functions.
9. Front panel LED's shall include ANT A/B and an AF PEAK that lights at 3 dB below clipping.
10. Front panel controls shall include Menu/Enter, Power, RF/AF/Next and Volume.
11. The wireless receiver shall be powered from the AC mains using a supplied AC-DC adapter with a power consumption of 250 mA (12 VDC). The unit shall operate within a temperature range of +14° F to +122° F (-10° C to +50° C).

12. Unit construction shall be black resin with dimensions of 8.27" W x 1.76" H x 7.09" D (210 mm x 44.6 mm x 180 mm) and weight of 5.2 lbs.(2.35 kg).Included accessories shall be two whip antennas and an external AC-DC adapter (120 VAC, 60 Hz).Up to two units shall be rack-mountable in one standard 19" rack height with an optional rack-mount kit.
13. The diversity wireless receiver shall be the TOA model WT-4800.
14. The wireless diversity receiver rack-mount kit shall be the TOA model MB-WT1/MB-WT2.

C. Wireless Microphone Transmitters

1. The handheld wireless microphone transmitter shall be dynamic type with a cardioid pattern and capable of a maximum input level of 145 dB SPL.
2. The lapel microphone with bodypack shall be electret condenser type with a cardioid pattern and be capable of a maximum input level of 120 dB SPL.
3. The transmission method shall be frequency modulation (F3E) with a PLL-based modulation system operating in the frequency range of 692 - 722 MHz with 64 selectable channels. The RF carrier power shall be no greater than 50 mW with maximum deviation of ± 40 kHz and a tone key frequency of 32.768 kHz.
4. The units shall operate for a minimum of 10 hours using a 9 V (6LR61), alkaline type battery.
5. A power LED shall glow continuously to indicate normal operation and flash to indicate low battery level (< 6 VDC).The transmitter shall utilize a 1/4 wave helical antenna.
6. Transmitter controls shall include Power On/Off, Frequency Bank/Channel Select and Input Sensitivity Adjust.
7. The bodypack shall include a TB-4M type input connector compatible with TA-4F type and a rotatable attachment clip.
8. The transmitters shall operate within a temperature range of $+14^{\circ}$ F to $+122^{\circ}$ F (-10° C to $+50^{\circ}$ C).The transmitters shall be constructed of black resin with an additional rubber coating on the handheld transmitter.
9. Dimensions shall be 2.06" dia.x 11" L (52.2 mm x 279.4 mm) for the handheld transmitter and 2.44" W x 5.59" H x 1.26" D (62 mm x 142 mm x 32 mm) for the lapel bodypack transmitter. The lapel microphone cable length shall be 4.76 ft.(1.45 m).
10. The weight (with battery) shall be 0.60 lbs.(270 g) (handheld) and 0.33 lbs.(150 g) for the lapel/bodypack.
11. Included accessories shall be a frequency adjust screw driver and storage case, stand adapter (handheld) and rotatable lapel clip (lapel/bodypack).

12. The wireless handheld microphone shall be the TOA model WM-4200.
13. The wireless lapel microphone with bodypack shall be the TOA model WM-4300.

1.6 ASSISTIVE LISTENING SYSTEM

A. Stationary FM Transmitter

1. The stationary FM transmitter shall be capable of broadcasting on 57 channels. The output power shall be adjustable to quarter, half or full.
2. Channel tuning shall be capable of being locked.
3. The device shall broadcast on both wide and narrow band channels.
4. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz, or of 30Hz to 10kHz, +/- 3dB at 216MHz.
5. It shall have two mixing audio inputs. The device shall have the following audio controls: input level, process control and an adjustable low pass shelving filter.
6. The Transmitter shall be Listen LT-800.

B. Rack Mounting Kit:

1. The mounting kit shall be capable of single and dual racking mounting of a Listen stationary transmitter or stationary receiver.
2. The kit shall include a Plexiglas cover that will prevent end users from making adjustments to the mounted equipment.
3. The kit shall be 19.0 in (48.3 cm) wide, 1.75 in (4.44 cm) high, and 8.0 in (20.3 cm) deep.
4. The Rack Mounting Kit shall be Listen LA-326.

C. FM Receiver (Deluxe)

1. The FM receiver shall be capable of receiving on 57 wide and narrow band channels.
2. The receiver shall be capable of seeking channels.
3. The device shall have an adjustable squelch.
4. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz, or of 30Hz to 10kHz, +/- 3dB at 216MHz.
5. The device will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to the audio normally.

6. The device shall incorporate an LCD display that indicates channel, battery level, low battery, battery charging, RF signal strength.
7. The Receiver shall be Listen LR-400.

D. FM Receiver (Basic)

1. The FM receiver shall be capable of at least receiving on 17 wide band channels.
2. The receiver shall be capable of seeking channels.
3. The device shall have a squelch.
4. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz.
5. The device shall incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to audio normally.
6. The receiver shall be Listen LR-300.

E. Ear Speaker

1. The ear speaker shall be a single ear clip that is easily cleaned (solid plastic speaker).
2. Shall be capable for use with any of the specified receivers and have a strong volume out-put
3. The receiver's antenna shall be built in to the headphone cord
4. The ear speaker shall have a cable Length of 36 in and weight 4 oz.
5. Max Input: 130mW maximum
6. Connector: 3.5mm mono
7. The ear speaker shall be Listen LA-164

1.7 LOUDSPEAKERS

- A. Assemblies shall consist of 2-way, woofer and tweeter, within environment-resistant housings. Enclosure shall be constructed of paintable UV-resistant, talc impregnated, polypropylene injection molded plastic finished in black.
- B. Each unit shall include a stamped, powder coated, aluminum grille and removable C-shaped mounting bracket.

- C. All hardware inserts shall be brass and threaded 1/4"-20. The 150 Watt RMS system shall have a 8" (133mm) HYCONE™ treated woofer, and a 1" exit compression driver frequency device. The dividing network crossover frequency shall be 2.5 kHz. The dividing network shall include protection circuits for the high-frequency component.
- D. The loudspeaker system shall meet the following performance criteria:
- E. Power handling, 150 Watts RMS ; Frequency response, ±3dB from 65 Hz to 20 kHz;. Pressure sensitivity, 92dB SPL at one watt, 100 Hz to 10 kHz measured at a distance of one meter on axis. Impedance shall be 8 ohms nominal.
- F. Input connectors shall include (1) sealed 1/4" phone jack and (1) 5-way touch-proof binding post. A tongue-in-groove cover with rubber wire exit grommet shall be provided to protect the input connectors.
- G. The loudspeaker system shall exhibit no performance or cosmetic degradation after a 100 hour salt spray test per ASTM B117.
- H. The unit shall be 16 1/2"high x 9 1/16"wide x 8 7/16"deep.
- I. The indoor/outdoor mini-loudspeaker system shall be Atlas Sound Model SM82-B.

1.8 ADJUSTABLE LOUDSPEAKER EQUIPMENT STAND

- A. Shall be designed for easy transportability, set-up and tear-down.
- B. Constructed of heavy-duty aluminum and shall be capable of supporting up to 150 lbs.
- C. Height adjusts from 48" to 85"
- D. Stand shall be equipped with a positive clamping system complete with an airdamped safety release to assure slip-free support of elevated equipment.
- E. Vertical tube assembly contains 11.2" and 13.8" tubing.
- F. Clutch mechanism includes a protective insert for scratch-free height adjustment.
- G. Equipment stand shall be finished in non-reflective ebony.
- H. SSA-7. Universal platform adapter for stand Model SS33E features two 3/8" x 2" equipment mounting holes to meet a variety of support applications. Material is molded plastic and the finish is ebony.
- I. Adjustable Equipment Stand shall be Atlas Sound #SS33E or approved equal.

1.9 CABLES, CONNECTORS AND MISCELLANEOUS HARDWARE

- A. Cable gauge sizes are nominal. Cable loss should be calculated and appropriate gauge wire be used for the required load.

B. Microphone Cables

1. Shall be twisted-pair construction to reduce audio bandwidth distortions for better clarity.
2. 87% coverage copper-braided shield rejects RFI and EMI for a lower noise floor and increased resolution.
3. Extra-flexible Duraflex® outer jacket for superior reliability and cut resistance.
4. Heavy-duty black Neutrik® XLR connectors provide increased durability.
5. Available in multiple sizes and pre-terminated.
6. Microphone cables shall be Monster Cable - Standard 100 Microphone cable or approved equal.

C. Loudspeaker Cables

1. Shall be Magnetic Flux Tube® construction and special cable windings for natural music reproduction.
2. Durable jacket for indoor and outdoor use.
3. 24k gold-tipped 1/4" connectors or gold Monster Tips (bananas) for durability and improved signal transfer.
4. Available in multiple sizes and pre-terminated or in spools. Minimum cable length shall be 30' per speaker.
5. Loudspeaker cables shall be Monster Cable - Standard 100 speaker cable or approved equal.

D. Input sources shall be comprised of one twisted pair of #18 gage stranded tinned copper conductors, polyethylene shielded with an aluminum foil-mylar shield; a #22 gage stranded tinned copper drain wire and polyvinyl jacket.

E. Three-conductor jumper wire shall consist of solid copper conductors, insulated with polyvinyl chloride and color coded, #22 gage. Colors shall be blue/red and white.

F. Cable Markers:

1. High-grade PVC clip-on or permanent-type cable markers with permanent markings or printed vinyl tape protected by clear shrink tubing.
2. Acceptable: Electrovert Type C or Z or Brady B-702 with Alpha FIT-221 series clear tubing or approved equal.

1.10 PROVIDE ALL NECESSARY POWER SUPPLIES, RELAYS, NETWORKS, AND OTHER REQUIRED COMPONENTS TO MAKE THE SYSTEM FULLY OPERATIONAL.

- A. Wiring enclosures, terminal cabinets, outlets, frames of cabinet racks and other enclosures shall be grounded and such grounding shall be done in compliance with requirements of local Electrical Code and as specified herein.

1.11 LOADS ON EQUIPMENT AND COMPONENTS

- A. All equipment and component parts shall carry continuously, without undue heating or change in rated value, loads connected thereto and rated output loads where such are specified. All equipment shall be properly fused. All components and parts shall be designed for continuous operation.
- B. Operating voltage on capacitors shall not exceed 60% of their rated working voltage.
- C. Operating wattage to be dissipated by resistors shall not exceed 25% of their ratings.

PART 3 - EXECUTION

1.1 GENERAL

- A. As it is not practical to enumerate in these specifications all details of fittings and accessory equipment required for proper operation of the system herein described, it is understood that they will be supplied by the Contractor in accordance with manufacturers' installation standards without extra compensation.
- B. The Contractor shall provide hardware and cable dressing to be consistent with layout and appearance to acceptable communications industry standards for a "neat" installation.
- C. Contractor shall coordinate locations of all components prior to installation to avoid conflicts.
- D. The Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, and support hardware, etc., necessary to facilitate the installation of the system.
- E. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the system. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment, jack stands for cable reels, or cable wenchers.
- F. The Contractor shall be responsible for printed labels for all cables and cords in distribution cabinets. Handwritten labels are not acceptable.

1.2 CABINET RACK EQUIPMENT INSTALLATION

- A. Amplifiers, power supplies and other heavy devices shall be mounted utilizing manufacturer recommended brackets or on steel shelves made by manufacturer of console and cabinet racks.
- B. Wiring within console and cabinets shall be installed to conform to standard engineering practice, and shall be terminated on terminal strips having a terminal for each required external connection.
- C. Wiring shall be cabled, laced and securely fastened in place so that no weight is imposed on any equipment, control switches, or terminals. Wires carrying audio power shall be shielded.
- D. Input and output circuits and terminal strips shall be installed to provide separation necessary for proper operation.
- E. Wires shall be identified by number and chart.
- F. Conductor shields for each system shall be grounded at one location only. Grounding shall be done within console and cabinet racks.
- G. There shall be no metallic connection between systems.
- H. Conduits for system and 120 volt AC system shall be bonded together at console and all cabinet racks.
- I. 120 volt AC supply conductors shall be terminated directly on disconnect switches specified.

1.3 PERMITS, LICENSES, ORDINANCES AND REGULATIONS

- A. Any and all fees that pertain to the Sound System and the work of the Contractor required by state, county or city laws will be paid by the Contractor. All other applicable permits or fees required by law, ordinances, tariffs and regulations shall also be paid by the Contractor. The Contractor must give all notices necessary in connection therewith.
- B. The Contractor shall comply with all applicable federal and state laws, regulations, ordinances and codes, including all applicable OSHA and Uniform Commercial Code regulations and requirements and requirements which are in effect at the date of execution of the contract and which place obligations on the Contractor with respect to its performance under the contract. In the event that sections of the contract explicitly address warranties and remedies in a manner which is not consistent with applicable provisions of the UCC, it is agreed that the provisions set forth in the contract shall apply. The Contractor shall submit, prior to their start of tasks that involve work on the Tenant's premises, details of their safety program.
- C. The Contractor shall be licensed to operate in the City.

1.4 FINAL TESTS AND ADJUSTMENTS

- A. Preliminary Testing: The contractor shall be responsible for the successful testing of ALL Sound Systems and components per systems performance specifications. Any discrepancies are to be resolved to ensure performance prior to acceptance of the distribution system.
- B. The installing contractor shall provide termination-to-termination testing and utilize appropriate signal level test equipment.

1.5 TRAINING

- A. The Contractor shall properly instruct the Owner or person designated by the Owner as to the correct operational procedures of the system.
- B. Provide not less than four hours (two- 2 hour sessions) for instruction of personnel in the operation and maintenance of the systems. This instruction time shall be scheduled as directed by the Owner.

1.6 GUARANTEES AND WARRANTIES

- A. Contractor is to guarantee the complete Autonomous Public Address/ sound systems, in writing, against defects in workmanship and material for a minimum of one year after final acceptance. During this time, the entire system must be kept in proper operating condition at no additional labor or material cost to the Owner. The Contractor will delineate the conditions of this warranty for this period.
- B. Warranty service must be rendered within 8 hours and all problems resolved within 48 hours of notification by the Technology Consultant.
- C. The manufacturer of the major components will maintain a replacement parts department and provide test equipment when needed.
 - 1. A complete parts department will be located in a geographical proximity consistent with rendering service within the stated twenty-four hour period.
 - 2. An ample stock of individual components and equivalent unit replacements will be carried for as long a period as demand warrants. This period will extend beyond the normal life expectancy of the equipment, with ten years being minimum period.
 - 3. Shipping costs associated with providing required equipment not available in local stock shall be the responsibility of the Contractor.
- D. Actions which may void warranty shall be identified and submitted for the Owners approval prior to award of contract.

- E. The contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment and shall maintain a spare set of all major parts for the system at all times. All circuit packs and boards, instruments and control sub-systems shall be 100 percent backed up with stock at contractor's facility.

END OF SECTION

SECTION 27 96 00 INTRUSION ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Integrated Digital Alarm Communicator and Access Control System (DACS), including but not limited to the following:
 - 1. Control panel.
 - 2. Enclosures.
 - 3. Lock and key.
 - 4. Power Supplies.
 - 5. Accessories required to provide a complete DACS.
 - 6. System O and I manual.
 - 7. System programming.
 - 8. Batteries.
 - 9. Wiring.
 - 10. Conduits.
- B. The Contractor shall be responsible for identifying requirements for permits from the local police department for the installation of the alarm system specified herein and shall assist the Owner in obtaining the relevant alarm permits.

1.2 RELATED SECTIONS

- A. Section 26 05 00 - Basic Electrical Methods and Materials: Intrusion detection systems Infrastructure.

1.3 SYSTEM DESCRIPTION

- A. A functionally complete, integrated Digital Alarm Communicator System (DACS) per manufacturer's guidelines, codes and specification requirements.
 - 1. The DACS shall include a Control Panel with built-in, supervised telephone line interface.
 - 2. The DACS shall include recording and retention of event information in a dedicated event log.
 - 3. The DACS shall incorporate an integral real-time clock, calendar, and a test timer.
 - 4. The DACS shall incorporate battery charging capabilities with supervision of battery voltage and battery leads.

5. The DACS shall accommodate a time / event-based scheduling system.
6. The DACS shall be capable of supervision of peripheral devices and communications interfaces.
7. The DACS shall support the connection and reporting of intrusion, fire detection and access control devices to a remote Digital Alarm Communicator Receiver (DACR).
8. The DACS shall accommodate configuration and operation of separate, independent areas.
9. The DACS shall accommodate hard-wired or wireless point expansion via expansion point interface modules and RF receivers.
10. The DACS shall have electrically supervised detection loops and power supplies with battery(s) maintenance. This supervision shall be programmable for the purposes of reporting this information to the DACR.
11. The DACS shall be capable of monitoring and switching to active telephone lines when trying to establish communications with the DACR and transmitting a report.
12. The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.
13. The DACS shall be able to accommodate test, diagnostics, and configuration programming functions locally or remotely via a portable programmer or a computer running the Remote Programming Software (RPS).
14. The DACS shall annunciate alarm, trouble, service reminders, and other relevant system status messages in custom English text at the ACC.

1.4 REFERENCES

- A. National Electric Code, Article 760.
- B. National Fire Alarm Code (NFPA 72).
- C. Administrative Council for Terminal Attachments (ACTA):
 1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.
- D. American National Standards Institute (ANSI):
 1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- E. California State Fire Marshal (CSFM):
 1. Title 19, California Code of Regulations, Building Material Listing Program (BML).
- F. Federal Communications Commission (FCC):

1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.
 2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).
- G. The National Institute of Standards and Technology of the United States of America (NIST):
1. Federal Information Processing Standards Publications 197 (FIPS 197) – Advanced Encryption Standard (AES).
- H. International Organization For Standardization (ISO):
1. 9001 - Quality System.
- I. Underwriters Laboratories, Inc. (UL):
1. UL 50 - Enclosures for Electrical Equipment.
 2. UL 294 – Access Control System Units.
 3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.
 4. UL 609 - Local Burglar Alarm Units and Systems.
 5. UL 864 - Control Units System for Fire-Protective Signaling System.
 6. UL 985 - Household Fire Warning System Units.
 7. UL 1023 - Household Burglar Alarm System Units.
 8. UL 1076 – Proprietary Burglar Alarm Units and Systems
 9. UL 1610 - Central Station Burglar-Alarm Units.
 10. UL 60950-1 - Information Technology Equipment - Safety.
 11. UL 636 – Hold up alarms

1.5 SUBMITTALS

- A. Submit under provisions of section 01300.
- B. Product Data: Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and other equipment required for complete Digital Alarm Communicator and Access Control System (DACS), including:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings: Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.

1. Detailed wiring diagrams and system description.
 2. System device locations on architectural floor plans.
 3. Full Schematic of system, including wiring information for all devices.
- D. Documentation to be submitted by the Contractor upon completion of system installation:
1. "As-builts": Upon completion of installation, the Contractor shall prepare "as-built" drawings of the system. These "As-builts" shall be 30 inches by 42 inches (76 cm by 107 cm) format mylar reproducible drawings of each floor plan indicating exact device locations, panel terminations, cable routes and wire numbers as tagged and color-coded on the cable tag.
 - a. Additionally, final point-to-point wiring diagrams of each type of device (on 30 inches by 42 inches (76 cm by 107 cm) format) shall be included in the "as-builts."
 - b. "As-builts" shall be submitted to the Owner for approval prior to the system acceptance walk-through.
 2. Operation and maintenance manuals: Three sets of operating manuals shall be provided explaining the operation and maintenance of the system.
 3. Parts list.
 4. Maintenance required and maintenance schedule.
- E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualification:
1. The system shall be the standard product of one manufacturer, and the manufacturer shall have been in business manufacturing similar products for at least 5 years.
 2. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard.
- B. Installer Qualification:
1. Minimum of five years experience installing access control, surveillance and security systems and devices.
 2. After-sales support: The Contractor shall be a factory-authorized and trained dealer of the system and shall be factory-trained and certified to maintain/repair the system after system acceptance.

C. System Requirements:

1. All equipment, systems, and materials furnished and installed under this section shall be installed in accordance with the applicable standards of:
 - a. National Codes: NEC, NFPA, UBC, BOCA, SBCCI, IBC as applicable.
 - b. Approvals and listings: UL, FM, ANSI SIA CP-01, CSFM, NYC-CoA, as applicable.
 - c. Local Authorities Having Jurisdiction (AHJ).

D. Mock-Up: provide a mock-up for evaluation of installation techniques and application workmanship.

1. Finish system in areas designated by Architect.
2. Do not proceed with remaining work until workmanship and aesthetics are approved by Architect.
3. Remake mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Protect store materials from environmental and temperature conditions following manufacturer's instructions.
- D. Handle and operate products and systems according to manufacturer's instructions.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. All components, parts, and assemblies supplied by the manufacturers and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.
- B. Service/Maintenance:
 1. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
 2. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone

lines.

3. The installer shall correct any system defect within six hours of receipt of call from the Owner.
4. Extended service/maintenance agreements shall be offered by the Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: [request info \(presales.support@us.bosch.com\)](mailto:presales.support@us.bosch.com). Web: www.boschsecurity.us.
- B. Substitutions: ***.
- C. Requests for substitutions will be considered in accordance with provisions of section 01600.

2.2 GENERAL DESCRIPTION

- A. Control Panel and Features:
 1. The DACS control panel shall be Bosch Security Systems, Inc. model D9412GV4 comprising a fully integrated intrusion, fire, and access control system. The control panel shall support the following:
 - a. The DACS system is capable of being utilized as a combination Intrusion and Fire system per code. Fully integrated intrusion, access and fire functions allow users to interface with 1 system instead of 3
 - b. Integrated Telephone Line Interface with programmable options for signaling and supervision.
 - c. Conettix IP based communication option provides high-speed, secure alarm transport and control.
 - d. 32 programmable areas with perimeter and interior partitioning.
 - e. 8 on-board, class B hardwired points with expansion capability for a total of 246 wired or wireless points.
 - f. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers.
 - g. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
 - h. The system shall support the use of an Apple iOS device for control.

Functions to include arming, disarming, control of outputs, lock, unlock, cycle and secure access doors.

- i. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
- j. Provide 1.4 amps of power for standby operation and 2 amps of alarm power, both rated at 12 VDC.
- k. 2 wet-contact relay outputs and 1 Auxiliary wet-contact relay output with expansion capability for up to an additional 128 dry-contact relay outputs.
- l. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
- m. Supervision of peripheral devices and communications interface(s).

B. Point Functionality and Expansion:

- 1. Each point in the system shall be programmable to provide the following type of response in the system:
 - a. Always on (24 hour response).
 - b. On when the system is Master Armed.
 - c. Only on when the system is Perimeter Armed.
 - d. Displays / Does Not Display at the ACC when the point is activated.
 - e. Provides / Does Not Provide entry warning tone.
 - f. Sounds / Does Not Sound audible alarm indication.
 - g. The Point is bypassable / not bypassable.
 - h. Alarm Verification with programmable verification time.
 - i. Relay activation by Point.
 - j. Provides / Does Not Provide "watch point" capability.
 - k. Provides Swinger Bypass.
 - l. Defers Bypass Report.
 - m. Can return to the system after being force armed and then restoring.
 - n. Can return to the system after being bypassed and then restoring.
- 2. The DACS shall be capable of supporting "group zoning." Group zoning refers to the combining of points into a separately identifiable and separately annunciated (programmable text) areas.
- 3. The DACS shall be capable of allowing variable point response times via programming. Point response times shall be programmable over a range of 300

milliseconds to 4.5 seconds.

4. The DACS shall have the capability to expand up to 246 separately identifiable points, of which 8 are on-board and 238 are off-board wired or wireless addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.
 - a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
 - b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
5. The DACS shall have the capability to expand up to 75 separately identifiable points, of which 8 are on-board and 67 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.
 - a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
 - b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
6. Capability to expand up to 40 separately identifiable points, of which 8 are on-board and 32 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.
 - a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
 - b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
7. Capability to expand up to 40 separately-identifiable points of which 8 are on-board points and 32 are off-board addressable points connected to point expansion modules and/or wireless receivers.
8. Capability to expand up to 24 separately-identifiable points of which 8 are on-board points and 16 are off-board addressable points connected to point expansion modules and/or wireless receivers

C. Areas/Accounts:

1. The DACS shall support 32 independent areas. Each of the 32 areas shall have custom text associated with the armed state, disarmed state and point-off-normal state.
2. All of the areas must be capable of Master (All) and/or Perimeter (Part) arming (excluding predefined Interior protection).
3. The DACS shall be capable of logically grouping 1 or more points into an area, or conversely, dividing 2 or more points into two or more areas.
4. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.

5. Areas shall be independently controlled by their corresponding ACC.
 6. Area(s) shall accommodate assignment of independent account numbers to define annunciation, control, and reporting functions.
 7. The DACS shall be capable of linking multiple areas to a shared area which may be automatically controlled (hallway or lobby).
 8. The DACS shall accommodate conditional area arming dependant on the state of other areas (master or associate). Any area can be configured for perimeter and interior arming, not requiring a separate area for this function.
- D. Output Relay Expansion: The DACS shall provide the capability for output relay expansion using relay expansion modules. Independent control of relay functions by area shall be possible through programming assignments.
1. The DACS shall be capable of activating 128 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module
 2. The DACS shall be capable of activating 64 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module
 3. The DACS shall be capable of activating 24 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module
 4. The DACS shall be capable of activating 16 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). 8 relays (Form C) are to be provided per octo-relay module
 5. The DACS shall be capable of activating 8 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). 8 relays (Form C) are to be provided per octo-relay module
 6. The DACS shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based.
 7. Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.
 8. The DACS shall support 4 different types of alarm output selections: Steady, Pulsed, California Standard, and Temporal Code 3.
- E. Scheduling: The DACS shall support scheduling capabilities with the following characteristics:
1. Arm / Disarm specific area(s) based on open/close windows.

2. Bypass / Unbypass point(s).
3. Activate / Deactivate relay(s).
4. Send test reports.
5. Up to 4 programmable holiday schedules of 366 days each (includes leap year). Based on the holiday settings, different time windows for open/close and other system functions can be executed.
6. Automatic adjustment of system clock for daylight savings time.
7. Turn an Access Authority Level On / Off.
8. Hold a Door Open (unlocked and shunted).
9. Secure a Door Closed (locked, no valid cards will allow entry).
10. Return a Door to Normal Operation (locked, valid cards will allow entry).
11. Turn recording of Access Granted events On/ Off (and transmittal if routing is ON).
12. Turn recording of Access Denied events On/ Off (and transmittal if routing is ON).

F. Alarm Command Centers:

1. The DACS shall accommodate connection with up to 32 ACCs, each capable of displaying custom English text on touch screen liquid crystal or vacuum fluorescent (VF) displays.
2. The Alarm Command Centers shall accommodate viewing and configuration of system parameters including:
 - a. Network Parameters:
 - 1) DHCP Enable/Disable for the selected network module.
 - 2) UPnP Enable/Disable for the selected network module.
 - 3) IP Address for the selected network module
 - 4) Subnet Mask for the selected network module.
 - 5) Default Gateway for the selected network module.
 - 6) Port Number for the selected network module - The module's port number shall range from 0 to 65,535.
 - 7) DNS Server Address for the selected module's DNS server IP address
 - 8) DNS Host Name for the selected module. The DNS host name shall contain up to 63 characters.
 - 9) AES Encryption Key Size – Enable/Disable encryption by selecting the AES encryption key size for the selected network module.

10) AES Encryption Key String - The user shall be able to display, add and modify the AES encryption string based upon the key size previously configured for the selected network module.

b. Point Parameters:

- 1) Point Selection between one and the maximum number of points in the control panel.
- 2) Point Registration to allow system response from a specific physical point on any one of the expansion modules; On-board, Point expansion modules (wired or wireless), and Access.
- 3) Wireless points shall be able to be enrolled in the system via an auto learn feature.

c. Event Routing Parameters to allow programming of upto 4 report routing groups as well as configuration of primary and secondary paths.

3. The DACS shall accommodate connection with up to 8 ACCs, each capable of displaying custom English text on liquid crystal or vacuum fluorescent (VF) displays.
4. The ACC's shall be capable of displaying point status, arm/disarm status, and carry out user command functions.
5. The ACC can be programmed to respond to the entry of any of the specifically authorized user passcodes.
6. The ACCs shall be able to be configured to control a specific area, or group of areas, or all areas in the system.
7. The ACCs shall be able to be temporarily re-addressed to view the status of a remote area.
8. The ACC's shall be able to provide different audible tones for Intrusion, Fire alarms, and system troubles

G. User Passcodes and Authority: Passcodes shall be programmable with authority levels to allow users to operate any or all areas.

1. Up to 99 different passcodes shall be accommodated
2. Each passcode shall be 3 to 6 digits (variable) and be assigned a 16-character user name that shall be printed on the local printer and DACR with associated opening and closing reports from the user.
3. User access to System features and functions shall be configurable based on 14 individually programmable levels of authority assigned to the user passcode. Additionally, the system shall have the capability to assign to the user passcode, a different authority level in each of the areas. A service passcode can be assigned to the servicing agent allowing the agent limited access to system functions. User-programmable / activated functions include:

a. Arming the system: All areas, specific area(s) only, perimeter instant,

- perimeter delayed, perimeter partial, watch mode, and arming the system with a duress passcode.
 - b. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.
 - c. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.
 - d. Implementation functions: Bypass a point, unbypass a point, reset sensors, silence bell, activating relays, initiating the remote programming function locally to allow programming the system from a remote location.
 - e. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote DACR to check the telephone link, and programming the time and date for the next test report transmission.
 - f. Change system parameters: ACC display brightness, system time and date, and add/delete/change passcodes.
 - g. Extend the closing time of the system.
 - h. Transmitting special alerts and activating audible and visible signals.
 - i. Executing multiple commands / ACC keystrokes from a single Menu / Command List item. This function shall be able to have a 16 character (alphanumeric) title to identify it on the ACC display.
 - j. Editing of time / event based scheduling program from the ACC.
 - k. The DACS shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number, and defaulting (toggling) text displays between custom and default text displays for troubleshooting.
4. The DACS shall allow users to change their own user passcode from the Alarm Command Center (ACC). Managers shall be capable of changing the user passcodes and authority assignments by area of other users from the ACC.
 5. The DACS shall incorporate a programmable "Passcode Follows Scope" feature to allow users to arm or disarm only the area they are entering with one simple command or control all areas from one ACC.
- H. Communication: The DACS shall be capable of reporting system events and supervisory reports including alarm, trouble, missing modules, restorals, system status, AC failure, battery status to primary and secondary off-site DACR's. The following features shall be supported.
1. The DACS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired network interface module, or over a cellular network using a GSM/GPRS interface module.
 2. The DACS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired dialer capture network interface module.

3. The Bosch ModemIIIa² communications format shall be utilized for optimum system performance. The ModemIIIa² format provides the maximum data information to the receiver for alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. The detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information. As an alternative format, Contact ID may be used when a non-Bosch receiver is used although it will include less detailed information like point or user text.
4. The DACS shall have the capability of communicating with up to 8 different DACRs using up to 4 different phone numbers, up to 24-digits in length and/or 4 URL/IP addresses over a network.
5. The DACS shall have the capability of communicating with up to 5 different DACRs using up to 4 different phone numbers, up to 32-digits in length or 1 IP address using a dialer capture network interface module.
6. The DACS shall support 2 telephone lines using a dual phone line module. The lines shall be capable of being alternated for the transmission of consecutive events.
7. The DACS shall report to a Commercial Central Station that is using a Bosch D6600 Receiver/Gateway or a Bosch D6100i Receiver using ModemIIIa² as a preferred format or Contact ID as an alternate format.
8. The DACR shall provide the transmission information sent from the DACS that includes alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. When using the ModemIIIa² format the detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information.
9. The DACS reports shall be classified, by event, into eleven subcategories or "report groups." Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled for transmission. The eleven report groups shall be as follows:
 - a. Fire Reports.
 - b. Burglar Reports.
 - c. User Reports.
 - d. Test Reports.
 - e. Diagnostic Reports.
 - f. Relay Reports.
 - g. Auto Function Reports.
 - h. RPS Reports.
 - i. Point Reports.
 - j. User Change Reports.

k. Access Reports.

10. The DACS shall be capable of listening to the telephone line when calls are answered by other devices on the premises side of the phone line and determining if a special tone is being sent from RPS (Remote Programming Software) and intercepting the call for RPS Sessions.
11. The DACS shall be have the capability to verify the integrity of the remote communications path and switch to alternate paths when a communications failure occurs.
12. The DACS shall be capable of unattended mode of operation whereby programming and configuration updates are automatically transferred using the Remote Programming Software (RPS). These updates can initiate from either the control panel or the remote computer using RPS.

I. Network Communication: The DACS shall be capable of network communications over a LAN, WAN, Intranet, or the Internet. The system shall include supervision of the network communication utilizing configurable periodic heartbeats to the Digital Alarm Communications Receiver (DACR). The DACR shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication. The notification options shall be programmable and include local annunciation or indication to automation software.

1. The network interface module shall be capable of supporting Dynamic Host Communication Protocol (DHCP) to obtain an IP Address.
2. The system shall support a method of authentication between the control panel and the receiver to ensure that the control panel has not been compromised or replaced.
3. The network interface modules shall be capable of supporting encryption using a minimum of 128-bit AES Encryption (Rijndael) certified by NIST (National Institute of Standards and Technology).
4. The network interface modules shall support a 10/100BaseT connection to an Ethernet network.
5. The control panel shall be capable of network communication with a programmable poll time to send periodic heartbeats to the receiver, programmable ACK Wait time, and programmable retry time. In the situation where a communication path is unsuccessful, the control panel shall be capable of attempting backup communication through an available communication method to the same receiver or a backup receiver.
 - a. The control panel shall have the ability to automatically adjust the heartbeat rate of a backup path that is using GPRS to the heartbeat rate of the primary path in case of a primary path failure. Upon restoral of the primary path, the heartbeat rate of the backup path shall automatically restore to the original rate. This allows a system utilizing GPRS communications to keep the wireless charges low.
 - b. The network communication between the control panel and the receiver shall use ModemIIIa².

- c. The control panel shall be capable of two-way communication using a wired network interface module with a 10/100BaseT on a LAN/WAN/Internet configuration or with a wireless GPRS module on the Internet.
 - d. The control panel shall be capable of configuring the destination of the receiver using a URL or static IP Address.
 - e. The control panel shall be capable of using DNS to lookup the IP Address of the receiver when programmed with a URL.
 - f. The control panel shall support UPnP for automated Port Forward configuration in the router where the control panel is installed.
 - g. The control panel shall support AutoIP to enable the RPS software to connect to the control panel locally using an IP Direct connection.
 - h. The control panel shall support configuration of the IP parameters from the keypad eliminating the need for a PC to configure the IP device.
 - i. The control panel shall support network diagnostics from a keypad to allow local testing of network connectivity. The diagnostics should include, Ethernet cable connected, gateway configuration ok, DNS lookup operational, and external network connectivity (such as the Internet) operational.
 - j. The system shall be capable of meeting DCID 6/9 and UL 2050 standards.
6. The system shall use a Dialer Capture Network Module (C900V2) to convert standard PSTN communications to send the messages to the receiver using the IP network.
- a. The Dialer Capture Network Module enables IP communications from the PSTN based DACS to the receiver using an IP network.
 - b. The Dialer Capture Network Module shall include supervision of the network communication utilizing periodic heartbeats to the Digital Alarm Communications Receiver (DACR). The DACR shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication.
- J. Event Log: The DACS shall maintain a log of events indicating time, day, month, year type of event, account number, area number, user ID, point text, user text and primary/secondary event route. The system shall allow the following characteristics:
- 1. The DACS shall be capable of storing up to 254 events.
 - 2. The DACS shall support the printing of these events on a local printer.
 - 3. The DACS shall support viewing of logs locally at the ACC and remotely via an upload to a remote central station computer running the RPS software.
 - 4. The DACS shall provide notification via a report to the DACR when the event log reaches a programmable "percent full capacity". This allows retrieval of stored

events via RPS to prevent any loss of event history.

5. Group, signal type and area can route events to specific printers.
 6. Each DACR shall be designated as a primary, backup, or duplicate destination for each report group. Assigning an event to multiple routing groups provides for duplicate destinations for the event. The transmission of grouped events allows the reporting of different types of information to different remote DACRs.
- K. Testing, Diagnostic, and Programming Facilities: The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.
1. The DACS shall be capable of sending automatic tests daily, weekly or once every 28 days. Automatic test times shall be programmable to provide an offset of up to 24 hours from the current time.
 2. Automatic test reports shall be programmable to be deferred by one test interval if any other report is transmitted in the current interval.
 3. Automatic test reports and remote system access for diagnostics shall be supported via a remote central station computer with Remote Programming Software (RPS).
 4. The DACS shall be programmable locally or remotely. Programming shall be accomplished via a command center or a computer with a remote programmer and diagnostic software package (RPS).
 5. The DACS shall allow an on-site user to initiate remote programming while on-line with the servicing location. The remote programming device must provide a compare feature and allow for downloading either the stored program or the (un)modified program copied from the panel.
 6. The DACS shall allow the local programming option to be disabled and must provide a method to program a panel while no one is on premises, when the panel shares a line with an answering machine.
 7. The DACS shall accommodate IP Diagnostic to verify settings and operation of the network interface modules; Host name, MAC address, IPV4 address assignment. The IP Connection test shall include; Link test to verify physical cable integrity, Ping test to verify gateway response, ping test to verify address on the internet.
 8. Wireless point diagnostics shall include signal strength and device states of registered wireless points in the system.
 9. The number of system testing and programming sessions shall be restricted via the use of program locking features and passwords. Passcode protection in excess of sixteen million combinations is required.
 10. New modules support enhanced diagnostics through RPS
- L. Miscellaneous Features: Programmable alarm output timer, 31 programmable entry delay times, exit delay programmable by area, individually programmable point of protection text, point bypassing, key switch arming capability with LED outputs, and fire verification.

- M. False Alarm Reduction: The DACS shall comply with all ANSI SIA CP-01 requirements for false alarm reduction
- N. Ambush Detection: The DACS shall include an early ambush feature that requires that the user disarm, and then inspect the facility within a specified time period, before entering their passcode or a different authorized passcode again. If the user does not enter a passcode a second time, a duress event is generated. If the user does enter a passcode within the specified time period, the system disarms.
- O. Two man rule: The DACS shall include a programmable feature that requires 2 separate passcodes to be entered to disarm the system. After 1 passcode is entered, the system will prompt for a second passcode to be entered on the same ACC. Without the second passcode, the system shall not disarm.
- P. User-Programmable Features: The DACS shall provide a menu driven interface to provide a user-friendly command structure for programming / customizing the system to the operational criteria of the application. The DACS shall be capable of being operated via:
 - 1. The Command Structure.
 - 2. Menu / Command List.

2.3 SYSTEM INTERFACE REQUIREMENTS

- A. Grounding: The Contractor shall properly earth ground the DACS to prevent electrostatic charges and other transient electrical surges from damaging the DACS panel.
- B. Primary power: The Contractor shall provide a dedicated 120 VAC power circuit to the DACS system. This circuit shall be connected to the emergency power system. The 120 VAC is stepped down to power the DACS panel using a class two, plug-in transformer. This power circuit shall be properly rated to continuously power all points and functions indefinitely in full alarm condition.
- C. Primary power supervision: When the primary power source fails, the system can be configured to report an "AC Fail" message to a commercial central station.
 - 1. The message can also be programmed to "tag-along" with another message transmitted to the central station.
 - 2. The system will always display a loss of primary power on the ACC and may be configured to provide additional audible warning.
 - 3. The transmission delay of this message is programmable from 5 seconds to 86 minutes with an optional 6 to 12 hour transmission delay
- D. Secondary power (standby battery): The Contractor shall provide adequate battery power as defined by the relevant application criteria, (UL 864 and UL 985 for alarm installations or NFPA 72 chapters for fire applications). Appropriate battery chargers shall be provided consistent with the battery back-up capacity. The most current accepted version of NFPA 72 and any applicable local codes or AHJ requirements must be met accordingly.

- E. Secondary power supervision: When the secondary power source experiences a 85 percent depletion of its standby capacity, the system can be configured to report a "Low Battery" message to a commercial central station. The system will always display a low battery condition on the ACC and may be configured to provide additional audible warning.
- F. Telephone interface: The control panel in the DACS shall be equipped with a phone line monitor and shall interface with the phone lines via RJ-31X jacks for supervision of the telephone line connection.
 - 1. The telephone line interface shall conform with FCC rules (Title 47 C.F.R. part 68).
 - 2. When a telephone line is determined to be out of service by the DACS panel, the event will be annunciated locally on the ACC and transmitted to the central station over the alternate communications interface. The transmission delay of this message is programmable from ten to two-hundred forty seconds.
 - 3. When a telephone line is determined to be out of service by the DACS panel, the event will be annunciated locally based on programming options
 - 4. A telephone line switching module shall be used to interface to a second telephone line.
- G. Ethernet Interface: The DACS may use an Ethernet interface module as the primary, or back-up means of communicating to a DACR.
 - 1. Built-in IP-based alarm transport, programming, and control
 - 2. The module shall accommodate 128-bit AES encryption.
 - 3. 10BASE T or 100BASE T network connection
 - 4. Full-duplex and half-duplex support
- H. GSM/GPRS interface: The DACS may use an GSM/GPRS radio module as the primary, or backup, means of communicating to a DACR. Up to 4 IP Addresses shall be available for routing system events. The supervision time shall be programmable with a range of 5 to 65,535 seconds. This module shall accommodate 128-bit AES encryption.
- I. Auxiliary function control interfaces: The DACS shall accommodate auxiliary functions such as activating bells, strobes, or lights and shall be accomplished using the optional application specific relay modules. These auxiliary interfaces shall be electrically isolated to avoid inter-system interferences or damage to the system.
- J. Wiring: The contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:
 - 1. Wiring shall be appropriately color-coded with permanent wire markers. Copper conductors shall be used.
 - 2. All signal cables provided under this contract shall be Class II, plenum-rated cable where required. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.

3. Data wires shall not be enclosed in conduit or raceways containing AC power wires.
 4. Where EMI may interfere with the proper operation of the DACS circuits, twisted/shielded cable shall be used.
- K. Environmental Conditions: The DACS shall be designed to meet the following environmental conditions:
1. The system shall be designed for a storage temperature of -10° C to 70°C (14° F to 158°F).
 2. The system shall be designed for an operating temperature of 0° C to 50°C (32° F to 120°F).
 3. The system shall be designed for normal operation in an 85% relative humidity environment.
4. The system shall meet or exceed the requirements of FCC rules Title 47 C.F.R. Part 15, Class B devices, and Part 68, IEC EMC directive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.
- B. Do not begin installation until unacceptable conditions are corrected.
- C. If preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.
- D. Ensure selected location is secure and offers protection from accidental damage.
- E. Location shall provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.
- F. Ensure power source is protected against accidental shutoff.
- G. Install all equipment and materials in accordance with the "current" recommendations of the manufacturer. The work shall also be in accordance with:
 1. Installation criteria defined in these specifications and in the construction documents.
 2. Factory Representative can be the Bosch Security Systems Inc Security Dealer.
 3. Approved submittals.
 4. Applicable requirements of referenced standards.
- H. The contractor shall provide the following services as part of the contract:

1. Supervision of sub-contractors.
 2. Coordination of other contractors for system-related work (electrical contractor, finish hardware contractor, architect, and general contractor).
 3. Attending site construction/coordination meetings.
 4. Keeping updated construction drawings at the construction site.
 5. Meeting construction deadlines per the construction schedule.
- I. Programming of the system shall include the following tasks:
1. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).
 2. Programming operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.
 3. Programming passcodes according to the authorities and functions defined by the owner.
 4. Other system programming tasks required by the owner. These additional programming requirements shall be coordinated between the owner and the contractor.
 5. Operational Testing: The contractor shall perform thorough operational testing and verify that all system components are fully operational.
 6. Hard-copy System Printout: The contractor shall submit a hard-copy system printout of all components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.
 7. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk-through.
 8. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walk-through.
 9. Fire Alarm Systems shall comply with NFPA 72 Standards for inspection, testing, and maintenance.
- J. The contractor shall certify completion in writing and schedule the commissioning walk-through. The contractor shall provide all the tools and personnel needed to conduct an efficient commissioning process.

3.2 FIELD QUALITY CONTROL

- A. Installation contractor shall submit a written test report that the system has been 100 percent tested and approved. Final test shall be witnessed by the owner, engineer, electrical contractor, chief security officer, and performed by the installation contractor. Final test report shall be received and acknowledged by the owner prior

to request for final payment.

- B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.
- C. Determine and report all problems to the manufacturer's customer service department.

3.3 ADJUSTING

- A. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
- B. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.
- C. The installer shall correct any system defect within six hours of receipt of call from the Owner.

3.4 DEMONSTRATION

- A. Demonstrate at final inspection that surveillance system and devices functions properly.
 - 1. The Contractor upon completion of installation shall furnish training in the complete operation of the systems.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION

SECTION 28 31 00

NETWORKED FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 27 21 00 - Data Networking.

1.2 DESCRIPTION

- A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.
- C. The system shall be able to support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.
- D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.
- E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.
- F. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 SCOPE:

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.
- B. Provide 12 strand single mode fiber optic cable for Digital Audio per plans and manufacturers requirements.
- C. Basic Performance:
 - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class B Signaling Line Circuits (SLC).
 - 2. Device Circuits (IDC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
 - 3. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
 - 4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
 - 5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
 - 6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
 - 7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
 - 8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
 - 9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
 - 10. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
 - 11. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
 - 12. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
 - 13. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y) circuits.
 - 14. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
 - a. The digital amplifier shall automatically broadcast the stored audio message.
 - b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for

the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.

- c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
- d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
- e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
- f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

1.4 GUARANTEE:

- A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.5 POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- D. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

- E. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.
- F. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.
- G. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
- B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 72	National Fire Alarm Code

- C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances

No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

- D. Local and State Building Codes.
 - E. All requirements of the Authority Having Jurisdiction (AHJ).
- 1.7 APPROVALS:
- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - UL Underwriters Laboratories, Inc
 - FM Factory Mutual
 - CSFM California State Fire Marshal
 - B. The system shall be certified for seismic applications in accordance with the California Building Code (CBC). The basis for qualification of seismic approval shall be via shake table testing.

PART 2 - PRODUCTS

- 2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:
- A. Main FACP network node shall be a NOTIFIER Model NFS2-3030 and contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.
 - B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
 - 1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 - 2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
 - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
- 2.2 System Capacity and General Operation
- A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently

regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

- B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either company.
- C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.
- D. The FACP shall be able to provide the following software and hardware features:
 - 1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
 - 2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
 - 3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
 - 4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
 - 5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
 - 6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
 - 7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
 - 8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
 - 9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.

10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result of all cooperating detectors chamber readings.
22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators,

- (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well as display a FIRE CONTROL Type Code and other information specific to the device.
23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
 24. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
 25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
 26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
 27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
 28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
 29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
 30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
 31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
 32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit

activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.

33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.
35. Secure/Access Operation: The system shall have the capability of configuring input modules to monitor status of door contact or other security type sensors. These input modules shall be able to be commanded from the normally 'Secure' state to an 'Access' state. While in the secure state, the module will transmit alarm conditions to the controller, which shall be annunciated on the LCD and LED displays. The modules shall be placed into the Access state either through the LCD display or through predefined operator keys. While in the Access state, all alarms from the module will be shunted. Placing the module into the access state shall cause a discrete LED associated with input point to flash, but no other trouble or disable condition will be annunciated. Change from Secure to Access and reverse shall be transmitted to the central monitoring station on a per zone basis. Systems that cause or indicate a trouble or disable condition are unacceptable.

E. Network Communication

1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit. Fault isolation modules shall be installed between each addressable SLC device per the manufacturers installation instructions. Systems which cannot provide full loop loading in Style 7 configurations are not acceptable.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.

2. Function: The Voice Command Center equipment shall perform the following functions:
 - a. Operate as a supervised multi-channel emergency voice communication system.
 - b. Operate as a two-way emergency telephone system control center.
 - c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
 - d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
 - e. Provide all-call Emergency Paging activities through activation of a single control switch.
 - f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
 - g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
 - h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
 - i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
 - j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
 - k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply:

1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Main Power Supply shall be power-limited per UL864 requirements.
6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunciated and logged to the system alarm history log.

7. Addressable Charger Power SupplyThe auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power. . NOTIFIER model # ACPS-610
8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.
9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "B" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Temporal.
20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.

21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power () for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
 - a. Earth Fault on DAP A (Digital Audio Port A)
 - b. Earth Fault on DAP B (Digital Audio Port B)
 - c. Audio Amplifier Failure Detected Trouble
 - d. Active Alarm Bus input
 - e. Audio Detected on Aux Input A
 - f. Audio Detected on Aux Input B
 - g. Audio Detected on Firefighter's Telephone Riser
 - h. Receiving Audio from digital audio riser
 - i. Short circuit on speaker circuit 1
 - j. Short circuit on speaker circuit 2
 - k. Short circuit on speaker circuit 3
 - l. Short circuit on speaker circuit 4
 - m. Data Transmitted on DAP A
 - n. Data Received on DAP A
 - o. Data Transmitted on DAP B
 - p. Data Received on DAP B
 - q. Board failure
 - r. Active fiber optic media connection on port A (fiber optic media applications)
 - s. Active fiber optic media connection on port B (fiber optic media applications)
 - t. Power supply Earth Fault
 - u. Power supply 5V present
 - v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble
4. The audio amplifier shall provide the following built-in controls:
 - a. Amplifier Address Selection Switches
 - b. Signal Silence of communication loss annunciation Reset
 - c. Level adjustment for background music
 - d. Enable/Disable for Earth Fault detection on DAP A
 - e. Enable/Disable for Earth Fault detection on DAP A
 - f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
 - a. Lamp Test
 - b. Trouble
 - c. Off-Line Trouble
 - d. Microphone Trouble
 - e. Phone Trouble
 - f. Busy/Wait
 - g. Page Inhibited
 - h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators
 - a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
 - b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
2. Emergency Two-Way Telephone Control Switches/Indicators
 - a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
 - b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

O. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
3. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
4. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the

verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
 - a. Device Status.
 - b. Device Type.
 - c. Custom Device Label.
 - d. Software Zone Label.
 - e. Device Zone Assignments.
 - f. Analog Detector Sensitivity.
 - g. All Program Parameters.
4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

R. System Maintenance Analysis and Reporting

1. The system shall automatically track NFPA 72 installation and testing requirements for all addressable devices to ensure that every device is functionally tested upon installation and then periodically as required by the Code.

2. If after twelve months any device has not been functionally tested a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
3. The system shall automatically track device testing to ensure that a visual inspection is performed at least semi-annually.
4. If after six months a device has not been indicated as "visually inspected" a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
5. A hand-held IR tool may be used to interact with each SLC device to indicate that a visual inspection has been performed. The IR device will explicitly identify the device by loop and address to ensure the correct visual inspection has been performed.
6. A comprehensive report shall be available from the laptop programmer which shows a predictive report of all devices that have upcoming testing requirements. These reports shall be configurable as either 30, 60 or 90 day predictive, current status, and "all database."
7. Systems that do not automatically track the individual testing requirements of the field devices will not be accepted.

2.3 SYSTEM COMPONENTS:

A. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

B. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - b. Independent Addressable Device Status
 - c. AC (Mains) Power Loss
 - d. Low Battery and Earth Fault

- e. System Off Normal
 - f. 12 and 24 Hour Test Signal
 - g. Abnormal Test Signal (per UL requirements)
 - h. EIA-485 Communications Failure
 - i. Phone Line Failure
5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
 6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
 7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
 8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

C. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

D. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

2.4 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status; NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-851 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
- D. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.
- E. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # FSD-751PL.
- F. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class B) or FMM-101 (Class B)
 2. The IDC zone shall be suitable for Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
 3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
 4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.
- G. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1
2. The control module NAC may be wired for Style Y (Class B) with a current rating of and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

H. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

I. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

J. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

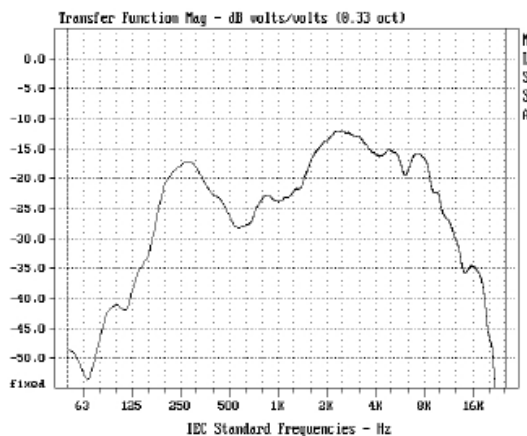
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

K. Speakers

1. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from 1/4 watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

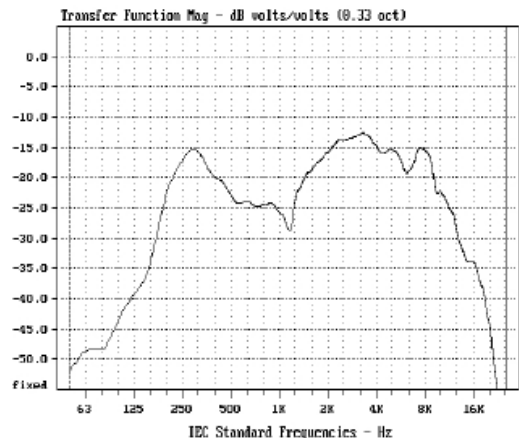
Ceiling Speaker

Wide Band Frequency Response



Wall Speaker

Wide Band Frequency Response



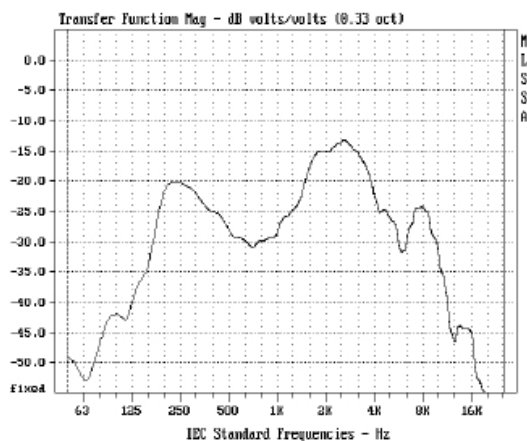
Note: The wide band frequency response is derived using MLS methods

L. Speaker Strobes

1. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from 1/4 watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

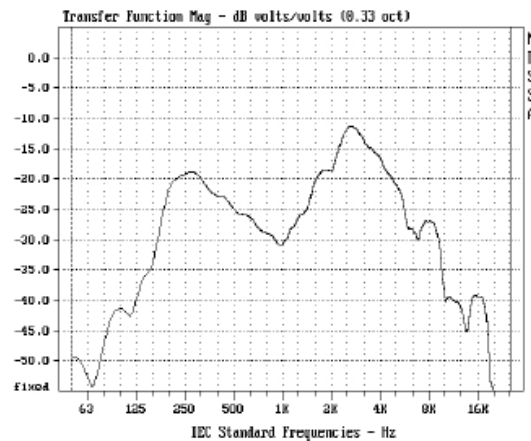
Ceiling Speaker Strobe

Wide Band Frequency Response



Wall Speaker Strobe

Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and be fully synchronized.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all waterflow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short signaling line circuits and verify that the trouble signal actuates.
- F. Open and short notification appliance circuits and verify that trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check presence and audibility of tone at all alarm notification devices.
- I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

- K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION:

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

SECTION 31 20 00 EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes (but Is Not Necessarily Limited to):
 - 1. Excavations, fill, and finish grading.
 - 2. Removal and legal disposal off the site of all debris, rubbish, and other materials resulting from earthwork operations.
 - 3. Compaction of fill.
 - 4. Graded Rock Base.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Grades and elevations are established with reference to benchmarks referenced on the Drawings.
 - 2. Maintain engineering markers such as monuments, benchmarks, and location stakes.
- B. Performance Requirements:
 - 1. Excavations and finished grades shall not exceed 1/10-foot variation from dimensions and elevations shown or noted, unless otherwise approved by Owner's Representative.
 - 2. Grading under pavements shall be graded within tolerance of 0 to -1/10 foot.

1.3 DEFINITIONS

- A. Native Material: That obtained from required on site excavation.
- B. Import Material: Hauled in from off-site borrow areas.
- C. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same material, as determined by laboratory test procedure ASTM D-1557.

1.4 QUALITY ASSURANCE

- A. The following reference is hereby made part of this Specification and all work of this Section shall conform to the requirements therein, except as herein modified.
 - 1. "Standard Specifications," State of California, Department of Transportation (CALTRANS), current edition; hereinafter called Standard Specifications. Delete all references to statistical testing and measurement and payment.
 - 2. In case of conflict between Standard Specifications and this Specification, this Specification governs.
- B. California Code of Regulations (C.C.R.), Title 24.

- C. Work shall comply with rules and regulations of local and state agencies having jurisdiction.
- D. State and local code requirements shall control disposal of debris.
- E. Geotechnical Report: GEOTECHNICAL INVESTIGATION, WALNUT CREEK SCHOOL DISTRICT, SEISMIC EVALUATION & MULTIPURPOSE BUILDING ADDITION, WALNUT CREEK INTERMEDIATE SCHOOL, 2425 WALNUT BOULEVARD, WALNUT CREEK, CALIFORNIA, dated August 23, 2019, performed by Miller Pacific Engineering Group.
 - 1. The accuracy, sufficiency, and competency of the Geotechnical Study are not ratified by the Architect and remain the sole responsibility of the Geotechnical Engineer.
 - 2. This report is available at the offices of the Architect.
 - 3. Unless otherwise specified or indicated on the drawings, it is the intent that all work shall be done in accordance with the applicable provisions of this report.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. When precipitation necessitates interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water.
 - 2. Provide adequate temporary drainage and other acceptable measures to prevent erosion.
 - 3. After interruption, reestablish compaction specified in last layer before resuming work.
- B. Locate active utilities traversing site, and protect them from damage.
- C. Tree Protection:
 - 1. Contractor shall exercise the utmost caution in working near existing trees & vegetation to remain, so as not to damage them.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fill materials shall be reviewed and found acceptable by the Owner's Representative.

2.2 AGGREGATE BASE MATERIALS

- A. Aggregate Base: Crushed aggregate, R-78 minimum, 3/4 inch maximum, conforming to Caltrans Standard Specification Section 26-1.02A, Class 2; free from vegetable matter and other deleterious substances, and shall be of such nature that it can be compacted readily under watering and rolling to form a firm, stable base.

2.3 FILL

- A. Utilize native soil material excavated from the site. Remove all debris, sticks, trash, vegetative matter and rocks greater than 8-inches in diameter before placement.
- B. Engineered Fill Materials
 - 1. Import fill or on-site fill that satisfies these requirements shall be a granular soil or soil-rock mixture which is free of organic matter (less than 2% by weight) or other deleterious substances. Fill shall meet the following requirements: Not contain rocks or lumps over 3" in greatest dimension, and should not contain more than 15 percent by weight larger than 2-1/2" and have a Plasticity Index of less than 20 and a Liquid Limit of less than 40. All Engineered Fill Materials shall be approved by the Owner's Representative.
 - 2. 3/4-inch crushed stone.

2.4 WATER

- A. Clean and free from deleterious amounts of acids, alkalis, salts, and organic matter.

PART 3 - EXECUTION

3.1 GENERAL

- A. Prior to commencement of earthwork, become thoroughly familiar with site conditions.
- B. When discrepancies are found, immediately notify the Owner's Representative with a follow-up in writing, indicating the nature and extent of differing conditions.
- C. Whenever acceptance of the Owner's Representative is required by these Specifications, notify the Owner's Representative at least twenty-four hours prior to commencing any phase of earthwork.
 - 1. No phase of work shall proceed until prior phase has been accepted by the Owner's Representative.
 - 2. Work shall not be covered up or continued until acceptance of the Owner's Representative has been obtained.
- D. Field Tests:
 - 1. Location and frequency of field density tests shall be determined by the Owner's Representative.
 - 2. Results of test and compliance with these Specifications shall be basis for determining satisfactory completion of work.
- E. Compacting:
 - 1. Compact by power tamping, rolling, or combinations thereof as accepted by the Owner's Representative.
 - a. Where impractical to use rollers in close proximity to adjacent construction, trees, etc., compact by mechanical tamping.
 - b. Scarify and recompact any layer not attaining compaction until required

- density is obtained.
2. Compaction by flooding, ponding, or jetting will not be permitted.

3.2 SITE PREPARATION

- A. Cleaning:
 1. Remove from area of designated project earthwork all obstructions, concrete and other matter determined to be deleterious.
 2. Removed material shall become property of the Contractor and shall be removed from site.
 3. Existing trees and shrubs to remain: trees, shrubs and vegetation damaged during construction shall be replaced without additional expense to the owner.
- B. Stripping:
 1. Where vegetation exists, the site shall be stripped to a depth of 1 to 3 inches or to such greater depth as the Owner's Representative in the field may consider as being advisable to remove all surface vegetation and organic-laden topsoil.
 2. Stripped topsoil shall be stockpiled clear of construction area for use in landscaped areas at a location as designated by the Owner's Representative.
 - a. Take reasonable care to prevent topsoil from being mixed with subsoil.

3.3 SITE EXCAVATION

- A. Perform all excavations to lines and grades and within the tolerance specified on the Drawings or as directed in the field as required to accomplish the work.
- B. Remove and replace subgrade materials designated by the Owner's Representative.

3.4 PREPARATION OF SUBGRADE

- A. Following excavation, exposed subgrade shall be scarified to depth of at least 12-inches, moisture conditioned, and recompact to at least 90 percent relative compaction.
- B. In pavement areas exposed subgrade shall be scarified to depth of at least 12-inches, moisture conditioned, and recompact to at least 95 percent relative compaction.

3.5 FILL AND COMPACTION

- A. General Requirements:
 1. Do not place fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Owner's Representative.
- B. Place and compact materials in continuous layers not exceeding 8-inches compacted depth, the upper 6-inches should be compacted to 90% relative compaction, except as otherwise recommended by the District's Representative.

3.6 TRENCHING

- A. Trenches of open vertical construction shall have sufficient width to provide free working space at both sides of pipe as required for caulking, joining, backfilling, and compacting.
- B. Where invert elevations are not shown, trench to sufficient depth to give minimum of 18 inches of fill above top of exterior pipe measured from adjoining finish grade.
- C. Where trench excavation is inadvertently carried below proper elevations, backfill with specified sand or gravel and compact to provide a firm and unyielding subgrade and/or foundation to approval of Owner's Representative and at no additional cost to the Owner.

3.7 FOUNDATION FOR PIPES

- A. Grade trench bottom to provide smooth, firm, and stable foundation at every point throughout length of pipe.
- B. Place pipe barrel on minimum of 6 inches of well graded sand.
- C. Remove soft, unstable materials encountered at surface where cohesionless material is to be placed, and replace with material approve by the Geotechnical Engineer/Owner's Representative.
 - 1. Excavate to sufficient depth to develop firm foundation for pipe.
 - 2. If in need for such over excavation has been occasioned by act or failure to act on part of the Contractor, make replacements at no additional cost to the Owner.
- D. Recess bottom of bedding at pipe joints as required to relieve bell of pipe of all load and to ensure continuous bearing of pipe barrel on firm foundation.
- E. Accurately shape subgrade and fit bottom of pipe to excavation.
 - 1. Use drag template conforming to outer surface of pipe if other methods do not produce satisfactory results.

3.8 BEDDING FOR PIPES

- A. Place cohesionless material specified above in trench simultaneously on each side of pipe for full width of trench.
 - 1. Densify bedding material after placing by thoroughly saturating with water and vibrating it with bedding equipment and concrete-vibrator stinger at maximum intervals of 2 feet along both sides of pipe to provide firm bedding support on underside of pipe and fittings for full length of pipe.
 - 2. Place additional lifts as required to extend bedding material 12 inches above top of outside diameter of pipe barrel.
- B. Other bedding procedures and materials may be used if prior written approval has been obtained from the Owner's Representative.

3.9 BACKFILL FOR PIPES

- A. After pipe has been bedded and covered, spread earth fill in uniform lifts of not more than 8 inches in uncompacted thickness; and then compact as specified below.
- B. Repeat spreading and compacting procedure until adjacent grade level is attained.
- C. Do not compact by ponding or jetting.
- D. After pipe has been properly bedded and covered, fill remaining portion of trench with cohesionless material or other material approved by the District's Representative and densify to 90 percent relative compaction.
- E. Backfill for trenches in pavement areas should consist of non-expansive granular fill.

3.10 GRADING

- A. Finish-grade building pad to elevations indicated on the Drawings or otherwise required for proper completion of the Work.
- B. Grade to at least a tolerance of +/-0.05 foot.

3.11 FIELD QUALITY CONTROL

- A. Soil Compaction Tests:
 - 1. Maximum dry-density determination shall conform with ASTM D-1557.
 - 2. Field density testing shall conform with ASTM D-556 (sand-cone method) or ASTM D-2922 (nuclear-gauge method).
- B. Number and location of tests shall be at option of the District's Representative.

3.12 CLEANING

- A. Remove debris and surplus materials from site upon completion of the Work, and dispose of in legal manner.

END OF SECTION