

PROJECT MANUAL

FOR THE
TENANT IMPROVEMENT FOR
**RIO SCHOOL DISTRICT
DISTRICT OFFICE**

**1800 N SOLAR DRIVE
OXNARD, CALIFORNIA**

Bid Set
June 21, 2019

Prepared by:

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PROJECT MANUAL

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SECTION 011100**SUMMARY****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The scope of work of this contract shall consist of the Interior Tenant Improvement of the whole third floor of 1800 N Solar Drive, Oxnard, CA for the District Office of the Rio School District. The project will include demolition of the raised floor, some partitions, replacement of doors, construction of new partitions, offices and conference room. The project also includes the modification of the mechanical and electrical and fire protection systems to match the new partition plan. New floor, ceiling and wall finishes shall be installed and applied to complete the tenant improvement.
1. Project Location: 1800 N. Solar Drive, Third Floor, Oxnard, CA
 2. Client: Rio School District
- B. All work shall be in conformance with the construction documents prepared by P K Architecture, 5126 Clareton Drive, Suite 110, Agoura Hills, CA 91301.

1.2 CODE COMPLIANCE

- A. All work performed, and products furnished, shall comply with the regulations of the following codes:
1. California Building Code based on the International Building Code, latest edition as adopted by the City of the Project's Jurisdiction.
 2. California Plumbing Code, latest edition.
 3. California Mechanical Code, latest edition.
 4. California Electrical Code, latest edition.
 5. California Architectural Barrier Laws, Title 24, Part 2, California Code of Regulations and ADA standards for accessible design.
 6. Energy Building Regulations, Title 24, California Code of Regulations.
 7. California Green Building Standards Code
 8. California Fire Code
- B. Except as noted above, or otherwise specified, the latest official date of publication, adoption, issue or revision of the code shall apply.

END OF SECTION

SECTION 013300

SUBMITTALS – SHOP DRAWINGS, PRODUCT DATA & SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Qualifying data on alternatives and substitutions.
2. Shop and erection drawings on all fabricated products and assemblies.
3. Catalog cuts, technical performance and composition data on all products and systems.
4. Qualifying mill test or field test data on basic materials.
5. Certificates of Compliance and Certificates of Inspection.
6. Samples, prototypes, color and finish submittals.

B. Related Work Specified Elsewhere

1. Specific Submittal Requirements – Respective Technical Sections of the Specifications.

C. General: Contractor shall make all submittals specified or required by the Contract Documents.

1.02 SHOP DRAWINGS

A. Original drawings, prepared by Contractor, subcontractor, supplier or distributor, which illustrate some portion of the Work; showing fabrication, layout, setting or erection details.

B. Prepared by a qualified detailer, under responsibility of the entity furnishing the work represented thereby.

C. Identify details by reference to sheet and detail numbers shown on Contract Drawings.

1.03 PRODUCT DATA.

A. Manufacturer's Standard Schematic Drawings:

1. Modify drawings to delete information which is not applicable to project.
2. Supplement standard information to provide additional information applicable to project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data:

1. Clearly mark each copy to identify pertinent materials, products or models.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.

4. Show wiring or piping diagrams and controls.

1.04 SAMPLES.

- A. Physical examples to illustrate materials, equipment or work quality, and to establish standards by which completed work is judged.
- B. Office Samples: Submit six samples of sufficient size to clearly illustrate:
 1. Functional characteristics of product or material, with integrally related parts and attachment devices.
 2. Full range of color, texture and pattern.
- C. Field Samples:
 1. Erect at project site at location acceptable to the Architect.
 2. Construct each field sample complete, including work of all trades required in finished work.
- D. After review, samples will be retained and used at site to compare against work completed for compliance. Remove field sample at conclusion of work when acceptable to the Architect.

1.05 REQUESTS FOR SUBSTITUTIONS AND ALTERNATIVES.

- A. The Contract Documents comprise the minimum standards for execution of the work. Submit requests for substitution and alternatives to products, systems and methods of construction specified to the Architect. No substitutions are permitted without written approval of the Architect.
- B. Submit 5 copies of request including the following:
 1. Complete data substantiating compliance of proposed substitution with intent of Contract Documents.
 2. For Products:
 - a. Product identification, including manufactures name and address.
 - b. Manufacturer's literature:
 - (1) Product description
 - (2) Performance and test data
 - (3) Reference standards
 - c. Samples
 - d. Name and address of similar projects on which product was used, and date of installation.
 3. For construction methods:
 - a. Detailed description of proposed method.
 - b. Drawings illustration methods.
 4. Itemized comparison of proposed substitution with product or method specified.
 5. Data relating to changes in construction schedule.
 6. Requirements of maintenance and service and source of replacement materials.

- C. In making request for substitution, Contractor represents:
 - 1. Contractor has investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
 - 2. Contractor will provide the same guarantee for substitution as for product or method specified.
 - 3. Contractor will coordinate installation of accepted substitution into work, making changes as may be required for work to be complete in all respects.
- D. Substitutions will not be considered if:
 - 1. They are indicated or implied on shop drawings or project data submittals without formal requests submitted in accord with this section.
 - 2. Acceptance will require substantial re-design of project or revision of Contract Documents.

1.06 CONTRACTOR RESPONSIBILITIES

- A. Review Shop Drawings, Product Data and Samples prior to submission.
- B. Verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Catalog numbers and similar data.
 - 4. Quantities required for each item.
- C. Coordinate each submittal with requirements of work and of Contract Documents.
- D. Contractor's responsibility for errors and omissions in submittals is not relieved by Architects review of submittals.
- E. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals, unless Architect gives written acceptance of specific deviations.
- F. Notify Architect in writing at time of submission, of deviations in submittals from requirements of Contract Documents.
- G. Begin no work that requires submittals until return of submittals with Architect's stamp and initials or signature indicating review.
- H. After Architect's review, distribute copies.

1.07 SUBMISSION REQUIREMENTS

- A. Schedule submissions sufficiently before the dates which reviewed submittals will be needed for fabrication or construction. Submittals to be checked by Consulting engineer shall be submitted to the Architect.
- B. Submit (5) five copies of all submittal samples. Submit (1) one copy of shop drawings and literature that can be submitted as a pdf .

- C. Submittals shall include:
1. Date and revision dates.
 2. Project title.
 3. Names of Contractor, Sub-contractor, Supplier and Manufacturer.
 4. Identification of product or material.
 5. Relation to adjacent structure or materials.
 6. Field dimensions clearly identified as such.
 7. Applicable specification section(s).
 8. Identification of deviation from Contract Documents.
 9. Contractor's stamp, certifying their review of submittal, and compliance with Contract Documents.

1.08 RESUBMISSION REQUIREMENTS

- A. Shop Drawings:
1. Revise initial drawings as required and resubmit as specified for initial submittal.
 2. Indicate on drawings any changes which have been made including those requested by Architect.
 3. Identify all revisions.
 4. Product Data and Samples: Submit new data and samples as required for initial submittal.

1.09 ARCHITECT'S DUTIES

- A. Architect and Consulting Engineers shall review and return submittals to Contractor within 10 working days.
- B. Review for:
1. Design concept of project.
 2. Information given in Contract Documents.
 3. Design Adherence.
- C. Review of separate item does not constitute review of an assembly in which item functions.
- D. Affix stamp and initials or signature certifying the review of submittals.
- E. Return submittals to Contractor for distribution.

END OF SECTION

SECTION 016600

MATERIAL AND EQUIPMENT – HANDLING AND STORAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Items Included:

1. General materials and equipment requirements.
2. Transportation and delivery to project site.
3. Product storage and protection.
4. General product installation procedures.

B. Related Work Specified Elsewhere:

1. Specific requirements for specific products – the respective section of the Specification for the Product.

1.2 GENERAL PRODUCT CRITERIA

A. All products, materials and equipment incorporated into the work shall:

1. Conform to specified specifications and standards.
2. Comply with size, dimensions, make, type, capacity and quality specified.

B. Manufactured and Fabricated Products:

1. Design, fabricate and assemble in accord with the best engineering and shop practices.
2. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
3. Two or more items of the same kind shall be identical, by the same manufacturer.

C. Do not use products, materials or equipment for any purpose other than that for which it is designed or specified

1.3 TRANSPORTATION AND DELIVERY

A. Arrange deliveries of products on accord with construction schedules and in ample time to facilitate inspection prior to installation.

B. Coordinate deliveries to avoid conflict with work and conditions at the site, and in consideration of:

1. Work of subcontractors
2. Limitations of storage space

3. Availability of equipment and personnel for handling products.
- C. Deliver products in undamaged condition in manufacturer's original containers or packaging, with identifying labels intact and legible.
- D. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of the parts and to facilitate assembly.
- E. Immediately on delivery, inspect shipment to assure:
 1. Product complies with requirements of Contract Documents and approved submittals.
 2. Quantities are correct
 3. Containers and packages are intact, and labels are legible.
 4. Products are properly protected and undamaged.

1.4 PRODUCT HANDLING

- A. Provide equipment and personnel necessary to handle products, by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods to prevent bending or overstressing. Lift heavy components only at designated lifting points.

1.5 STORAGE

- A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
- B. Store products subject to damage by the elements in substantial weather tight enclosures.
 1. Maintain temperatures within the ranges required by manufacturer's instructions and/or the specifications.
 2. Provide humidity control for sensitive products, as required by manufacturer's instructions and/or specifications.
 3. Store unpacked products on shelves, in bins or in neat piles, accessible for inspection.
- C. Exterior Storage:
 1. Provide substantial platforms, blocking or skids to support fabricated products above ground and to prevent soiling or staining.
 2. Cover products subject to discoloration or deterioration from exposure to the elements with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
 3. Store loose granular materials on solid surfaces such as paved areas, or provide plywood or sheet materials to prevent mixing with foreign matter.

- a. Provide surface drainage to prevent flow or ponding of rainwater.
 - b. Prevent mixing refuse or chemically injurious materials or liquids/with site soils.
- D. Arrange storage in a manner to provide easy access for inspection, and access to all parts of the project.
- 1. The state of storage facility is adequate to provide required protection.
 - 2. Required environmental conditions are maintained on a continuing basis.
 - 3. Surfaces of products exposed to the elements are not adversely affected.

1.6 INSTALLATION – MANUFACTURER’S INSTRUCTIONS

- A. When Contract Documents require that installation of work shall comply with manufacturer’s printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including copies to Architect. Maintain one set of complete instructions at the jobsite during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
- C. Should job conditions or specified requirements conflict with manufacturer’s instructions, consult with Architect for further instructions. Do not proceed with the work without clear instructions.
- D. In complying with manufacturer’s instructions, do not omit any preparatory step or any installation procedure unless specifically modified or exempted by Contract Documents.

1.7 PROTECTION AFTER INSTALLATION

- A. Provide protection of installed products to prevent damage from subsequent operations. Remove such protection only when no longer needed, prior to completion of work.
- B. Control traffic to prevent damage to equipment and surfaces.
- C. Provide coverings to protect finishes from damage.
 - 1. Cover projections, wall corners, jambs, sills and soffits of openings in areas for traffic and for passage of projects in subsequent work.
 - 2. Protect finish floors and stairs from dirt and damage.
 - 3. In areas subject to foot traffic, secure heavy paper, sheet goods or other material in place.
 - 4. For movement of heavy materials, lay planking or similar materials in place.
 - 5. For storage of products in finished surfaces, lay tight wood sheathing in place.
 - 6. Cover walls and floor elevator cars and surface of elevator car doors used by construction personnel.

END OF SECTION

SECTION 017400

CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Execute cleaning, during progress of the work, and at completion of the work.

B. Related Work Specified Elsewhere:

1. Cleaning for specific products or work; the respective specification section for that work.

1.2 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with local codes, ordinances, regulations and laws.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 – EXECUTION

3.1 DURING CONSTRUCTION.

- A. Execute cleaning to ensure that building, grounds, and adjacent properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to prevent blowing dust.
- C. At reasonable intervals during progress of work, remove waste materials, debris and rubbish from site and dispose of legally away from site.
- D. Provide on-site metal containers for collection of waste materials, debris, and rubbish.

- E. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for occupancy.
- F. Handle waste materials and debris in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly painted surfaces.

3.2 FINAL CLEANING

- A. Employ experienced professional cleaners for final cleaning.
- B. In preparation for occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
- C. Remove grease, dust, dirt stains, labels, fingerprints, and other foreign materials, from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
- D. Wash and shine glazing and mirrors.
- E. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.
- F. Broom clean paved surfaces; rake clean other surfaces of grounds.
- G. Replace air conditioning or ventilation system filters if units were operated during construction.
- H. Clean ducts, blowers and coils, if air handling units were operated without filters during construction.
- I. Maintain cleaning until project is occupied.

END OF SECTION

SECTION 017700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 GENERAL

- A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.2 RELATED REQUIREMENTS

- A. Fiscal provisions, legal submittals and additional administrative requirements: Conditions of the Contract.
- B. Cleaning: section 01710
- C. Record Documents: Section 01720.
- D. Closeout submittals required of trades: The respective sections of the Specifications.

1.3 SUBSTANTIAL COMPLETION - PUNCHLIST

- A. Substantial completion is the stage in the progress of the project or designated portion thereof when the project is sufficiently complete in accordance with the Contract Documents so the Owner can occupy and utilize the project for its intended purpose.
- B. When contractor considers the Work is substantially complete, Contractor shall submit to Architect:
 - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- C. Within ten (10) working days after receipt of notice, Architect will make a "Punchlist" inspection to determine the status of the work.
- D. After "Punchlist" inspection, Architect will promptly notify the Contractor in writing of the items remaining to obtain substantial completion.
 - 1. Contractor shall promptly and with due diligence remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
 - 2. Architect will inspect the work.
- E. When the Architect concurs that the Work is substantially complete, Architect will:

1. Prepare a Certificate of Substantial Completion accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect.
2. Submit the Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

1.4 FINAL INSPECTION

- A. When Contractor considers the Work is complete, Contractor shall submit written certification that:
 1. Contract Documents have been reviewed.
 2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with the Contract Documents.
 4. Equipment and systems have been tested in the presence of the Owner's representatives and are operational.
 5. Work is completed and ready for final inspection.
- B. Architect and Owner will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Architect consider the Work is incomplete or defective:
 1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
 2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification by Architect that the work is complete.
 3. Architect will re-inspect the work.
- D. When the architect finds that the Work is acceptable under the Contract Documents, Architect will request the Contractor to make closeout submittals.
- E. Refer also to General Conditions for other completion requirements.

END OF SECTION

SECTION 017836

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Compile and submit specified warranties and bonds.
2. Compile and submit specified service and maintenance contracts.
3. Standard guarantees to be submitted by all subcontractors.

B. Related Work Specified Elsewhere:

1. Submittals – Section 01300
2. Operating and Maintenance Data – Section 01730
3. Provisions of warranties and bonds of respective sections of specific products.

1.2 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and services and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Submit two (2) each original signed copies of all documents.

C. Content of warranties, bonds and service and maintenance contracts:

1. Basis on which all such documents apply and all provisions applicable to validity.
2. Date of beginning of warranty, bond or service and maintenance contract.
3. Duration of warranty, bond or service and maintenance contract.
4. Any interim inspections required and schedule pertaining thereto.
5. Proper procedure in case of failure.
6. Instances that might affect the validity of warranty or bond.
7. Notification requirements applicable.
8. Name and signature of responsible principal issuing the document and address and telephone number.

1.3 TIME OF SUBMITTALS.

A. Make submittal within thirty days after Date of Substantial Completion.

B. For items of work, where acceptance is delayed beyond the Data of Substantial Completion, provide updated submittal within ten days after acceptance, listing the date of acceptance as the start of the warranty period.

GUARANTEE/WARRANTY FOR: _____
(Description of Work)

DATE OF ACCEPTANCE: _____

_____ of _____
(Print Name of Subcontractor and Company)

hereby warrants that all work, materials and equipment associated with the above described scope of work that we have installed in the Rio School District- District office Tenant Improvement, in the City of Oxnard, California, are new, unless otherwise specified, and that all work completed is of good quality free from faults and defects and in conformance with the Contract Documents.

If within a period of one (1) year from the date of acceptance of the subject project or designated equipment, by the Owner, or after the Date of Substantial Completion of the work or designated portion thereof, or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be defective or not in accordance with the Contract Documents, we agree to correct it promptly, along with any adjacent work displaced by doing so or damaged by such defect, after receipt of a written notice from the Owner to do so. This obligation shall survive termination of the Contract.

If we fail to commence compliance with the above paragraph promptly after receipt of written notice from the Owner to do so, or fail to pursue such compliance with diligence, we do hereby authorize the Owner to proceed to have the defects repaired and made good at our sole expense and will pay the cost and charges therefore on demand.

Signed: _____ Date: _____

Printed Name: _____ Company Name: _____

Local Representative to be contacted for Service:

Name: _____

Address: _____

Tel. Number: _____

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Exterior metal stud framing system.
2. Bracing, fasteners and related accessories.
3. Backing for cabinets, toilet grab bars and accessories, ladders and handrails.

B. Related Sections include the following:

1. Structural steel
2. Metal fabrication
3. Interior non-bearing metal framing

1.2 QUALITY ASSURANCE

A. Applicable Code: California Building Code latest edition as adopted by Project's jurisdiction.

B. AISI's 2004's "North American Specification for the Design of Cold-Formed Steel Structural Members" combines Allowable Stress Design (ASD) and Load and Resistance Factor Design (LRFD) methods in one edition and incorporates provisions for screw connections that earlier editions did not. Verify with authorities having jurisdiction if compliance with an earlier edition is required. If so, retain LRFD option and the subparagraph referencing CCFSS Technical Bulletin and insert the date of the edition of AISI specification being referenced. For edition dates, see "Reference Standards" in Evaluations.

C. AISI Specifications: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.

1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

D. Applicable Standards:

1. ASTM specifications as referred to herein by number.
2. AWS as referred to herein by number.

C. All studs shall be marked with the manufacturer's name and gauge size of material.

1.3 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.4 QUALITY ASSURANCE

- A. AISI Specifications: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.
 - 1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."
- B. Applicable Standards:
 - 1. ASTM specifications as referred to herein by number.
 - 2. AWS as referred to herein by number.
- C. All studs shall be marked with the manufacturer's name and gauge size of material.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Studs shall be formed from steel conforming to ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated with a minimum yield of 33,000 psi. Stud sizes and gauges as shown on the drawings. Studs shall be required dead and live loads as indicated in the drawings and code-required lateral loads.
- B. All track, bridging and closures and other accessories shall be formed from steel conforming to ASTM A 1003/A 1003M, with a minimum yield of 33,000 psi.

- C. Bridging, 16 gauge, $\frac{3}{4}$ " deep, cold rolled channels.
- D. All studs, joists, accessories and components shall be formed from steel having a G-60 galvanized coating, conforming to ASTM A1003/A 1003M.
- E. Welding Electrodes: Conform to AWS D1.1, Table 4.1.1.

PART 3 - EXECUTION

3.1 METAL STUD INSTALLATION

- A. Install tracks securely anchored to the structure as detailed. Shim off of structural steel as detailed to achieve vertical alignment within industry tolerances, Butt weld or splice together track butt joints; anchor to common structural member.
- B. Space studs at 16" on center or as otherwise indicated. Studs shall be fabricated full length with no splices permitted. Studs shall be cut accurately to length to seat squarely and to bear on webs of sill and head tracks.
- C. Unless detailed otherwise, all connections of studs at joints between stud and track and at supports and bracing shall be electric arc fusion welds. Welding process, procedures and quality shall conform to AWS Code D1.3. Clean slag from all welds and touch up all welds with a self-curing inorganic zinc-rich primer. Reference product: "A#5686" by Rust-Oleum Corp.; "Tnemec-Zinc 90E-75" by Tnemec Co.
- D. At corners provide not less than 3 studs, located so as to provide surfaces for attachment of all interior and exterior facings.
- E. For framing around door and window openings, install two studs at each jamb, continuous from floor to structure. Weld or tie studs adjacent to frames securely to jamb anchors in frames. Stiffen jack studs over and below opening with bridging located approximately 6" above or below frame and extending approximately 36" beyond jamb on each side. Securely attach jack studs to structure.
- F. Install bridging to provide resistance to bending and rotation where plaster is not on each side. Install at 5 ft. on center.
- G. Provide bracing and bridging as detailed, or as required.
- H. Connections of bridging, bracing, supports and similar conditions shall provide rigid joints capable of withstanding deflections. Augment by doubling studs and the use of gussets or braces as required for rigidity.
- I. Provide for rigidly connecting all blocking, special braces, framing for attachments and support of electrical outlets and plumbing fixtures, and other such equipment requiring support by the metal framing.

- J. Any stud attachment to structural members with fireproofing require the connection to be patched around and totally encased with fireproofing to match the structural members fire protection.

END OF SECTION

SECTION 064100

ARCHITECTURAL CASEWORK

PART - 1 GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Architectural casework, including counters, upper and lower cabinets.

B. Related Work Specified Elsewhere:

1. Sealants and caulking.
2. Stone countertops

1.02 QUALITY ASSURANCE.

A. Applicable Code: California Building Code latest edition.

B. Applicable Standards:

1. Woodwork Institute of California (WIC) Manual of Millwork. All casework delivered to the job shall bear a WIC Certified Compliance Label.

C. SUBMITTALS.

1. Shop Drawings: Submit shop drawings for all casework, identifying location in building, and showing all materials and species, connections, fabrications details, installation details and hardware. Show casework in plan, elevation and section and in scale as required to fully detail work. Front page of shop drawings shall bear the WIC Certified Compliance Label.

D. PRODUCT DELIVERY AND STORAGE.

1. Deliver casework to job only after installation of all plaster, tile and other "wet" work, and when is no danger of damage due to excessive moisture conditions.
2. Store all casework indoors protected from all wet conditions. Maintain temperature at 60 deg. F minimum after delivery of all casework. Protect casework adequately against moisture, dust, paint and other damaging elements prior to and during installation.

PART 2 – PRODUCTS

CASEWORK

- A. Casework shall be wood casework conforming to WIC Manual of Millwork, Section 14, Economy Grade, suitable for base for stone countertops. Casework shall be of the sizes and configurations shown on the drawings.
- B. Refer to Section 09600 for stone countertop requirements.

PART 3 – EXECUTION

3.01 CASEWORK INSTALLATION.

All work shall be assembled at the mill insofar as is practical, in sections and lengths as required to be accessible to locations in the building. Deliver casework to the job ready to set in place.

- B. Install casework plumb and level in accordance with WIC Manual of Millwork Installation Requirements. Shim as necessary using concealed shims.
- C. Anchor wall units securely to wall to obtain loading requirements required by code. Indicate methods on shop drawings.
- D. Accurately scribe and closely fit all face plates, filler strips, and trim strips to irregularities of adjacent surfaces. Caulk as required to provide for complete fit against adjoining surfaces.

END OF SECTION

SECTION 072100
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Glass fiber building thermal insulation
 - 2. Cavity wall insulation.
 - 3. Concealed building insulation.
 - 4. Exposed building insulation.
 - 5. Rigid Insulation

- B. Related Sections include the following:
 - 1. Roof Framing
 - 2. Gypsum Wallboard

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.

- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

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

- B. All materials shall be delivered to the job site in their original unopened packages bearing manufacturer's label.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

- A. Exterior Walls and Roof: Insulation shall be un-faced fiber glass material in roll or Batt form or as specified in the drawings, complying with ASTM C665, Type III, Class A for concealed application. Material thickness shall be as required for the R-Value shown on drawings. Insulation shall have a maximum flame spread rating of 25, and a maximum smoke density of 450 when tested according to UBC Standard 8-1. Add Type II or FSKF scrim-reinforced foil over un-faced fiberglass batts at open manufacturing and warehouse areas or where otherwise visible.
- B. 4 Layer Multi- cavity layer foil or single layer Type II or FSKF Scrim Reinforced Foil where called out on the plans.
- C. For Rigid Insulation, (exterior furring wall application where required insulation thickness is less than 2 ½"): use Polyiso Foam and Fiberglass Rigid Boards by Celotex or Dow Chemical in thickness and R-value specified on the plans which equals R-6.5 per inch of thickness.
- D. Interior Walls and Ceilings: Use R-11 fiberglass un-faced batts between studs and joists.
- E. Use sound batts or blankets as called for in the plans or where the cavity is less than 3 ½".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.
- F. At roof installation: Insert flanged blankets between framing members, vapor barrier facing inward. Where framing spacing permits, flanges shall be stapled to sides of framing members at

each end of batt or rolled along length of flanges at 8 inches o.c. using 9/16-inch staples in a power stapler. Where framing space does not permit stapling of flanges, use 18 gauge wires, stretched between framing as required for proper installation and to permanently prevent insulation from sagging or settling. Avoid gaps or bulges. Fit insulation around penetrations by cutting, not piercing. Insulation shall fit all framing spaces to form a complete insulated blanket, neatly trimmed and snug, with vapor barrier completely sealed.

- G. Where multi layer or single layer is installed, the ends of the foil must be cut back from the edge of trusses at least 2” for air to flow and not be trapped.
- H. Batt insulation to be installed on non furred masonry or concrete walls shall be pinned in place with an appropriate number of pins to prevent sagging or displacement.

END OF SECTION

SECTION 079200

SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Caulking specified in this Section includes, but is not necessarily limited to the following major items requiring caulking.
 - 1. Sheet metal work
 - 2. Door frames
 - 3. Aluminum window framing
 - 4. Glass and glazing
 - 5. Joints in concrete, masonry and precast concrete
 - 6. Through penetrations and sealing of rated assemblies
 - 7. EIFS exterior system joints

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.
- C. Provide rated exterior wall sealants for 4 hour walls as shown on the drawings.

1.3 QUALITY ASSURANCE

- A. Applicable Code: California Building Code latest edition.
- B. Applicable Standards: Unless noted otherwise, latest edition applies.
 - 1. ASTM Specifications as noted herein by number.
 - 2. Federal Specifications as referred to herein by number.
 - 3. Underwriters laboratory (UL) Through penetration firestop systems as referenced by number.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

- B. Submit independent laboratory certification that sealants provided conform to all specifications listed and to all testing criteria.
Submit items under each of the various sections under which those materials are used.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Sealant shall be able to be easily applied by caulking gun, putty knife or trowel. Sealant shall not sag or flow when applied in vertical or overhead installations and shall cure under normal temperature conditions to a flexible, firm rubber. Sealants shall be non-staining.
- B. Exterior Joints in Horizontal Wearing and Traffic Surfaces: Two-part self leveling urethane sealant conforming to Fed. Spec. TT-S-00227E, Type I, Class A and ASTM C-920. Reference products:
 1. Sikaflex – 2c, SL.
- C. Tilt-up Concrete Panel Joints: One part non-sag polyurethane sealant conforming to Fed. Spec. TT-S-001543, Type A, non-sag, and ASTM C-920, Type S, Grade NS, Class 25. Must be compatible with Tex-Cote Finish. Reference Product:
 1. Elasto-Thane 230
- D. All other Exterior Joints: Includes perimeters of exterior openings (and interior of exterior openings), expansion and control joints and sheet metal joints and sheet metal to façade joints. Use two part, non-sag polyurethane sealant conforming to Fed. Spec. TT-S-227E, Type II, Class A and ASTM C-920, Type M, Grade NS. Must be compatible to Tex-Cote Finish. Reference product:
 1. Pecora Dynatrol II
 2. Sika-Flex 1-A

3. Elasto-Thane 230

E. Exterior Storefront and Glazing: One part construction grade silicone conforming to TT-S-00230C, Type II, Class A and ASTM C920, Type S, Grade NS. Must be compatible with Tex-Cote finish. Reference product:

1. Dow 795
2. G.E. Ultraglaze 4000
3. Tremco Spectrem 1
4. Sika-Flex 1-A

Use one part, non-sag polyurethane sealant, conforming to Fed. Spec. TT-S-230C, Class A, Type II and ASTM C-920, Type S, Grade NS for fasteners of storefront can and at end dams. Reference product:

1. Pecora Dynatrol I

F. Warehouse Floor Slab Joints: Two part, self-leveling epoxy resin. Reference product:

1. Sikadur 51 SL

G. All Interior Work: One part, construction grade silicone sealant conforming to TT-S-001543A, Class A, and ASTM C-920. Reference products:

1. Pecora 863
2. Dow 999
3. G.E. Construction 1200

H. Fire Resistant: For sealing all penetrations through, and perimeters of, all rated assemblies, use products specially formulated as a fire resistant sealant. Sealant shall be UL listed and approved for use by California State Fire Marshal. Sealant shall be rated according to ASTM E814, for the hourly rating required by surrounding assembly. Use products as referenced in the approved UL details for each through-penetration fire stop system. Reference products:

1. Dow Corning Fire Stop 2000.
2. G.E. RTU 7403.
3. 3M Fire Barrier Caulk CP 25.

When size of the opening preclude use of above specified sealant, use two-part silicone foam penetration type sealant. Foam sealant shall conform with all listings and ratings as required for one part fire resistant sealant. Use damming materials as recommended by manufacturer. Reference products:

1. Dow Corning Fire Stop 2001
2. G.E. RTU 851.

I. Colors as selected by Architect. Colors selected will be required to match or contrast with adjacent material as required.

H. Primer: Provide primers supplied by manufacturer of sealants that have been tested in combination with the sealant for staining and durability.

- K. Filler and Backing: Use non-absorbent, closed cell polyurethane foam, polyethylene foam or butyl, free from oil or other staining elements. Filler and backing materials shall be of compressive nature. Refer to Section 07270 for mineral fiber backing material for rated assemblies.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - B. Concrete: Cure and dry fresh concrete before primer is applied. Wash away and surface dry alkaline seepage from fresh concrete.
 - C. Metal: Remove corrosion by sandblast, wire brush, grinder or chemical corrosion remover. Remove coatings from coated metal surfaces.
 - D. Primer: Use primer in accordance with manufacturer's recommendations.
 - E. Joint Filler: Provide filler or backing by tightly packing the back of joints over 2 inch in depth with specified material.

3.3 APPLICATION

- A. Apply sealant in accordance with manufacturer's instructions. Apply sealants Internationally smooth and free of wrinkles and tooled sufficiently convex to result in a flush joint when cured.
- B. Firmly press sealant into joint to insure complete wetting of bondage surface.

- C. Caulk around entire perimeter of each opening.
- D. Seal all penetrations of fire-rated assemblies with fire resistant sealant. Conform to approved UL details.
- E. Seal all exterior joints if they constitute a potential source of leakage or weather incursion.
- F. Sealant shall not be used when it becomes too gelled to be discharged in a continuous flow from a gun or when poured. Modification of caulking compound by addition of liquids, solvents or powders is not permitted.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 081200

METAL FRAMES

Part 1 - GENERAL

1.01 Work Included

- A. The work under this section shall include the furnishing of all items shown on the drawings and as specified, including but not limited to, the following:
 - 1. Knocked down, site assembled prefinished steel door frames
 - 2. Knocked down, site assembled sidelight, borrowed light, transom, and fullbound access door frames

1.02 Related Sections

- A. Section 01 30 00 – Coordination, Site meetings
- B. Section 01 60 00 - Product Requirements
- C. Section 08 11 13 – Hollow Metal Doors and Frames
- D. Section 08 12 16 – Aluminum frames
- E. Section 08 14 00 - Wood Doors
- F. Section 08 71 00 - Hardware
- G. Section 08 80 00 - Glazing

1.03 References

- A. ASTM A653 – Standard for hot dipped galvanized steel material
- B. UBC 7-2-97, UBC 7-4-97 Positive Pressure Fire Test Certification
- C. UL 10B Fire test of Door Assemblies and UL10C Standard for Positive Pressure Fire Tests of Door Assemblies
- D. NFPA 80 - Fire Doors and Windows (Latest Edition)
- E. NFPA-101 - Life Safety Codes (Latest Edition)
- F. ASTM D2197 - Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
- G. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- H. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- I. ASTM D3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc exposures of Paint and Related Coatings.
- J. ASTM B117 – Standard test for salt spray testing

1.04 Submittals

- A. Section 01 33 00: Submittal procedures.
- B. Product Data: Indicate frame material, Gauge, configuration and finishes.
- C. Shop Drawings: See section 08 06 00. Indicate frame elevations, details of frame anchorage, reinforcements required, rough opening requirements, location of hardware embosses, and finishes. Detail each floor of the building separately.
- D. Samples: Submit 5 standard frame samples, illustrating factory finished frame colors.
- E. Manufacturer's Installation Instructions: Provide installation instructions for all products under this section.
- F. Manufacturer's Certificate of Warranty: Provide manufacturer's standard warranty certificate stating material is warranted for a period of one year from date of building occupancy
- G. LEED Qualification
 - 1. LEED Credit MR4.1, MR4.2: Post consumer and Pre consumer recycled material content
 - 2. LEED Credit MR5.1: Location of manufacturer/proximity to project
 - 3. EQc4.1: VOC – MSDS sheet for paint materials

1.05 Quality Assurance

- A. Quality Standards
 - 1. Material free from defects in material and according to project specifications for pre-engineered opening systems
 - 2. Proven durability of factory finishes allowing for bending and shaping of material after finish is applied
- B. Fire Rated Frame Construction
 - 1. Conform to ASTM E152, NFPA 252, UL 10B and 10C.
- C. Installed Frame Assembly: Conform to NFPA 80
 - 1. Use only installers familiar with installation of prefinished opening systems and applied casing frame installation

1.06 Delivery, Storage and Handling

- A. Section 01 60 00: Transport, handle, store, and protect products in a dry area off the ground.
- B. Accept frames on site in manufacturer's box packaging with identification labels intact. Inspect for damage.
- C. Do not open individual boxes until installation is to begin.

Part 2 - PRODUCTS

2.01 Acceptable Manufacturers

- A. Timely Industries, A Division of SDS Industries, Inc., 10241 Norris Avenue, Pacoima, CA, 91331-2292; Phone toll free: 800-247-6242; Fax: 818-492-3530. Web site: www.timelyframes.com.
- B. Frames: Provide all interior frames for project from same manufacturer.

2.02 Frames

- A. Frame Material: Hot dipped galvanized steel, for interior frames in normal atmospheric exposures. Color: Black
- B. Frame Throat Opening: As shown on plan details to suit finished wall thickness.
- C. Frame Profile - Unequal Rabbet profile, standard with manufacturer
 - 1. "S" Series, 0.9 mm (20 Gauge) thick, interior office spaces
 - 2. "C" Series, 1.2 mm (18 Gauge) thick, other areas, non standard jamb depths
- D. Casings
 - 1. Provide steel or aluminum casings formed to be applied to heat treated clips on frame face after frame is anchored to wall
 - 2. Standard Steel - TA-8 with 6 mm (1/4 inch) reveal, on steel, stainless steel, and/or brass frames. Fit factory assembled units with MiterGard corner alignment clips.

2.03 Frame Reinforcement and Accessories

- A. Provide reinforcements shipped loose to project site for hardware application
 - 1. TA-10 - Regular arm closers, casing mounted coordinators
 - 2. TA-12 - Parallel arm closers, Rim Exit device strikes, other stop mounted surface hardware
 - 3. TA-47 - For CK frame, Parallel arm closers, Rim Exit device strikes, other stop mounted surface hardware
 - 4. TA-25 - Double acting spring hinges, continuous hinges, other surface mounted hardware on door rabbet or cased opening frame
 - 5. Provide hinge reinforcement (TA-11) of 14 Gauge steel pierced to create depth of thread for hinge screws equal to or exceeding 7 Gauge steel.
- B. Prepare frames for ASA 4-7/8" strikes where required. Provide minimum 1/4" depth of threads in factory tapped screw holes

2.04 Fabrication

- A. Casing Clips: Fabricate frames with factory applied, heat treated clips to ensure no deflection in the clip upon application or removal of casing. Attachment clips may not be of same material as frame
- B. Provide notches, tabs and/or stops for positive alignment of frame parts at all corners
- C. Mullions to be notched as required to provide tight joints

- D. Provide manufacturer's standard mullion brackets for positive connection of frame and mullion parts
- E. Provide adequate structural support (by others) for ceiling insert channel for ceiling height frames

2.05 Finishing

- A. Frame Units: Prefinished with factory applied impact resistant, polyurethane baked enamel finish.
- B. Casing Finishes
 - 1. Steel: Prefinished with factory applied impact resistant, polyurethane baked enamel finish.
- C. Colors: Frame shall be Black
 - 1. Colors: Frame shall be Timely standard Black

Part 3 – EXECUTION

3.01 Examination

- A. Verify acceptability of existing conditions before starting work.
- B. Verify that opening sizes and wall thicknesses are within specified tolerances. Verify that all finished walls are in plane to ensure proper door alignment.

3.02 Installation

- A. Install frames in accordance with manufacturer's requirements.
- B. Anchor frames with screws located at every casing clip or every 11" as shown on manufacturer's instructions. Field verify quantity and location of fasteners prior to installing casing.
- C. Install prefinished frames near end of the project after wall painting and wall coverings are applied.
- D. Install frames using qualified installers familiar with installation of prefinished drywall frames.
- E. Coordinate installation of glass and glazing in glazed units.
- F. Coordinate installation of frames with installation of hardware specified in Section 08 71 00 and doors in Section 08 21 00.
- G. Touch-up blemishes on finished frames with factory prepared touch up paint.

END OF SECTION

SECTION 081400

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Solid-core doors with wood-veneer faces.
- B. Related Sections include the following:
 - 1. Metal Frames
 - 2. Finish Hardware

1.2 QUALITY ASSURANCE

- A. Applicable Code: California Building Code latest edition as adopted by Project's jurisdiction.
- B. Retain one standard below. NWWDA I.S.1-A is less restrictive than AWI or WIC; WIC applies only in California, Nevada, and Oregon. See Evaluations. Review standard selected and coordinate its requirements with options selected.
- C. Applicable Standards: AWI Quality Standards of Architectural Woodwork Institute.
- D. Indicate AWI Quality Standard Grade on all submittals.

1.3 SUBMITTALS

- A. Submit complete manufacturer's product data and specifications for products proposed for use.
- B. Submit sample sections of doors showing stile, rail, veneer and core construction. Mark each sample with manufacturer's name and product designation.
- C. Submit samples for face veneer, minimum 12" x 12" showing full range of stain shades for stain selection. Samples shall have sealer and topcoat applied to ½ of each sample face.
- D. Door supplier shall coordinate information furnished by frame and hardware suppliers, and prepare a complete schedule showing door sizes, opening number, mortising and dimensions prior to fabrication.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

- B. Store doors flat off floor at job prior to installation, in a clean, dry, well ventilated room.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Doors with Paint finish: Provide solid core wood doors conforming to the following:
1. Flush style conform to AWI Quality Standards.
 2. Solid core Architectural grade of 5 -Ply Construction
 3. Model: AWI Type PC-5.
 4. Grade: AWI Paint Grade Wood Doors
 5. Face: AWI Premium grade veneer, see drawings for cut and wood species.
 6. Core: Refer to drawings and door schedule for size, thickness type. Use Type II adhesive unless otherwise noted. Stiles and rails shall be bonded to core material where indicated. Particleboard Solid Core shall be manufactured per ANSI A208.1 "Mat-Formed Wood Particleboard," Grade 1-L-1 as modified by W.D.M.A. Stiles and rails bonded to core. Provide Acoustical Rated Doors as indicated in the drawings shall be of the manufacturer's tested and approved assemblies for the Sound Transmission Class specified. If none specified provide 60 STC rating. (ASTM International Classification E413 and E90)
 7. Style Edges: Edge stiles shall be mill option species of W.D.M.A. 1 1/8" minimum after trim.
 8. Rail Edges: Doors shall have rails of mill option species. Minimum thickness, 1 1/8" min. after trim.
 9. Adhesive, Type II.
 10. Blocking: All blocking to be full core thickness as follows: 1. Hollow core doors shall have one 2 5/8" X 18" lock block each side.
- B. Provide Underwriter's Laboratories label when required with appropriate fire resistance rating for class of opening indicated. Construction details and hardware application shall be as approved by labeling authorities. Where rating requires, provide doors with mineral core.

2.2 FACTORY FITTING AND MACHINING

- A. Furnish doors that are factory pre-fit to net size required and machined for all hardware requiring routing and mortising.
- B. Pre-fit doors to scheduled frame opening size, tolerance as follows:
1. Top = 1/8 inch
 2. Width = 1/8 inch
 3. Bottom = as detailed or as required by floor condition.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drill pilot holes for all screws and screw home all screws. Hammer driving is not acceptable. Neatly and accurately drill for and attach surface mounted hardware.
- B. Doors are to operate freely but not loosely, without sticking or binding, without hinge bound conditions and with hardware properly adjusted and functioning.

END OF SECTION

SECTION 087100

DOOR HARDWARE

Part 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door Hardware, including electric hardware.
2. Storefront and entrance door hardware.
3. Power supplies for electric hardware.
4. Cylinders for doors fabricated with locking hardware.

B. Related Sections:

1. Section 06200 - Finish Carpentry: Finish Hardware Installation.
2. Section 07900 - Joint Sealers – exterior thresholds.
3. Section 08100 - Metal Doors and Frames.
4. Section 08200 - Wood and Plastic Doors.
5. Section 08300 - Special Doors.
6. Section 08400 - Entrances and Storefronts.
7. Section 16722 - Fire/Life-Safety System.

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.
7. Access doors and panels, except cylinders where detailed.

1.2 REFERENCES:

- A. Use date of standard in effect as of Bid date.
- B. American National Standards Institute – ANSI 156.18 – Materials and Finishes.
- C. ANSI A117.1 – Specifications for making buildings and facilities usable by physically handicapped people.
- D. ADA – Americans with Disabilities Act of 1990
- E. BHMA – Builders Hardware Manufacturers Association
- F. DHI – Door and Hardware Institute
- G. NFPA – National Fire Protection Association

1. NFPA 80 – Fire Doors and Windows
2. NFPA 101 – Life Safety Code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Door Assemblies

1.3 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Provide quantity of submittals as described in Submittal Section 013300. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
- B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
- C. No substitutions are allowed for Door Hardware Section
- D. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, wiring/riser diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

1.4 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
 - (1) Responsible for detailing, scheduling and ordering of finish hardware.
- B. Hardware: New, free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C / UBC Standard 7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
 - 1. Note: scheduled resilient seals may exceed selected door manufacturer’s requirements.
 - 2. See 2.6.E for added information regarding resilient and intumescent seals.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 - 1. Permanent keys and removable cores: secured delivery direct to Owner’s representative.
- B. Acceptance at Site: Items individually packaged in manufacturers’ original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

- C. Storage: Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc...

1.6 PROJECT CONDITIONS:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical as the same operation and quality as type specified, subject to Architect's approval.

1.7 SEQUENCING AND COORDINATION:

- A. Conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
- B. Furnish manufacturer templates to door and frame fabricators.
- C. Use hardware consultant to check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
 - 1. Confirm that door manufacturers furnish necessary UBC-7-2 compliant seal packages.

1.8 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' warranties:
 - 1. Closers: Ten years mechanical.
 - 2. Exit Devices: Five years.
 - 3. Hinges: Life of Building.
 - 4. Manual Surface Door Closer Bodies Twenty Five years.
 - 5. Locks Latches Ten years
 - 6. Cylindrical Heavy Duty Locks Latches Seven years

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Listed manufacturers as listed below. All hardware shall be Heavy Duty rated, Grade 1 products only. No substitutions allowed.

ITEM:	MANUFACTURER:
Hinges	McKinney ASSA ABLOY
Door Closers	Norton
Key System	Corbin Russwin (RU)
Cylindrical Locksets	Corbin Russwin (RU) CL3300 Series
Mortise Lockset	Corbin Russwin (RU) ML2000 Series
Multi-Point Lockset	Corbin Russwin (RU) FE6600 Series
Push Rail Exit Devices	Corbin Russwin (RU) ED4000/ED5000S Series
Auto Flush Bolts Surface Bolts	Rockwood Products ASSA ABLOY

Push & Pull Plates	Rockwood Products ASSA ABLOY
Kickplates	Rockwood Products ASSA ABLOY
Stops	Rockwood Products ASSA ABLOY
Overhead Stops	Rockwood Products ASSA ABLOY
Thresholds	Pemko Products ASSA ABLOY
Seals & Bottoms	Pemko Products ASSA ABLOY

- B. Provide hardware items required to complete the work in accordance with these specifications and manufacturers' instructions.
1. Include items inadvertently omitted from this specification that are shown in the door schedule. Submit items from the same list of manufacturers as listed above. Note these items in submittal for review.
 2. Where scheduled item is now obsolete, bid and furnish manufacturers updated item at no additional cost to the project.

2.2 HANGING MEANS:

- A. Conventional Hinges: Hinge open widths minimum, but, of sufficient throw to permit maximum door swing. Steel or stainless steel pins and concealed bearings.
1. Three hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.
 2. Extra heavy weight hinges on doors over 3 foot, 5 inches in width.
 3. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins.
 4. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
 5. Provide shims and shimming instructions for proper door adjustment.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Mortise Locksets and Latchsets: as scheduled.
1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
 2. Latchbolts: ¾ inch throw stainless steel anti-friction type.
 3. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
 - a. Spindles: security design independent break-away. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
 4. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
 5. Deadbolts: stainless steel 1-inch throw.
 6. Electric operation: Manufacturer-installed continuous duty solenoid.
 7. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
 8. Certifications:
 - a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.

- b. ANSI/ASTM F476-84 Grade 31 UL Listed.

2.4 EXIT DEVICES/PANIC HARDWARE

A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through touch pad design. No exposed touch bar fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. ¾" throw deadlocking latchbolts.
4. No exposed screws to show through glass doors.
5. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
6. Releasable with 32 lb. maximum pressure under 250 lb. load to the door.

B. Specific features:

1. Non-Fire Rated Devices: cylinder dogging.
2. Lever Trim: Breakaway type, forged brass or bronze escutcheon min .130" thickness, match lockset lever design.
3. Rod and latch guards with surface vertical rod devices.
4. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware".

2.5 CLOSERS

- A. General: One manufacturer for closer units throughout the Work, including surface closers, high security closers, overhead concealed closers, floor closers, low-energy door operators and electromagnetic hold-open closers.

B. Surface Closers:

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Thru-bolts and wood doors unless doors are provided with closer blocking. Non-sized and adjustable. Place closers inside building, stairs and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Opening pressure: Exterior doors 8.5 lb., interior doors 5 lb., labeled fire doors 15 lb.
7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
9. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
10. Exterior doors do not require seasonal adjustments in temperatures from 120 degrees F to -30 degrees F, furnish data on request.
11. Non-flaming fluid will not fuel door or floor covering fires.

- C. Floor Closers: See 2.2: HANGING MEANS.

2.6 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Stainless steel (100 & 410 series). Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework or other hardware.
 - 1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
- E. Seals: Finished to match adjacent frame color. Resilient seal material: polypropylene, nylon brush, or solid high-grade neoprene. UL label applied to seals on rated doors. Substitute products: certify that the products equal or exceed specified material's thickness and durability.
 - 1. Proposed substitutions: submit for approval.
 - 2. Solid neoprene: MIL Spec. R6855-CL III, Grade 40.
 - 3. Non-corroding fasteners at in-swinging exterior doors.
 - 4. Fire-rated Doors, Resilient Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 - 5. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C / UBC Standard 7-2. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required. Adhesive-applied intumescent strips are not acceptable, use concealed-in-door-edge type or kerfed-in-frame type.
- F. Thresholds: As scheduled and per details.
- G. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

2.7 FINISH:

- A. Generally BHMA 625 Polished.
 - 1. Areas using BHMA 625 to have push-plates, pulls and protection plates of BHMA 629, Polished Stainless Steel, unless otherwise noted.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

- C. Aluminum items: match predominant adjacent material. Seals to coordinate with frame color.

2.8 KEYING REQUIREMENTS:

- A. Key System: Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. Initiate and conduct meeting(s) with Owner to determine system keyway(s) and structure, furnish Owner's written approval of the system.
 - 1. New factory registered master key system.
 - 2. Non-I.C. construction keying: inserted type partial key. At substantial completion, remove inserts in Owner's presence; demonstrate consequent non-operability of construction key. Give all removed inserts and all construction keys to Owner.
 - 3. Furnish 10 construction keys.
 - 4. Furnish 2 construction control keys.
 - 5. Furnish 1 extractor tool.
 - 6. Re-key entire project at no extra expense to Owner if missing construction keys.
- B. Key Cylinders: utility patented, 7-pin solid brass construction.
- C. Locks and cylinders: keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer. Provide removable cores.
- D. Permanent keys: secured shipment direct from point of origination to Owner.
- E. Billing List: Secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

- A. Factory trained, certified, and carries a factory-issued card certifying that person as a "Certified Installer". Alternative: can demonstrate suitably equivalent competence and experience.

3.2 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
 - 1. Notify Architect of any code conflicts before ordering material.
 - 2. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

3.3 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.
 - 1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 - 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
- B. Locate floor stops not more than 4 inches from the wall.
- C. Drill pilot holes for fasteners in wood doors and/or frames.
- D. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.4 ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
 - 1. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner's satisfaction.
- B. Inspection: Use hardware supplier. Include suppliers with closeout documents.
- C. Follow-up inspection: Installer to provide letter of agreement to Owner that approximately 6 months after substantial completion, installer will visit Project with representatives of the manufacturers of the locking devices and door closers to accomplish following:
 - 1. Re-adjust hardware.
 - 2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.
 - 3. Identify items that have deteriorated or failed.
 - 4. Submit written report identifying problems and likely future problems.

3.5 DEMONSTRATION:

- A. Demonstrate electrical and electronic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

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- B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

END OF SECTION

SECTION 092100
GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Gypsum drywall construction.
2. Joint and corner reinforcing.
3. Drywall accessories, including access panels.
4. Installation of access doors.

B. Related Work Specified Elsewhere:

1. Metal framing and furring.
2. Painting.
3. Furnishing access doors by trades requiring same.

1.2 QUALITY ASSURANCE

A. Applicable Code California Building Code latest edition as adopted by Project's jurisdiction.

B. Standards: Unless noted otherwise, latest edition, issue or revision applies.

1. Conform to Gypsum Association Recommended Specifications for Application and Finishing of Gypsum Board and Levels of Gypsum Board Finish.
2. American Society for Testing and Materials (ASTM) Specifications as referred to herein by number.

1.3 SUBMITTALS

A. Submit manufacturer's printed data and specifications for all materials proposed for use.

1.4 PRODUCT DELIVER, STORAGE AND HANDLING.

- A. All materials shall be delivered in the original packages, containers, or bundles, bearing the brand name and name of manufacturer.**
- B. All materials shall be kept dry and shall be stored in enclosed areas under roof and fully protected by weather. Do not use gypsum board that has been damaged by water.**
- C. Gypsum board shall be neatly stacked flat avoiding undue sagging or damage to edges, ends and surfaces.**

PART 2 – PRODUCTS**2.1 MATERIALS.**

- A. Water-resistant Gypsum Wallboard: Conform to ASTM C-630 with moisture resistant core and chemically treated paper; use 5/8 inch thick, tapered edge. For use at walls in toilet rooms and janitors room. Do not use for ceilings. Fire rated type “x” green board when specified to be fire walls.
- B. Fire Retardant Gypsum Wallboard: Gypsum board shall be 5/8-inch, tapered edge, mill fabricated, Type “X”, fire retardant, conforming to ASTM C-36 Use square edge panels for base layer of two layer application. For all uses except where shown to be water resistant.
- C. Gypsum Sheathing Board: Conform to ASTM C79 with treated core for fire rating. Use 5/8” thick with square edge. Provide with water-repellant paper.
- D. Fasteners: 1-1/4” Type “S” drywall screws.
- E. Corner Beads, Casing Beads and Edge Trim: Standard wallboard accessories, manufactured or galvanized steel with perforated flanges. Use Fast Mask drywall edge trim where drywall abuts window mullions or other hard finished surfaces.
- F. Joint Treatment Materials: Joint tape, adhesive, or compounds, as manufactured and recommended by the wallboard manufacturer, conforming to ASTM C-475.
- G. Access Doors: Specially designed for use in drywall construction and shall be fabricated from 16 gauge min. cold-rolled steel. Provide with concealed hinge and flush lock. Access doors shall have factory prime painted, except in toilet rooms provide satin stainless steel finish. Where construction requires, provide with fire rating.

PART 3 – EXECUTION**3.1 WALLBOARD APPLICATION.**

- A. Cut or saw all openings; do not score or punch. Sand cut edges and ends where necessary to obtain neat joining when wallboard is erected. Stagger joints in the board with abutting ends occurring over supports. To minimize end joints, use wallboard sheets of maximum practical lengths. Arrange joints on opposite sides of partition to occur on different studs.
- B. Fasteners: Space fasteners at 12” o.c. in the field and 8” o.c. staggered along abutting edges. While fasteners are being driven, hold the wallboard in firm contact with the underlying support. Proceed from the central portion of the wallboard toward ends and edges. Drive home with heads slightly below wallboard surface in a dimple formed by the fasteners head. Take care to avoid breaking the paper face. Fasteners shall be placed not closer than 3/8” from ends or edges of wallboard.

3.2 JOINT TREATMENT.

- A. Field Joints: Apply tape properly either by applying compound to joint and pressing in tape, or by mechanical tool designed for the process. Apply the second coat, extending the compound to least 3” beyond the joint centerline. Draw down to a smooth even plane. After drying, sand as needed to eliminate any high spots or excessive compound. Apply third coat, feathering joint treatment compound edges approximately six inches from center of joint. After drying, sand joints to leave a smooth even surface. Do not raise nap of paper when sanding.
- B. Fasteners: Cover fastener heads with three successive coats, each applied at a different direction. Apply as specified for field joints.
- C. Inside Angles: Treat inside corners and angles as for field joints, except fold the tape in the middle to provide a clean sharp corner, fully embedded.
- D. Outside Angles: Use metal corner beads and accessories standard with the wallboard manufacturer set in and finished with adhesive as for joints.
- E. Intersections with Other Materials: Where gypsum board abuts masonry and other materials, trim edge with metal trim.

3.3 GYPSUM BOARD FINISH.

- A. Gypsum Board shall be finished to the following levels according to Gypsum Association Recommended Specifications:
 - 1. Level 1: Concealed areas above ceilings; shafts; areas not visible in the finish work. Note: Where fire rating is required, conform to details of construction as required by approved fire-rated assemblies.
 - Level 3: Tile Substrate.
 - Level 5: All areas exposed to view in the finish work and to be painted.

3.4 ACCESS DOORS

- A. Install access panels in gypsum board walls and ceilings. Coordinate location with installation requiring the access panels. Bring to the attention of the Architect any discrepancies, lack of adequate clearance, interferences with cabinetwork, lighting fixtures, etc., for final decision by the Architect.
- B. Check access panels at the end of the job for proper opening and closing, and, if damaged, repair or replace as necessary.

3.5 MECHANICAL, PLUMBING AND ELECTRICAL WORK.

- A. Coordinate with mechanical, plumbing and electrical trades in the location and installation of their work. Provide bridging, bracing and backing to support their work installed in or on drywall construction. Do not close both faces of walls until their installations have been inspected and approved.

END OF SECTION

SECTION 093013

CERAMIC TILE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Ceramic floor tile.
2. Ceramic wall tile.

B. Related Work Specified Elsewhere:

1. Gypsum drywall backing.
2. Concrete finishes.
3. Prefabricated shower stalls

1.2 QUALITY ASSURANCE

A. Applicable Codes: California Building Code, latest edition.

B. Standards: Unless noted otherwise, latest edition or revision applies.

1. American Society for Testing and Materials (ASTM) as referred to herein by number.
2. American National Standards Institute (ANSI) Specifications as referred to herein by number.
3. Tile Council of America (TCA) "Handbook for Ceramic Tile Installation."

C. Provide a Master Grade Certificate bearing the certification mark of Tile Council with each carton of tile.

1.3 SUBMITTALS

A. Submit manufacturer's printed data and specifications for all material proposed for use.

B. Submit samples of tile showing full range of manufacturer's colors, textures and finishes. Samples shall be marked with manufacturer's name and color designation.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING.

- A. Deliver all products to jobsite in manufacturer's unopened cartons and containers with manufacturer's label and product designation intact.
- B. Store all tile cartons in a dry place.

PART 2 – PRODUCTS

2.1 MATERIALS.

- A. General: All ceramic tile shall meet or exceed the requirements of ANSI 137.1.
- B. Wall and Floor Tile: Refer to finish schedule for product designation, size, color and pattern designations and locations.
- C. Trim Tiles: Shall be of the type appropriate for the specified installation method. Trim size, color and shade shall match field tile. All exterior corners, jambs and closings to other surfacing materials shall use the proper trim units to complete a finished installation such as cove or bullnose units.
- D. Grout: Factory manufactured, non-shrinking, uniformly colored, latex Portland cement grout, conforming to ANSI A118.6.
- E. Latex – Portland Cement Mortar: Conform to ANSI 118.4.
- F. Sealer: For grout at all toilet and shower floors: Standard manufacturer sealer for tile grout equal to Hydroment “Grout Seal” as manufactured by Bostik (800)523-6530.
- G. Threshold: Solid marble in color as selected. Provide in shape as detailed; use single piece with no joints at each threshold.
- H. Provide extra amount of tile materials.

PART 3 – EXECUTION

3.1 INSPECTION.

- A. Inspect concrete slab to insure that no flooring materials or adhesives remain. Verify that curing compound were not used or have been completely removed.
- B. Inspect stud walls to insure proper installation, suitable for tile.

3.2 INSTALLATION - GENERAL

- A. General: Layout tile so field of pattern is exactly centered so that maximum size border tile may be used. Do cutting along outer edges. Cut and drill without

marring tile; smooth edges with fine stone. Fit carefully around pipes, outlets and similar items so cover plates or trim will cover cut holes.

- B. Wall Tile: Install wall tile over gypsum wallboard in accordance with ANSI A108.5 according to TCI Installation Method W243.
- C. Floor Tile: Thin Set Over Concrete Slabs: Install in accordance with ANSI 108.5 according to TCI Installation Method F113.
- D. Grout: Conform to ANSI 108.10. Grout tile flush with face of tile making a neatly finished surface even with top edge of the tile. Force grout into joints and compact at least three-quarters of joint depth or until it meets bond coat.
- E. Caulk around penetrations through tile using caulking compound compatible with grout color.
- F. Threshold: Place threshold in accordance with TCA Installation Method TR611, using specified mortar as bond coat. Provide 100% coverage of bonding material between threshold and floor.

3.3 CLEANING.

- A. Remove surplus mortar and clean tile. Use neutral cleaners as recommended by the tile manufacturer.
- B. After final cleaning allow tile to stand for a minimum of three days for curing of the grout. During this period, the traffic way shall be closed and no traffic allowed on the floor during this time.
- C. Seal all grout at toilet room floors. Conform to sealer manufacturer's recommendations.

END OF SECTION

SECTION 095100

ACOUSTICAL CEILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes

1. Acoustical ceiling panels
2. Exposed grid suspension system
3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
4. Perimeter Trim

B. Related Sections

1. Section 09 51 00 - Acoustical Ceilings
2. Section 09 51 13 - Acoustical Fabric-Faced Panel Ceilings
3. Section 09 53 00 - Acoustical Ceiling Suspension Assemblies
4. Section 09 20 00 - Plaster and Gypsum Board
5. Section 01 81 13 - Sustainable Design Requirements
6. Section 01 81 19 - Indoor Air Quality Requirements
7. Section 02 42 00 - Removal and Salvage of Construction Materials
8. Divisions 23 - HVAC Air Distribution
9. Division 26 - Electrical

C. Alternates

1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been approved by Addenda, the specified products shall be provided without additional compensation.

2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition,

color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material
 - A. Armstrong Fire Guard Products
10. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
11. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
12. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
13. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

G. International Code Council-Evaluation Services Report - Seismic Engineer Report

1. ESR 1308 - Armstrong Suspension Systems

H. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report

1. 0244 - Armstrong Single Span Suspension System

I. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010

J. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

K. International Well Building Standard

L. Mindful Materials

M. Living Building Challenge

N. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

1.4 SYSTEM DESCRIPTION

Continuous/Wall-to-Wall

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.

D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

a. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.6 SUSTAINABLE MATERIALS

Transparency: Manufacturers will be given preference when they provide documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List

Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.

1. Health Product Declaration. The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration open Standard.
2. Declare Label. The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).
3. Low Emitting products with VOC emissions data. Preference will also be given to manufacturers that can provide emissions data showing their products meet CDHP Standard Method v1.1 (Section 01350).
4. Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.
5. End of Life Programs/Recycling: Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.
6. Products meeting LEED V4 requirements including:

Storage & Collection of Recyclables

Construction and Demolition Waste Management Planning

Building Life-Cycle Impact Reduction

Building Product Disclosure and Optimization Environmental Product Declarations

Building Product Disclosure and Optimization Sourcing of Raw Materials

Building Product Disclosure and Optimization Material Ingredients

Construction and Demolition Waste Management

1.7 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

B. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

C. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.9 PROJECT CONDITIONS

A. Space Enclosure:

Standard Ceilings: Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

HumiGuard Max Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Ceilings with HumiGuard Max performance can be installed in conditions up to 120°F (49°C) and maximum humidity exposure including outdoor applications, and other standing water applications, so long as they are installed with either SS Prelude Plus, AL Prelude Plus, or Prelude Plus Fire Guard XL suspension systems. Products with HumiGuard Max performance can be installed in exterior applications, where standing water is present, or where moisture will come in direct

contact with the ceiling. Only Ceramaguard with AL Prelude Plus suspension system can be installed over swimming pools.

1.10 ALTERNATE CONSTRUCTION WASTE DISPOSAL

A. Ceiling material being reclaimed must be kept dry and free from debris.

B. Contact the Armstrong Recycle Center a consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant will provide assistance to facilitate the recycling of the ceiling.

C. Recycling may qualify for LEED Credits:

a. LEED 2009 - Category 4: Material and Resources (MR)

i. Credit MRc2: Construction Waste Management

b. LEEDv4 - MRp2 - Construction Waste Management Planning Qualifies as a material stream (non-structural) targeted for diversion. Ceilings will be source-separated and diverted through the Armstrong Ceiling Recycling Program.

c. LEEDv4-MRc5 -

i. Option 1: Divert ceilings to qualify for one of the 3 material streams (50%)

ii. Option 2: Divert ceilings to qualify for one of the 4 material streams (75%)

1.11 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Acoustical Panels: Sagging and warping

2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:

1. Acoustical panels: Ten (10) years from date of substantial completion

2. Suspension: Ten (10) years from date of substantial completion

3. Ceiling System: Thirty (30) years from date of substantial completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.12 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ceiling Panels:

1. Armstrong World Industries, Inc.

B. Suspension Systems:

1. Armstrong World Industries, Inc.

C: Perimeter Systems

1. Armstrong World Industries, Inc.

2.2.1 ACOUSTICAL CEILING UNITS

A. Acoustical Panels Type AP

1. Surface Texture: Fine

2. Composition: Mineral Fiber

3. Color: White

4. Size: 24 in x 48 in

5. Edge Profile: Angled Tegular 15/16 in for interface with PRELUDE XL 15/16" Exposed Tee grid.

6. Noise Reduction Coefficient(NRC): ASTM C 423; Classified with UL label on product carton 0.50

7. Ceiling Attenuation Class (CAC) : ASTM C 1414; Classified with UL label on product carton 35

8. Sabin:N/A
9. Articulation Class (AC):
10. Flame Spread: ASTM E 1264; Class A (UL)
11. Light Reflectance (LR) White Panel: ASTM E 1477; 0.83
12. Dimensional Stability: HumiGuard Plus
13. Recycle Content: Post-Consumer - 1% Pre-Consumer - 40%
14. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
15. Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
16. Acceptable Product: DUNE Second Look, 2711 No added formaldehyde as manufactured by Armstrong World Industries

2.3.1 METAL SUSPENSION SYSTEMS

A. Components:

Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

- a. Structural Classification: ASTM C 635 Heavy Duty duty
- b. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
- c. Sustainability: Environmental Product Declaration (EPD), Health Product Declaration (HPD)
- d. Acceptable Product: PRELUDE XL 15/16" Exposed Tee as manufactured by Armstrong World Industries

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three design load, but not less than 12 gauge.

D. Edge Moldings and Trim:

1. 7800 - 12' Wall Molding

E. Accessories:

1. 5594 - Compression Strut
2. 6091 - Safety Cable
3. 7126 - Spreader Hold Down
4. 7127 - Snap-in Access Tool

- 5. 7129 - Torsion Spring Hook Access Tool
- 6. 7130 - Torsion Spring Suction Access Tool
- 7. 7425 - Stabilizer Bar

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Follow manufacturer installation instructions.

B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

C. Suspend main beam from overhead construction with hanger wires spaced 4'-0" on center along the length of the main runner. Install hanger wires plumb and straight.

D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

C. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876, select option #1 then #8 to review with a consultant the condition and location of building where the ceilings will be removed. The consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant will provide assistance to facilitate the recycle of the ceiling.

END OF SECTION

SECTION 096500

RESILIENT FLOOR TILE

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. Solid vinyl floor tile.
- 2. Rubber floor tile.
- 3. Vinyl composition tile (VCT).
- 4. Resilient wall base and accessories.

- B. Related Sections include the following:

- 1. Division 9 Section "Resilient Athletic Flooring" for resilient floor tile for use in athletic-activity or support areas.
- 2. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with resilient floor tile.
- 3. Division 9 Section "Linoleum Floor Coverings" for linoleum floor tile.
- 4. Division 9 Section "Static-Control Resilient Floor Coverings" for resilient floor tile designed to control electrostatic discharge (ESD).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
 - 1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
- D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than **70 deg F** or more than **95 deg F**, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than **55 deg F** or more than **95 deg F**.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every **50** boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
 - 2. Resilient **Wall Base and Accessories**: Furnish not less than **10 linear feet** for every **500 linear feet** or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

- A. Colors and Patterns: **As indicated in the drawings.**

2.3 SOLID VINYL FLOOR TILE

- A. Solid Vinyl Floor Tile: ASTM F 1700.
 - 1. Armstrong World Industries, Inc.; as indicated in the drawings
- B. Class: As indicated by product designations.
- C. Type: as indicated in the drawings.
- D. Thickness: Per manufacturer's
- E. Size: as indicated in the drawings
- F. Fire-Test-Response Characteristics:
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 RUBBER FLOOR TILE

- A. Rubber Floor Tile: ASTM F 1344.
 - 1. As indicated in the drawings
- B. Fire-Test-Response Characteristics:
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.5 VINYL COMPOSITION TILE

- A. Vinyl Composition Tile (VCT): ASTM F 1066.
 - 1. As indicated in the drawings
- B. Class: As indicated by product designations.
- C. Wearing Surface: As indicated by product designations.
- D. Thickness: As indicated by product designations.
- E. Size: As indicated on the drawings.

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.6 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861. As indicated in the drawings.

2.7 RESILIENT STAIR ACCESSORIES

- A. Treads: FS RR-T-650. As indicated in the drawings.
- B. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
- C. Fire-Test-Response Characteristics:
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.8 RESILIENT MOLDING ACCESSORY

- A. Description: As indicated in the drawings.

2.9 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. 24 hours or per manufacturer's recommendation, whichever is more stringent.
 - b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles [**square with room axis**] [**at a 45-degree angle with room axis**] [**in pattern indicated**] <Insert requirements>.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles [**with grain running in one direction**] [**with grain direction alternating in adjacent tiles (basket-weave pattern)**] [**in pattern of colors and sizes indicated**].
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.
- G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 RESILIENT ACCESSORY INSTALLATION

A. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096800

CARPET

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. Woven carpet.
 - 2. Carpet cushion.
 - 3. Carpet Tile
- B. Related Sections include the following:
 - 1. Adhesives

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 12-inch square Sample.
 - 2. Exposed Edge Stripping and Accessory: 12-inch long Samples.
 - 3. Carpet Cushion: 6-inch square Sample.
- C. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.
- D. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- D. Mockups: Before installing carpet, install mockups for each type of carpet installation required to demonstrate aesthetic effects and qualities of materials and execution. Install mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Install mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be installed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before starting work.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Remove mockups when directed.
 - 7. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

- A. General Warranty: Special warranty 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. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Carpet Cushion Warranty: Written warranty, signed by carpet cushion manufacturer agreeing to replace carpet cushion that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse. Failure includes, but is not limited to, permanent indentation or compression.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET

- A. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Product: Use carpet as specified in the drawings finish plan. Provide carpet cushion on stairs.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:
 - 1. Carpet manufacturer.
 - 2. Carpet cushion manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following:
 - 1. Carpet manufacturer.
 - 2. Carpet cushion manufacturer.
- C. Tackless Carpet Stripping: Water-resistant plywood in strips as required to match cushion thickness and that comply with CRI 104, Section 11.3.
- D. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- E. Metal Edge Transition Strips: Extruded Aluminum Schluter with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:
 - a. Carpet manufacturer.
 - b. Carpet cushion manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. For wood subfloors, verify the following:
 - 1. Underlayment over subfloor complies with requirements specified in Division 6 Section "Rough Carpentry."
 - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:
 - 1. Carpet manufacturer.
 - 2. Carpet cushion manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."
- B. Double-Glue-Down Installation: Comply with CRI 104, Section 9, "Double Glue-Down Installation."
- C. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 10, "Attached Cushion."
- D. Carpet with Preapplied Adhesive Installation: Comply with CRI 104, Section 10.4, "Pre-Applied Adhesive Systems (Peel and Stick)."
- E. Hook-and-Loop Installation: Comply with CRI 104, Section 10.5, "Hook and Loop Technology."
- F. Stretch-in Installation: Comply with CRI 104, Section 11, "Stretch-in Installation."
- G. Stair Installation: Comply with CRI 104, Section 12, "Carpet on Stairs."
- H. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
 - 1. Bevel adjoining border edges at seams with hand shears.
 - 2. Level adjoining border edges.
- I. Do not bridge building expansion joints with carpet.

- J. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- K. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- L. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- M. Install pattern parallel to walls and borders.
- N. Install carpet cushion seams at 90-degree angle with carpet seams.
- O. If transitions between Carpet finishes and or other type of floor finish happens at doors, provide the transition directly below the door where it cannot be seen when door is in the closed position. Provide Schluter or thresholds between tile carpet and tile transitions.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 099000

PAINING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Painting and staining of all surfaces including as indicated in the drawings, but not limited to, the following:
 - a. Interior walls and hard lid ceiling surfaces as indicated in the drawings.
 - b. Interior exposed concrete plaster and masonry surfaces.
 - c. Interior ferrous metals.
 - d. Interior gypsum wallboard.
 - e. Interior wood trim, when indicated.
 - f. Exposed piping, conduits, and ductwork, when indicated.
 - g. Exposed mechanical equipment, when indicated.
 - h. Exposed electrical equipment, when indicated.

B. Related Work Specified Elsewhere:

1. Shop prime coats.
2. Factory finishes.
3. Painting work specified as work of other sections.

C. Materials not to be Painted:

1. Following surfaces are not to receive painter's finishes:
 - a. Work having complete factory finish other than prime coat.
 - b. Stainless steel and plated finishes (not zinc or cadium).
 - c. Finish hardware, except prime-coated items.
 - d. Walking surfaces, except when indicated.
 - e. Work specified not to be painted under other sections.

1.02 QUALITY ASSURANCE.

- A. Applicable Code: California Building Code, latest edition. California Green Standards Code, latest edition.
- B. Environmental Regulations: Conform to all applicable environmental regulations of all governing jurisdictions.

1.03 SUBMITTALS

- A. List of paint materials: Prior to submittal of color and gloss samples, submit for approval complete list of paint materials proposed for use, identifying each material by manufacturer's name, product name and number, including primers, thinners, and coloring agents. Submit manufacturer's catalog data fully describing each material as to contents, recommended usage, and preparation and application methods. Identify surfaces to receive various paint materials. Make no deviations from approved list. If applicable, provide a chart for comparison of manufacturer's numbers as herein specified to types of paint proposed for use.
- B. Color and Gloss Samples: Obtain color and gloss selections and instructions from Architect. Using materials from approved list, prepare and submit 8-1/2"x11" samples of each complete paint finish.

1.04 DELIVERY AND STORAGE.

- A. Delivery of Materials: Deliver to site in original, unopened containers with manufacturer's labels intact, describing contents with manufacturer's name, product name and number.
- B. Storage: Store all material off ground and in area providing protection from damage and from weather. Empty containers, and remove oily rags from building at end of each day's work. Take every precaution to prevent fire.
- C. Extra Paint: Provide Owner with 2 gallons of each type and color and gloss combination of paint used. Unless requested differently by Owner. Provide in manufacturer's sealed containers.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials of standard manufacture of types as specified herein in paint schedule. Provide materials by one of the following manufacturers: Dunn-Edwards, Sherwin Williams, and PPG. Equal products by other manufacturers are acceptable upon approval by the Architect first.
- B. Paint Systems: Unless otherwise specified or approved, use paint products of one manufacturer. In any case, primers and intermediate and finish coats in each paint system must be products of same manufacturer, including thinners and coloring agents.
- C. Factory Mixing: To maximum extent practicable, factory mix each paint material to color, gloss and consistency for application.
- D. At completion of job, provide 5 gallons of extra paint for field colors and 2 gallons for accent colors of all type and color.

PART 3 – EXECUTION

3.01 CONDITIONS OF SURFACES.

- A. Examination of Surfaces: Examine surface to be finished under this Section and verify that work of other trades has been left or installed in satisfactory conditions to receive paint, stain or specified finishes. Before starting work notify Architect in writing of any surfaces unsatisfactory for proper paint finish. Application of first coat of any finishing process constitutes acceptance of surface.

3.02 PREPARATION.

- A. Properly prepare surfaces to receive finishes indicated, scheduled and specified.
- B. Shop coated Metal: Thoroughly degrease and clean all foreign matter. Clean and spot paint field connections, welds, soldered joints, burned or abraded portions with same material used in shop coats.
- C. Uncoated Ferrous Metal: Thoroughly degrease and clean dirt, rust, mill scale and foreign matter, using rotary brushes, solvent or sandblasting as necessary. Remove pits and welding slag, and clean to bright metal before priming. Apply primer within three (3) hours after preparation.
- D. Gypsum Wallboard Surfaces: Fill cracks, holes and other imperfections with proper patching compound, finish to match adjoining surface, and allow to thoroughly dry. Remove glaze on surfaces by sanding. After first or primer sealer coat is applied, touch up visible suction spots before next coat is applied; work shall not proceed until suction spots are sealed.
- E. Galvanized Metal and Zinc Alloy: Thoroughly degrease and clean off foreign matter. Apply phosphoric metal etch or vinyl-type pre-wash if type recommended by primer manufacturer, allow to dry and immediately apply primer paint.
- F. Wood: Carefully putty nail holes, cracks and other defects. Use non-staining putty to match wood. Remove all marks with a thorough final sanding of all exposed surfaces using 150 grit or finer sandpaper. Thoroughly dust and clean prior to applying sealer.
- G. Clean concrete surfaces of dirt, encrustations, efflorescence, and other matter. Repair all cracks, holes, pits, and smooth off to match adjacent surface.
- H. Fixtures, Equipment and Hardware Cooperate with other trades and coordinate removal of fixtures, equipment, and hardware items as required for painting work.
- I. Surfaces Not Mentioned: Prepare in accordance with paint manufacturer's recommendations and as approved.

3.03 WORK QUALITY

- A. Application: Unless otherwise specified, apply materials in accordance with manufacturer's instructions by brush, rollers or spray. Apply each coat at proper consistency, free of brush or roller marks, sags, runs, or any other evidence of poor work quality. Avoid lapping paint on glass, hardware, and other surfaces not to be painted; apply masking as required.
- B. Protection: Protect floors, fixtures, equipment and like surfaces with impervious protective covers or drop cloths. Exercise care to prevent paint from being splattered

onto surfaces not to be painted. Paint or repaint surfaces from which such paint cannot be satisfactorily removed, as required to produce acceptable finish.

- C. **Contrasting Color:** Where painting is executed in contrasting colors, cut to meet true lines. Holidays and restrikes on painted surfaces are sufficient cause for necessitating recoating entire surface involved.
- D. **Barricades:** Maintain barricades and wet paint signs for duration of need.

3.04 COATS AND COLORS

- A. Numbers of coats specified to be applied are minimum. First coat may be omitted on surfaces already painted; spot or undercoat with specified first coat as necessary to achieve results. Insure acceptable paint finishes of even, uniform color, free from cloudy or mottled appearance in surfaces and evident thinness of coating.
- B. **Mechanical and Electrical Items:** (Exposed on walls only in the finish work.)
 - 1. Exposed pipe line, fire sprinkler lines, ducts, plenums, conduits, hangers and like items, paint with one prime coat and two coats of flat wall paint.
 - 2. Electrical panels, cabinets, and like items, paint bare surface with one prime coat and then same as for exposed pipes.
 - 3. Plumbing fixtures: Except where concealed in cabinets or counters, paint unfinished underside of cast iron plumbing fixtures with enamel, finish matching color of wall finish against which same occurs, unless otherwise specified.
 - 4. Exposed mechanical equipment as specified for metal surfaces.

3.05 CLEANING AND TOUCH-UP WORK

- A. Make detailed inspection of paint finishes after painting work is completed, carefully remove spattering of paint material from adjoining work of others, particularly plumbing fixtures, trim, tile, and finish metal surfaces, and make good any damage thereto. Repair any abraded, stained or otherwise disfigured painting work and leave entire painting work in new conditions.

3.06 PAINTING SCHEDULE.

- A. Paint and finish surfaces as indicated by the following schedule of finishes for materials or surfaces indicated on drawings and specified herein. To designate type and quality of paint, Dunn-Edwards product numbers and designations are used. Specialty products are also indicated by special product designations.
- B. **Exterior Surfaces:**
 - 1. **Concrete Flat finish**

First Coat	ESPR00
Second Coat	EVSH10
Third Coat (as needed)	EVSH10
 - 2. **Concrete – Accent Colors: Semi Gloss finish**

First Coat	ESPR00
Second Coat	EVSH50
Third Coat (as needed)	EVSH50

3. Metal – Ferrous: Semi Gloss finish

First Coat	BRPR00 (omit if shop primed, touch-up as needed.)
Second Coat	EVSH50
Third Coat	EVSH50

4. Metal (Roll-Up Door and hollow metal doors):

First Coat	BRPR00 (omit if shop primed, touch-up as needed.)
Second Coat	EVSH50
Third Coat	EVSH50

5. Metal Ferrous

First Coat	Carboguard 890VOC (omit if shop primed, touch-up as needed.)
Second Coat	Carbothane 134VOC
Third Coat	Carbothane 134VOC

6. Metal Galvanized:

First Coat	ULGM00
Second Coat	EVSH50
Third Coat	EVSH50

7. Wood (Stain)

First Coat	SSHL10
Second Coat	SSHL10

8. Precision Concrete Masonry Block

First Coat	SBPR00
Second Coat	EDLX10-0
Third Coat (as needed)	EDLX10-0

9. Textured Masonry Block

First Coat	Okon W-1 or W-2
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C Interior Surfaces:

1. Concrete: Low Sheen finish Semi Gloss finish

First Coat	ESPR00	ESPR00
Second Coat	SPMA20	EVSH50
Third Coat	SPMA20	EVSH50

- | | | |
|---|---|-------------------|
| 2. Gypsum Wallboard: | Low Sheen finish | Semi Gloss finish |
| First Coat | VNSL00 | VNSL00 |
| Second Coat | SPMA20 | EVSH50 |
| Third Coat | SPMA20 | EVSH50 |
| 3. Gypsum Wallboard: Flat Finish | | |
| First Coat | VNSL00 | |
| Second Coat | SPMA10 | |
| Third Coat | SPMA10 | |
| 4. Metal: Ferrous | | |
| First Coat | ENPR00 (Omit if shop primed, touch-up as needed.) | |
| Second Coat | EVSH50 | |
| Third Coat | EVSH50 | |
| 5. Wood: (Unless specified otherwise in cabinet and door details) | | |
| Pretreatment | Old Masters Wood Sealer | |
| First Coat | Old Masters Wood Stain | |
| Second Coat | Old Masters WB Polyurethane | |
| Third Coat | Old Masters WB Polyurethane | |
| 6. Concrete Floors (where shown) | | |
| First Coat | Epoxy spot filler as needed | |
| Second Coat | Micro-Seal Densifier by Rainguard | |

END OF SECTION

SECTION 220000**PLUMBING****PART 1 - GENERAL**

- 1.0 Applicable provisions of General Conditions apply to the work of this section.
- 1.1 **WORK INCLUDED:** All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations of the work of this section, complete, as shown on the drawings or specified herein. Work included but not necessarily limited to the following:
- A. Note that the work of this section may be indicated on any of the contract drawings.
 - B. All soil, waste, vent and sanitary drainage piping inside of building and their connection from new fixtures to existing plumbing lines inside the building.
 - C. Domestic hot and cold water inside of building.
 - D. Furnishing and installing of plumbing fixtures, etc.
 - E. Work indicated on drawings but not mentioned in specifications, or vice versa, shall be performed the same as if specifically mentioned or indicated in both locations. All supplementary labor or materials required for a complete, approved, and properly operating installations shall be furnished whether or not indicated and specified, and without additional cost to Owner.
 - F. Permits and fees required for the installation of work of this section.
- 1.2 **RELATED WORK IN OTHER SECTIONS**
- A. Temporary water.
 - B. All line voltage electrical wiring and conduit.
 - C. All field painting.
 - D. Miscellaneous structural concrete, iron work and floor gratings.
 - E. Fire sprinkler system including standpipe systems.
- 1.3 **REFERENCED GENERAL REQUIREMENTS**
- A. Administrative Requirements: Work covered by Contract Documents; Site Conditions; Codes.

- B. Cutting and Patching.
- C. Submittals: Scheduling submittals: project schedule data.
- D. Shop Drawings, Product Data and Samples: Drawings; material list; catalog cuts; samples.
- E. Quality Control.
- F. Field Quality Control tests.
- G. Construction Facilities and Temporary Controls: Protection of work and property; cleanup during construction.
- H. Product Options and Substitutions: Proprietary specifying; Contractor requested substitutions.
- I. Contract Closeout: Final cleanup; warranties; record documents; operation and maintenance manuals.

1.4 PROJECT CONDITIONS

- A. Provide for site conditions. Contractor to note that part of this project consists of an existing building and parts of the building will be occupied at all times. Contractor shall include all coordination in regard to this specific item.
- B. Verify location of connections to existing waste, water and gas lines. Verify structural elements of existing conditions.
- C. Examine drawings and specifications. Report discrepancies. Report conflicts with statutory requirements. Obtain resolution of discrepancies and/or conflicts prior to bidding.
- D. Provide products and labor for work of this section to same extent required for work as a whole as specified in other sections and to extent required by statute.
- E. Coordinate work of this section with affected trades. Report conflict and discrepancies.
- F. Consult with affected trades regarding installation clearances. Report conflicts.
- G. Do not proceed in area of conflict until such has been resolved.

1.5 CODE PERMITS, FEES AND ACCEPTANCES

- A. Codes.
 - 1. Defined in other sections.
 - 2. Comply with codes.
 - 3. Comply fully with local fire department.
- B. Permits and Fees.

1. Provide for the work of this section as required.
2. Obtain and pay for permits for work of this section.

C. Acceptances.

1. Prior to acceptance furnish owner with such sets of operation and maintenance manuals as are required by other sections. Provide valve legend, table of contents, and all warranties.
2. Obtain architects acceptance of all systems and operations.

1.6 UTILITIES CONNECTION AND METERING:

A. PERMITS, FEES, TAXES AND UTILITY CHARGES

1. It shall be the responsibility of the Plumbing Contractor to give all notices obtain all permits required for the plumbing installation and to pay all charges required for such permits.
2. The Plumbing Contractor shall further pay all fees, utility service charges and taxes imposed by State, Municipal, Utility and other bodies, required in connection with the installation of the project covered by this specification.
3. If certain plumbing work is done by others, such as a utility company or a municipality, all charges for such work shall be paid by the Plumbing Contractor.
4. Where inspections are required by the state, local building, fire and/or utility authorities is shall be the responsibility of the contractor to secure such inspections as required by the Authorities with jurisdiction over the project site. All charges made by plumbing inspections shall be paid by the Plumbing Contractor.
5. Where applications for permits or services are required for procuring of such permits or Utility service to the project, the Contractor shall see that all such applications are properly filed with the Utility Company or regulatory agency. All information required for such applications by the authorities having jurisdiction is presented to the extend and in the form required.
6. Additionally, the Plumbing Contractor shall obtain all required Certificates of Inspection for the work under his contract and deliver same to the Engineer before request for acceptance of any portion of the work is made and before final payment.
7. UTILITY COMPANY REQUIREMENTS: All parts of gas and water installation shall comply with the requirements of the respective utility company serving the building.

1.7 QUALITY ASSURANCE

- A. Supervision: Perform the work under the continuous supervision of a competent superintendent and/or foreman capable of understanding the contract documents and implementing their requirements. Do not change supervisor without acceptance of substitution by Architect.
- B. Workmanship: Employ workmen skilled in the various types of work being performed.
- C. Perform work as specified.
- D. Replace work not conforming to reviewed/accepted shop drawings/product data.

- E. Replace work not conforming to contract requirements.

1.8 SCHEDULING

- A. As specified in other sections.
 - 1. Schedule submittals.
 - 2. Provide progress schedule data.
 - 3. Contractor shall include all required time to meet with owner's representative in his work to schedule all construction for the project, at no additional cost.

1.9 SUBSTITUTION

- A. Procedures for requesting substitutions are specified in General Conditions.

1.10 SUBMITTALS

- A. Shop Drawings.
 - 1. Comply with pertinent provisions of other sections.
 - 2. Drawings shall indicate following.
 - a. All information required to indicate compliance of system with design criteria and other contract requirements.
 - b. Coordination with structural elements, ceiling system, lighting fixtures, HVAC outlets, and ductwork.
 - 3. Submit underground plan and riser plan for preliminary review.
 - 4. Submit dated, certified reports for required tests.
 - 5. Submit complete drawings for final review.
- B. Product Data.
 - 1. Piping and accessories for each system.
 - 2. Fixtures, faucets, etc.
 - 3. Gauges.
 - 4. All storage tanks.
 - 5. Hangers.
- C. Manufacturer/Supplier product specifications and installations instructions.
- D. Manufacturer/Supplier certificates attesting that products furnished comply with standards specified/referenced herein.
- E. Samples.
- F. Contractor's Material and Test Certificates.
- G. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

1.11 RECORD DOCUMENTS

- A. Provide as required by General Conditions.
- B. Provide/maintain shop drawings for work of this Section.
- C. Record drawings shall bear stamp imprints and signatures indicating their acceptability to building authorities.

1.12 PROTECTION OF WORK AND PROPERTY

- A. Provide as specified in other sections.
- B. Repair and make good damage resulting from the work of this section.

1.13 TEMPORARY WATER

- A. Provide as required per code.

1.14 INSPECTIONS REQUIRED

- A. Arrange for and provide inspections required by building authorities.
- B. Include all inspections as required by tank manufacturer.

1.15 CUTTING AND PATCHING

- A. Perform as specified in other sections.

1.16 WARRANTY

- A. Provide installer's warranty as specified in other sections.
- B. Provide warranties for all new equipment installed under the work of this section. Contractor to provide a full one-year warranty from the date of project's final acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

- A. To the extent possible mechanical and electrical components shall be:
 - 1. U.L. listed.
 - 2. Factory Mutual approved.

2.2 MATERIALS

- A. All materials for the same general use shall be of the same type and manufacturer.

2.3 PIPE SCHEDULE

- A. Pipe and fittings.
 - 1. Main water service below grade:
 - a. Pipe: Copper type K make joints with silfose.
 - b. Fittings: Wrought copper to match pipe material.
 - 2. Domestic and Industrial water piping in building:
 - a. Pipe: Copper type L make joints with 95-5 silver solder or staybrite or approved equal by governing authorities.
 - b. Fittings: To match pipe material.
 - 3. Soil, Waste and Vent piping:
 - a. Soil, waste and vent piping to 5' outside the building may be one of the following:
 - 1) Hubless cast iron soil pipe and fittings, CISPI - 301, ASTM A888, with stainless steel clamp and shield couplings, CISPI - 301
 - 2) Hubless cast iron soil pipe, CISPI- 301, ASTM A888 with hub and spigot cast iron fittings CISPI - 301, ASTM A74 with the A.B. & I. "Best" cast iron coupling and rubber gaskets, ASTM C564.
 - 3) Hubless cast iron soil pipe, CISPI-301, ASTM A 888 with M.G. mechanical joint couplings.
 - 4) Schedule 40 ABS or PVC DWV pipe and drainage pattern fittings. Solvent cement joints.
 - b. Soil piping from 5' outside the building may be one of the following:
 - 1) Certainteed Corp. "fluid tight" p.v.c. gravity sewer pipe and fittings or approved equivalent.
 - 2) Extra heavy bell and spigot vitrified clay pipe and fittings with compression joints.

3) Same as specified to 5' outside building.

c. Cleanouts:

- 1) Acceptable Manufacturers: J.R. Smith as specified, or equivalent by Josam, Wade or Zurn.
- 2) Accessories: Where installed in construction with waterproof membrane, provide cleanouts with flashing clamp device with corrosion-resistant clamping bolts.
- 3) Floors:
 - a) Finished (tile or resilient covering): J.R. Smith #4048 with Nikaloy square top and tapered thread bronze plug. Set tops square with floor tile or resilient covering pattern.
 - b) Unfinished: J.R. Smith #4248 with cast iron round tractor type cover and tapered thread bronze plug.
- 4) Walls: Tapped tee or C.I. ferrule, with tapered thread bronze plug. J.R. Smith #4472 chrome plated for tiled walls, prime coated for painted walls.

d. Floor Drains:

- 1) Acceptable Manufacturers: J.R. Smith as specified, or equivalent by Josam, Wade or Zurn.
- 2) Accessories:
 - a) Where installed in conjunction with waterproof membranes, provide with flashing clamp device with corrosion-resistant clamping bolts.
 - b) Provide with trap primer tailpiece where required. J.R. Smith #2695Y-2.

B. Pipe Supports.

1. Provide pipe support and bracing to comply with governing authorities.
2. Manufacturers: Unistrut, Grinnel, Superstrut.

2.4 PIPE MATERIALS, FITTINGS AND VALVES

- A. Copper pipe Type L wrought copper to match with pipe material. Make joints with 95-5 silver solder.
- B. Lead: New pig lead, conforming to ASTM B29-43.
- C. Hemp Packing: Impregnated jute, manufactured for caulking soil pipe and fittings.
- D. Galvanized or Black Iron Pipe: Standard weight pipe conforming to ASTM A12-47.
- E. Fittings Service weight cast iron drainage type fittings for steel lines. Wrought copper fittings for copper lines.
- F. Unions: For connections in iron pipe lines 2 1/2 inches and smaller, use ground joint brass to iron unions. Unions in copper lines shall be copper to copper.
- G. Victaulic Couplings may be used where permitted by code.

H. Valves shall conform to the following (unless specifically noted on the drawings as another type):

1. Gate Valves: Solid wedge disc, rising stem. Non rising stem may be used only where there is insufficient clearance.
 - a. 3" and smaller: Nibco #111 (rising stem)
 - b. 3" and smaller: Nibco #113 (non-rising stem)
 - c. 4: and larger: Crane # 465
2. Globe Valves: Replaceable composition disc suitable for 200 degrees hot water.
 - a. 2" and smaller: Crane #7, bronze, screwed.
 - b. 2 1/2" and larger: Crane #359, iron body, flanged.
3. Check Valves:
 - a. 3" and smaller: Nibco #433 bronze, screwed, swing check type.
 - b. 4" and larger: Crane #373, flanged
4. Gas Cocks:
 - a. 2" and smaller: Crane #250. bronze, screwed.
 - b. 2 1/2 and larger: Nordstrom #142
5. Strainers:
 - a. 3" and larger: Crane #988, screwed.
 - b. 4" and larger: Crane 989, flanged.
6. Ball Valves, 3" and smaller:
 - a. Water Service Nibco #595
 - b. Gaseous Service Nibco #595
7. Pressure Regulators: (except as specifically noted on the drawings), Wilkins Series 500. Install with brass strainer upstream of regulator.
8. Partition Stop Valves: Chicago Faucet #1771, loose key type.

2.5 FLASHING

- A. Flash all pipes passing through roof with Semco #1100-4 seamless four-pound flashing with steel reinforced varipitch boot and cast iron counterflashing sleeve.

2.6 PIPE HANGERS

- A. Water piping: ee and Mason #199 adjustable split ring hangers with supporting rods. Provide Semco Series #100 or #500 Trisolators.

- B. Soil and Waste Piping: Fee and Mason #199 adjustable split ring hangers with supporting rods. Use Fee and Mason #241 riser clamps at each floor and as required.
- C. Hangers and/or clamps may be Unistrut or Superstrut.
- D. For all piping with insulation, use sheet metal pipe saddles, minimum of eight inches (8") long, saddles to match pipe size and shall be 180 degrees, for insulation protection.

2.7 CLEANOUTS

- A. Exterior: Smith #4253 with X.H. cast iron top in concrete areas. In nonsurfaced or blacktop areas install with ring of concrete 6" below surface.
- B. Floors: Smith #4023 with round nickel bronze top in finished room floors. Smith #4223 with round cast iron top in unfinished room floors. Cleanouts shall be flush with floor type with adjustable water-type cover, having integral anchoring flange and clamping collar when waterproofing membrane is used.
- C. Finished Walls: Smith #4532 with round chrome plated or stainless-steel access plate and screw.
- D. Cleanout plugs shall be extra heavy bronze plugs.

2.8 ACCESS BOXES

- A. Walls: Potter-Roemer #9000 with stainless steel face in tile walls. Use Potter-Roemer #9000-AZ with bonderized prime coated steel face and with Allen lock in walls of other finished rooms.
- B. Ceilings: Use Potter-Roemer #9000-AZ with bonderized prime coated steel face and with Allen lock in walls of other finished rooms.
- C. Floors: Smith #4910 with polished aluminum alloy or nickel bronze non-skid top in finished rooms. Use Smith #4910 with plain aluminium or nickel bronze not skid top in unfinished rooms. Use Smith #4920 for floors covered with tile.
- D. Yard Boxes: Set flush with finished grades with 4" thick concrete pad under perimeter, but not interior of box.

2.9 PRESSURE GAGES AND THERMOMETERS

- A. Pressure gages shall be Marsh with 4 1/2-inch dial, provide with gage cock.
- B. Thermometers shall be Trerice 9" BX series straight, angle or oblique as required, equipped with separable sockets and well. Provide extension necks as required on insulated lines.
- C. Gauges and thermometers shall be installed and arranged for easy reading from the floor.

2.10 TRAPS

- A. For lavatories and sinks, except service sinks, shall be chrome plate cast brass, L.A. pattern with brass nuts. Provide trap insulators as required by Handicapped Code. Insulators shall be preformed. Wrapping insulation around trap is NOT acceptable.

2.11 WATER HAMMER ARRESTORS

- A. Smith #5000 Series stainless steel.

2.12 FIXTURES AND EQUIPMENT:

- A. Refer to drawings for fixture specifications.

2.13 BACKFLOW PREVENTERS

- A. Where installed in finished rooms, all exposed surfaces shall be polished chrome plated. All flush valves shall be diaphragm type and shall be furnished with approved vacuum breakers.

2.14 INSULATION

- A. Hot water and hot water return piping: Furnish and install 1" thick fiberglass pipe insulation with preformed insulation fittings. This shall also apply to industrial hot water and hot water return piping.
- B. Condensate drain lines inside the building shall be insulated with one-inch (1") fiberglass insulation.

2.15 WATER COOLERS - Type DF-1:

- A. As schedule on the drawings.

2.16 OTHER MATERIALS

- A. All other materials, not specifically described but required for a complete and operating facility, shall be new, first quality of their respective kinds, and subject to acceptance.
- B. Materials not specifically mentioned shall conform to ASTM, ASME, AGA, and ANSI standards.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect area of installation and status of related work.
- B. Measure work in place: Dimensions critical to installation, including level and plumb.
- C. Report conditions preventing proper execution.
- D. Do not proceed in areas adversely affected until deficiencies are corrected.

3.2 PREPARATION, LAYOUT AND DETAILING

- A. Verify all spaces, dimensions, locations, conditions, etc., required for installation of all plumbing and related work, assume full responsibility thereof.
- B. Obtain all necessary rough-in data and dimensions for all fixtures, equipment, owner furnished equipment, and equipment furnished under other sections.
- C. Earth or gravel cover over under-floor lines shall be 4" minimum.
- D. No exposed pipes or conduit will be permitted to show on interior of building in any finished room. Where this would occur, exposed portion shall be furred or cased when not adjacent to the wall.
- E. No underground line shall be installed less the ten inches away from any refrigerant piping.
- F. Maintain ample headroom, clearances and accessibility. Interferences between work of various trades will be resolved by the Architect whose decision will be final. Relocate or offset any work as required to accommodate work of other trades, all at no additional cost to Owner. Maintain ceiling heights to avoid excessive furring requirements.
- G. If not exactly located on drawings, obtain locations of fixtures, equipment, appliances, etc. from Architect. No tolerance will be allowed.

3.3 ROUGHING-IN

- A. Proceed with rough-in as rapidly as construction will permit. Fit all piping within available spaces using fittings, offsets, hangers, etc. as required to accomplish this result. Notify Architect and Owner when rough-in is complete s they may inspect and verify locations of all rough-ins, stub-ups, etc., prior to closing in of walls or pouring of concrete floors.

3.4 PIPE INSTALLATION AND HANGERS

- A. All piping shall be run concealed in finished rooms. In other rooms where piping run is exposed, place in unimportant and out-of-way places, and as accepted by Architect.
- B. All vertical pipes shall be plumb, grade horizontal pipes to uniform slopes as required, where two or more pipe runs are placed together, run parallel to each other.
- C. All piping shall be installed either parallel or at right angles to building walls.
- D. Remove foreign material from all pipes, valves, and fittings. Whenever pipes are cut for caulking or screwed fittings, carefully ream out and cleanoff all burrs, chips, and dirt.
- E. Provide shut-off valves at all fixtures, where indicated on the drawings, and where required for proper control of the system. Provide shut-off valves at the piping connections to all equipment can controls. Where valves are located in concealed piping, furnish and install metal access panels of suitable size and of the type specified
- F. Unless flanges are indicated, a union shall be installed at bypasses and equipment connection adjacent to all valves and elsewhere as indicated or required for ease of installation and servicing. Under no circumstances shall unions be installed in inaccessible locations.
- G. Install approved dielectric unions when joining dissimilar metals. Use of couplings will not be permitted.
- H. Make suitable provisions for maximum expansion and contraction of all piping. Provide swing joints fittings and anchors as required.
- I. Furnish and install water hammer arrestors on both the hot and cold-water pipe. Install in upright position at quick closing valves and fixtures, etc. as required. Locate behind access panel when located in concealed areas.
- J. Pipes passing though concrete or masonry walls or partition shall be run through rust-proof sleeves. Sleeves through waterproofed surfaces shall be cast iron and caulked watertight in an approved manner. Space between sleeves and pipes in other walls or partitions shall be packed tight with dense fiberglass, or other approved material. Any holes required after concrete is poured shall be cored drilled.
- K. Pipes passing through ceilings and stud walls shall be run through Sperzel Crete Sleeve.
- L. Exposed piping shall be equipped with cast brass, split hinged chrome plated escutcheon plates, locked in place with set screws. Where covering occurs, use long screws through covering.
- M. Joints in copper lines shall be thoroughly cleaned with sandpaper, fluxed, and lined as follows:
 - 1. 2 1/2 " and smaller: Use 95-5 silver solder where pressure is less that 150 PSIG and temperature is less that 150 degrees F.
 - 2. 3" and larger: Use silfose or stay-bite.
- N. Exposed plated, polished or enameled connections for fixtures shall show no tool marks.
- O. Valves, traps, and other apparatus shall be installed in easily accessible locations.

- P. Corrosion Control:
1. All steel pipe and fittings installed below grade shall be protected from the soil.
 2. All steel pipe and fittings below grade shall have a factory applied protective coating of extruded high-density polyethylene, 35 to 70 mils total thickness. All fittings and areas of damaged coating shall be covered with two-layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Protective coating shall be extended 6" beyond surrounding grade.
 3. All coated or wrapped piping shall be subjected to a 6000-volt holiday test in the field. Owner shall be furnished a certificate of inspection and guaranteed.
- Q. Water lines shall be run from point of connection at main to all fixtures, equipment and outlets as required for complete installation. Connect hot water lines to hot water heaters as shown on drawings. Extend hot water services to all fixtures, equipment and outlets as indicated on drawings. Hot water lines shall grade upward from the source of supply. Exercise care to prevent air traps in the hot water system. Insulate as required by governing codes.
- R. Cast Iron Pipe Joints:
1. Caulked joints shall be made with hemp packing and soft pig lead. Joints shall be run full at one pouring and caulked solid flush with hub. Hemp packing for sealed joint shall be of long fibers of best quality jute, woven in to strands and kept clean on covered bales until used.
 2. No hub joints are permitted if approved by local authorities. Use stainless steel bands above grade and type MG below grade.
 3. Vitrified pipe joints shall be made with wedgelock fittings.
- S. Access Boxes shall be provided and installed where indicated on drawings and over all concealed equipment such as valves, trap primers, water hammer arrestor, etc., of suitable size for service intended, minimum 10 x 10.
- T. Install cleanouts at all bends, angles and ends of all waste and sewer piping and where noted on drawings. All cleanouts shall be brought to grade and in all cases shall be accessible. Cleanouts shall not be located under or behind fixtures unless inaccessible. Verify where cleanouts will be considered accessible. All cleanouts threads shall be thoroughly greased when installed.
- U. Change in line sizes shall be made with reducing fittings. No bushings shall be used.
- V. Thoroughly ream or de-burr all piping prior to installation and after installation thoroughly blowout and wash out all piping. Make up all runs of piping with full length sections of pipe or lengths cut to fit. Use no couplings, except where length of run requires more than one length of pipe. The short length shall be used at ends and not in the middle of the run. Street elbows, long threaded pipe or running thread, or bullhead tees, shall not be used. All offsets shall be made with fittings and pipes shall not be bent at any time.
- W. Cut threads on pipe with clear sharp dies, full thickness of die. Make joints in all screwed pipe with approved pipe compound, completely covering male thread.
- X. Pipe supports: Provide pipe hangers and hanging rods as required to fully support pipes and weight of materials carried. Submit schedule of rods, pipe sizes, and supporting brackets.

- Y. Water Lines: Securely attach to walls, studs, etc. Isolate all such piping from the structure by a 1/8" thick felt pad wrapped around piping.
- Z. Backflow Prevention: Provide and install prevention devices where indicated on the drawings and where required by local ordinances. Where the operation of a backflow device causes water to be discharged, suitable collection devices shall be provided, and the water shall be piped to the nearest approved receptor or to a place of discharge acceptable to both the local authorities and the Architect.
- AA. Where maximum water pressure exceeds 75 PSIG or where indicated, furnish and install a pressure regulation valve assembly. Each PRV shall have a shutoff valve and strainer upstream and a shutoff valve downstream, unless otherwise detailed on the drawings. Provide pressure gauges on both sides of PRV. Install gage cocks ahead of each gage.
- BB. Polypropylene Pipe installation: Install per manufacturer's instructions. For clarity, submit these installation instructions for approval. If contractor has any questions regarding installation, request further direction from the engineer prior to beginning installation.
- CC. Submit hanger spacing allowed by manufacturer if contractor desires to exceed three feet between hangers.

3.5 HOT WATER HEATERS

- A. Provide shutoff valves and unions at both inlet and outlet connections. Install pressure temperature relief valve with test lever at each heater, mounted with element inside of tank. Mount heater inside 22 gage galvanized sheet metal pan with 3" lip and with soldered seams. Run 1" drain from pan to nearest receptor.

3.6 FLOOR DRAINS AND FLOOR SINKS

- A. When waterproofing membrane is used, permanently anchor membrane to drain with heavy cast iron clamping and bolts. Set floor drains low enough to permit slope of concrete floor where required by Architectural drawings.
- B. Install receptors for fire sprinkler test and system drain if required.

3.7 VALVES

- A. All valves shall be located in accessible places. Where it is necessary to install valve bodies in walls or floors, provide access panels with valve wheels and bonnets in accessible location. Gate valves shall be used on all lines requiring valves to be wide open or tight shut. All valves shall have name or trademark of manufacturers and guaranteed working pressure cast or stamped on body. All valves of the same type shall be of the same manufacturer.

3.8 PROTECTION

- A. Close all waste, vent, water and other pipe openings by means of a test plug, screw cap or other fitting. No paper, wood, brick, or other substitutes will be allowed. Plugs or caps shall not be

removed from openings except during the time the opening in pipe is being actually worked upon.

- B. All traps in closet bowls, urinals, sinks and lavatories shall be closed so that no debris can enter. Area drains shall be provided with an inner topping and shall be plugged during construction.
- C. Water Closets, lavatories, sinks, and other fixtures shall be fully protected during the course of construction. Should any fixture become damaged, then the contractor shall replace without additional cost to Owner.
- D. On completion of work and immediately prior to final test, remove all protection coverings, thoroughly clean all fixtures, and other equipment in connection with work, polish all bright work and leave work in neat, clean condition ready for use operation and acceptable to Architect.
- E. Valves, meters, regulators, and other equipment shall be protected from damage, when so directed by Architect, by properly located 6" diameter concrete filled pipe guard.

3.9 ADJUSTING

- A. Upon completion of work and after cleaning of system and apparatus, automatic parts of plumbing system shall be carefully adjusted for normal operation and make final adjustments where required. Inspect and clean vacuum breakers of any foreign materials that would hinder their proper functioning.

3.10 PIPE INSULATION

- A. Cover all hot water supply and return lines. Apply insulation over clean dry pipes with all joints butted firmly together. Insulate fittings with sections of pipe insulation cemented to a thickness equal to the adjoining insulation. Finish fittings with Glass cloth and with mastic type H. Insulation shall be protected at hangers, sleeves etc., with 16 gage saddles. All sections applying to domestic hot water apply also to the industrial hot water and industrial hot water return.
- B. Condensate drains for air conditioning units shall be insulated inside of building.
- C. Insulation exposed to weather shall be protected and make weatherproof by covering with aluminum jacket. Arrange seams to prevent trapping of moisture.

3.11 TRENCH EXCAVATION

- A. Perform as specified in other sections,
- B. Excavate all trenches for pipe work. Trenches for pipe assemblies in trench shall be of sufficient width to permit proper assembly of pipe. Excavate trench for cast iron soil pipe to a true gradient in a manner that will fully support pipe on sub-grade and with adequate bell-holes at proper intervals.

- C. Provide and maintain all necessary guard rails, covers or their protective structures as required by regulations.
- D. Upon completion of pipe work, all trenches shall be backfilled and compacted. Trenches shall be backfilled to spring line of pipe, moistened and thoroughly tamped with mechanical tamper to 90% of maximum density.
- E. All backfill in trenches containing wrapped pipe shall be done with sand to a level 6" above the top of the pipe.
- F. Promptly remove all water from all trenches or other excavations. Furnish pumps, attendants, and other facilities as required to keep the excavations dry until completion of work.

3.12 TESTS

- A. All tests shall be made in strict accordance with the applicable ordinances or as outlined below. If requirements of ordinances are more severe, they shall be followed.
- B. Architect, Owner and local authorities shall be notified in advance of time scheduled for tests so that they may have a representative at all tests.
- C. All tests shall be made in presence of and to satisfaction of Owner and local authorities. Test pressure shall be held for minimum of four hours without showing any leakage.
- D. Equipment which could be subject to damage due to test pressure shall be removed or isolated from system.
- E. All power and water and all instruments required shall be furnished by contractor as well as all necessary labor.
- F. Entire soil, waste and drainage system shall be tested under water pressure of 5 PSIG.
- G. All hot and cold-water piping shall be tested under a hydrostatic pressure of 175 PSIG.

3.13 CUTTING AND PATCHING

- A. Perform as specified in other sections.
- B. Do all cutting and patching and provide all openings together with lintels and supports which may be required for installation or work under this section of the specifications. Patching shall be of same material, workmanship and finish and accurately match all surrounding construction. All cutting and patching shall be done under the Architect's instruction, and when so required by mechanic who did original work. Where pipes pass through or interfere with any structural member, or where notching, boring, or cutting of structure is necessary, work shall be done as directed by the Structural Engineer. Top plates in bearing partitions shall not be cut or notched.

3.14 CHASES, SHAFTS, ETC.

- A. Contractor shall ascertain that all chases, furred pipe spaces and other shafts and pipeways required through walls, floors, ceilings, and roofs and through any parts of the structure, are properly located. Otherwise he shall cut new opening required at his own expense.

3.15 CLEAN-UP

- A. Perform as specified in other sections.
- B. After plumbing work has been tested and approved, contractor shall thoroughly clean all parts of the equipment and piping installation. Exposed parts which are to be painted, shall be thoroughly clean of cement, plaster, and other material, all grease or oil spots removed, and the material left in proper condition to receive painter's finish.
- C. Carefully wipe or scrape out all cracks and corners.
- D. Exposed rough metal work shall be carefully brushed with steel brushes to remove rust and other spots and left in proper condition to receive painter's finish.

3.16 STERILIZATION OF WATER LINES: DOMESTIC AND INDUSTRIAL WATER SYSTEMS.

A. General

1. Before being placed in service all potable water piping shall be chlorinated as specified by the local building and health department codes.
2. Chlorine may be applied by the use of chlorine gas-water mixture, direct chlorine- gas feed or a mixture of calcium hypochlorite and water. The powder shall be mixed with water to form a paste thinned to a slurry and pumped or injected into the piping as hereinafter specified.
3. If direct chlorine-gas feed is used it shall be fed with either a solution feed chlorinator or a pressure feed chlorinator with a diffuser in the pipe.

B. Procedure

1. Prior to cleaning, remove all dirt and foreign matter by a thorough flushing of the water system. The cleaning agent shall be fed slowly into the water system and the chlorine applied in quantities to produce a dosage of 50 PPM of available chlorine. Retention in the system shall be for a minimum of 8 hours. During the process all valves and accessories shall be operated.
2. After completion of the above requirements, the system shall be flushed until the water in the systems gives chemical and bacteria test readings as required by governing authorities.
3. Tests shall be conducted by a state-certified laboratory and approved by the local authorities having jurisdiction. Copies of the tests shall be submitted to the Architect and all governing authorities.
4. Warning signs shall be provided at all outlets while the cleaning of the system is in progress.

3.17 FIXTURES AND TRIM

- A. All faucets shall be equipped with renewable seats. All exposed metal parts of plumbing fixtures in toilet rooms and public areas shall be chromeplated. All plumbing fixtures shall be the product of one manufacturer, except where changes are approved in writing by the Architect.
- B. All fixtures shall be securely attached to supporting surfaces as specified and installed plumb and level. Grout behind all wall hung plumbing fixtures with white, durable plastic material, eliminating all cracks and voids.
- C. Separately valve every supply to every fixture and piece of equipment requiring various services with lockshield loose key stops. In general, these valves are specified with fixture, but where not called for in fixture specifications, provide suitable stops in addition to faucets.
- D. All connections to fixtures shall be made with drop elbows secured to building structure and outlet of elbow shall be screwed. Connections from elbow to fixture supply pipe shall be made with 85 % brass chrome plated nipple.
- E. Wall hung fixtures except as specified otherwise, shall be securely attached to 1/4 inch thick plate by 6" wide steel plate with 5/16" steel studs and nuts. Plate shall extend at least one stud beyond the first and last fixture mounting points. In wood stud construction, plate shall be carefully recessed flush with face of studs and securely attached to each stud with two 1/2" steel bolts on 4" on centers with 1/8" thick by 1 1/2" backup plates. In steel construction the plate shall be securely welded to each stud or as indicated with fixtures.

3.18 ACCESSIBILITY OF EQUIPMENT

- A. All valves, motors, controls, and other devices or components requiring service, maintenance, and/or adjustment shall be placed in fully accessible positions and locations. Provide access doors where required in construction, whether specifically detailed or not, to render all such items accessible.

3.19 EQUIPMENT EXPOSED TO WEATHER

- A. All equipment exposed to weather shall be protected in a manner recommended by the manufacturer and subject to approval of Architect whether indicated on plans or not.
- B. Where possible, weatherproofing shall be by manufacturer.
- C. Components requiring access for service, inspection, etc., shall have hinged access openings provided with clamp latches. The use of screws in lieu of hinges, or latches will not be permitted.

END OF SECTION 220000

SECTION 220100
DOMESTIC WATER SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION: Division 1 Conditions applies to this Section. Provide domestic water systems, complete.

A. Work in This Section: Principal items include:

1. Valved connection to site mains.
2. Backflow preventers.
3. Piping.
4. Plugged outlets.
5. Required connections to plumbing fixtures and equipment requiring same.

B. Related Work Not in This Section:

1. Section 230593 - Air and Water Test and Balance.
2. Section 230501 - Basic Mechanical Materials and Methods.
3. Section 230700 - Insulation.

1.2 SUBMITTAL DATA: In addition to requirements of Section 230500 - Mechanical General Provisions, submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, following:

A. Descriptive Data:

1. Piping.
2. Hose bibbs.
3. Sill cocks.
4. Backflow preventers.
5. Vacuum breakers.
6. Drain valves.
7. Automatic air relief valves.
8. Air chambers.
9. Relief valves.
10. Pumps, manufacturer's specifications including materials, construction, capacity rating, pump curves, controller, controls and wiring diagram.

B. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The

process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Industrial and Domestic Water Piping: Piping shall be Schedule "D" as specified in Section 230501 - Basic Mechanical Materials and Methods.
- B. Hose Bibbs: 1/2" faucets with CP cast brass body, composition washer, metal handle, 3/4" hose thread end. Wall flange on concealed piping. On exposed piping, less wall flange. Provide with vacuum breaker.
 - 1. HB - 1: Acorn Model 8121 with removable key handle.
 - 2. HB - 2: Acorn Model 8156, stainless steel wall box, with removable key handle.
- C. Sill Cocks: Flush type 3/4" wall hydrant with flush wall box, key locked hinged cover, integral vacuum breaker, 3/4" hose thread nozzle, bronze or brass parts throughout, female key operated valve with renewable seat and composition washer. Similar to Zurn No. 1340 or equal by Josam or Smith. Nickel bronze box and cover with polished face.
- D. Backflow Preventers: Reduced pressure type with bronze or stainless-steel trim, 2 spring loaded check valves, differential pressure relief valve, 2 rising stem gate valves and test cocks. Bronze body. Low head loss type. Similar to Watts No. 909 or equal by Cla-Val or Febco.
- E. Vacuum Breakers:
 - 1. For Plumbing Fixtures: As specified under Plumbing Fixtures.
 - 2. Hose Outlets: Cast brass body with rubber or flap type valve, 3/4" female hose thread inlet and 3/4" male hose threaded outlet. Similar to Watts No. 8B or equal by Febco.
 - 3. Noncontinuous Pressure Use Without Back Pressure: Cast brass body with full size orifice. Atmospheric type similar to Watts No. 288A.
- F. Drain Valves: Heavy rough cast brass faucets with composition washer and 3/4" hose end.
- G. Automatic Air Relief Valves: 3/4" cast brass construction, 150 psi wp; similar to Hoffman Specialty No. 78.
- H. Shock Absorbers: Provide for individual water branches to fixtures and equipment. 12" long air chambers same diameter as branch.
- I. Hot Water Circulators:
 - 1. Capacity as indicated. Similar to Bell & Gossett, Series "100".

2. Pumps: In-line, all bronze, flanged, flexible coupled centrifugal type with oil lubricated sleeve bearings, bracketed to motor. Maximum casing pressure 125 psi. Similar to Bell & Gossett.
3. Motors: Single phase capacitor or repulsion induction type, built-in overload protection, grease lubricated ball bearings, oil lubricated sleeve bearings and horizontally mounted.
4. Controllers: Single phase type, 2 poles, HP rated toggle disconnect switch, heavy duty HOA selector switch on single NEMA-1 enclosure. Similar to Allen Bradley Bulletin No. 600.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

- A. General: Piping installation shall be made in accordance with Section 230501 - Basic Mechanical Materials and Methods. Pressure testing shall be in accordance with Section 230593 - Air and Water Test and Balance.
- B. Insulation: Piping insulation shall be as specified in Section 230700 - Insulation.
- C. Piping:
 1. Free of traps.
 2. Grade and valve for complete control and drainage of system with drain cocks at low points and base of valved risers.
 3. Connections to equipment:
 - a. Flanges or unions.
 - b. Threaded adaptors used for swing connections.
 4. Terminate plugged or capped connections in threaded plug or threaded nipple and cap as required.

3.2 DISINFECTION OF WATER SYSTEMS:

- A. General: Disinfect all hot and cold-water systems.
- B. Supervisions and Testing: Perform disinfection under observation of the Architect. Give 2 days notice. Disinfection shall be subject to written approval upon receipt of satisfactory laboratory test results.
- C. Certification: Submit a certificate stating (1) system capacity (2) disinfectant used, (3) time and rate applied and (4) resultant residuals in parts per million at completion of work.
- D. Disinfecting Agent: Use chlorine gas aqueous carrier, type approved by the Architect, for water system disinfection with approved chlorinator.
- E. Preparation:

1. Service Cock: Provide service cock or valve within 3-feet of supply main for introducing disinfecting agent for lines.
2. Flushing: Leave each fixture or outlet wide open after final pressure tests until flow shows only clear water.
3. Domestic Hot Water Temperature: Reduce to that of cold-water system during disinfecting procedure.

F. Procedure:

1. Flushing: With system full of water and under "main" pressure, open all outlets.
2. Inject disinfectant through service cock at slow, even continuous rate until orthotolidine test at each outlet shows chlorine residual concentration of more than 50 parts per million (ppm).
3. Close all outlets and valves including service valve at main and injection cock. Maintain 24 hours.
4. Test: Orthotolidine test, after 24-hour period, shall show minimum chlorine residual concentration of 50 ppm. If not, repeat entire disinfection procedure.
5. Final Flushing: After satisfactory completion of above test, flush out system until orthotolidine tests show maximum chlorine residual of 0.5 ppm.

G. Preliminary Approval: After satisfactory completion of the disinfection procedure, inspector may issue a temporary approval for immediate human use of piping system pending bacteriological analysis of water samples.

H. Bacteriological Analysis of Water: After final flushing, analysis water samples to test negative for coil-aerogene organisms. Analysis to show total plate count less than 100 bacteria per cc or equal to control sample.

END OF SECTION 220100

SECTION 221300
DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION: Division 1 Conditions applies to this Section. Provide drainage system, complete.

A. Work in This Section: Principal Items Include:

1. Complete sanitary waste and vent systems, including:
 - a. Sanitary and storm system to point of connection (see drawings).

B. Related Work Not in This Section:

1. Section 230501 - Basic Mechanical Materials and Methods.
2. Section 230593 - Air and Water Test and Balance.
3. Section 230700 - Insulation.

1.2 SUBMITTAL DATA: In addition to requirements of Section 230500 - Mechanical General Provisions, submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, following:

A. Descriptive Data:

1. Floor drains.
2. Floor sinks.
3. Roof drains.
4. Overflow roof drains.
5. Cleanouts.
6. Pipe and fittings.
7. Valves.
8. Pumps: Manufacturer's specifications including materials, construction, capacity rating, pump curve, controller, controls, and wiring diagrams.

B. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: Piping systems shall be as specified in Section 230501 - Basic Mechanical Materials and Methods. Piping material shall be in accordance with the following:
 - 1. Sanitary Waste and Vent Piping: Schedule "F".
 - 2. Storm Drainage Piping: Schedule "F".

END OF SECTION 221300

SECTION 223000

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all plumbing equipment as shown on the Drawings, as specified, and as necessary for a complete system.

1.2 SUBMITTALS

- A. Shop Drawings and Product Data:

- 1. Refer to other sections, SHOP DRAWINGS, PRODUCT DATA & SAMPLES, for procedures.

- B. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractor's convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

1.3 GUARANTEE

- A. Furnish to owner a written guarantee against all defects in materials and workmanship in the hot water storage tank cement lining including cracking, leakage and flaking, for five (5) years from date of acceptance. Refer to other sections, GUARANTEES, WARRANTIES, BONDS, SERVICE & MAINTENANCE CONTRACTS, for submittal form.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As specified on the plumbing drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with the manufacturer's printed recommendations.
- B. Provide valves at each piece of equipment to provide isolation of the equipment from its connected system.

END OF SECTION 223000

SECTION 230500**MECHANICAL GENERAL PROVISIONS****PART 1 - GENERAL**

1.1 DESCRIPTION: Division 1 Conditions apply to Division's 22 and 23. This Section covers the Mechanical General Provisions and applies to all other Sections of Division's 22 and 23.

A. Work In Division's 22 and 23: Principal items include:

1. All labor, materials, equipment, and services necessary for a complete, safe installation in conformity with applicable codes and authorities having jurisdiction, including the following Specification Sections of the Contract Documents:

- a. Section 220000 - Plumbing
- b. Section 220100 - Domestic Water Systems
- c. Section 221300 - Drainage System
- d. Section 223000 - Plumbing Equipment
- e. Section 230500 - Mechanical General Provisions
- f. Section 230501 - Basic Mechanical Materials and Methods
- g. Section 230502 - Identification
- h. Section 230593 - Air and Water Test and Balance
- i. Section 230700 - Insulation
- j. Section 233100 - Ductwork
- k. Section 233200 - Duct and Plenum Lining

B. Related Work Not In This Section:

1. Consult all other Divisions, determine the extent and character of related work; coordinate work specified herein with that specified elsewhere.

1.2 DEFINITIONS:

- A. "Furnish" or "Provide": To supply, install and connect up complete and ready for safe and regular operation of particular work referred to unless specifically otherwise noted.
- B. "Install": To erect, mount, and connect complete with related accessories.
- C. "Supply": To purchase, procure, acquire, and deliver complete with related accessories.
- D. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.
- E. "Piping": Pipe, tube, fittings, valves, controls, strainers, hangers, supports, union, traps, drains, insulation, and related items.
- F. "Wiring": Raceway, fittings, wire, boxes, and related items.

- G. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within couple partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
 - H. "Exposed": Not installed underground or "concealed" as defined above.
 - I. "Indicated", "Shown", or "Noted": As indicated, shown, or noted on Drawings or Specifications.
 - J. "Similar" or "Equal": Equal in materials, weight, size, design, and efficiency to the specified product.
 - K. "Reviewed", "Satisfactory", "Accepted", or "Directed": As reviewed, satisfactory, accepted, or directed by or to the Architect.
 - L. "Motor Controllers": Manual or magnetic starters (with or without switches), individual pushbuttons or Hand-Off-Automatic (HOA) switches controlling the operation of motors.
 - M. "Control Devices": Automatic sensing and switching devices such as thermostats, pressure float, electropneumatic switches electrodes controlling operation of equipment.
 - N. "Unfinished Space": A room or space that is ordinarily accessible only to building maintenance personnel. A room that in the Architect's finish schedule has exposed and unpainted construction for walls, floor and ceiling. Room specifically mentioned as "unfinished".
 - O. "Finished Space": A room or space that is not unfinished as described above. Any space ordinarily visible to the visiting public, including exterior spaces.
 - P. "This Division": The Mechanical Division of the Specifications; a portion of the Specifications that includes all the Sections of Specifications listed herein under 1.01 - DESCRIPTION.
 - Q. "Individual Mechanical Section": Any one of Sections of Specifications listed herein under DESCRIPTION, herein.
 - R. "Other Divisions": The portion of the Specifications that does not include the Mechanical Division.
 - S. "Riser": A vertical pipe or duct having a vertical length greater than one story height.
 - T. "Drop": A vertical pipe or duct that does not penetrate a floor.
 - U. "Upfeed Connection": A vertical pipe or duct that penetrates a floor, but has a vertical length of less than one story height.
 - V. "Header": A pipe or duct of constant size that serves a battery of closely spaced inlet or outlet connections.
- 1.3 REFERENCES:
- A. References made herein, or in any of the Mechanical Sections listed above, to standards, codes, specifications, or recommendations of various technical societies, trade organizations, or governmental agencies are to the edition in effect at the time of the proposal, including addenda.

- B. If code changes occurring between time of proposal and date of permit issue, and the Contractor has unnecessarily delayed the acquisition of his permits, the Contractor shall hold the Owner free from additional expense resulting from such code change.

1.4 ABBREVIATIONS:

AFI	Air Filter Institute
AGA	American Gas Association
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
FIA	Factory Insurance Association
FM	Factory Mutual Association
FS	U.S. Government, Federal Specifications
IBR	Institute of Boiler and Radiator Manufacturers
MIL	U.S. Government, Federal Specifications
NBS	National Bureau of Standards
NEMA	National Electrical Manufacturers Association
NEC	National Electrical Code
NAAB	National Association of Air Balance
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriters' Laboratories

1.5 SHOP DRAWINGS AND SUBMITTAL DATA:

- A. Refer to Supplementary Conditions for requirements.
- B. Refer to individual Mechanical Sections for submittals required.
- C. If the equipment under Division 15 requires changes in materials or labor from that required in the Contract Drawings and Specifications, such changes shall be submitted as Shop Drawings.
- D. Any approved changes in piping, wiring, controls, or installation procedures required by the equipment shall be made at no additional cost to the Owner, and with no reduction in scope.
- E. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

1.6 SERVICE MANUALS:

- A. Upon completion of the installation, and as a condition of its acceptance, prepare and submit an Operating and Maintenance Manual to the Owner for approval. The Contractor shall compile the manual from information supplied by equipment manufacturers and from test and balance data furnished.

Each manual shall contain:

1. Complete instructions on the operation of all mechanical equipment, including all control settings, switch positions timer operation, etc.
 2. Complete instructions regarding the maintenance of all mechanical equipment including periods and frequencies of all inspections, lubrications and filter replacement, etc.; type of lubricants required; and exact description of performance of such maintenance and full description of inspections and corrections to make a step-by-step basis.
 3. Copy of all control and wiring diagrams.
 4. Complete nomenclature of all replaceable parts, their part numbers, and the name and address of the nearest vendor.
 5. Copy of all guarantees and warranties issued for components of the systems, showing all dates, of expiration. Such dates shall not be sooner than the expiration of the completed installation guarantee specified herein.
 6. Copy of the test and balance report.
 7. A complete index at the front furnishing immediate information as to location in the manual of all data regarding the installation. Numbered tab sheets shall be used.
 8. Name, address, and telephone number of the Contractor and each Subcontractor employed for work under this Division.
- B. Material shall be neatly typed or shall be printed material. Instructions specified shall be in continuous narrative form, not fragmented, sections as prepared by individual equipment manufacturers.
- C. Submit 3 copies of manuals in permanent hardback 3-ring binders with identification readable from the outside stating "MECHANICAL SYSTEM INSTALLATION."
- D. Any approved changes in piping, wiring, controls, or installation procedures required by the equipment shall be made at no additional cost to the Owner, and with no reduction in scope.

1.7 RECORD DRAWINGS: Conform to the following:

- A. General: Two complete sets of Mechanical Drawings will be provided as record drawings, which shall be separate, clean blue line prints reserved for the purpose of showing a complete picture of the work as actually installed.
- B. Progress Drawings: These Drawings shall also serve as work progress, report sheets, and the Contractor shall make any notations, neatly and legibly, thereon daily as the work proceeds. These Drawings shall be available for inspection at all times and shall be kept at the job at a location designated by the Architect.
- C. Reproducible Drawings: Prepare and submit according to Supplementary Conditions.
 - 1. Contractor shall certify to completeness and accuracy of the Record drawings information indicated on the reproducible prints with his signature.
 - 2. On or before the date of the final inspection, the set of reproducible prints along with one print thereof and one set of marked-up "progress drawings" shall be delivered to the Engineer.

1.8 SURVEY OF SITE:

- A. Before submitting proposals for this work, each bidder shall be familiar with Drawings and Specifications and shall have examined premises and understood conditions under which he will be obliged to operate in performing this contract.
- B. No allowance will be made subsequently in this connection, in behalf of the Contractor, for any error through negligence on his part.

1.9 MANUFACTURER'S DIRECTIONS: In all cases where manufacturers of articles used in this Contract furnish directions covering points not shown on Drawings or specified, such directions shall be followed.

1.10 CODES:

- A. Code Compliance: All work performed under this Division of the Specifications shall comply with the latest regulation of all applicable codes including but not limited to:
 - 1. Local Building Codes and Administrative Codes- Titles as applicable.
 - 2. Uniform Building Code.
 - 3. Uniform Mechanical Code.
 - 4. Uniform Plumbing Code.
 - 5. California Administrative Code - Titles as applicable.

1.11 PERMITS, LICENSES AND INSPECTIONS:

- A. Permits: The Contractor shall pay for all permits required by work under this Division.

- B. Inspections: All work shall be regularly inspected and certificates of approval shall be delivered to the Engineer.
- C. Permit to Operate: Obtain and pay for State Industrial Accident "Permit to Operate" for each pressure vessel.

1.12 DRAWINGS:

- A. Diagrammatic Drawings: For Purposes of clearness and legibility the Drawings are essentially diagrammatic and, although size and location of equipment is drawn to scale, Contractor shall make use of all data in all of the Contract Documents and verify this information at building site.
- B. Routing of Ducts and Piping:
 - 1. Drawings indicate required size and termination of pipes and ducts and suggest proper routes of piping and duct to conform to the structure, to avoid obstructions and to preserve clearance.
 - 2. It is not the intent to indicate all necessary offsets, and it shall be the responsibility under this Section to install ductwork and piping in such a manner as to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without further information or extra cost to the Owner.
- C. Coordination with Other Trades:
 - 1. Check with other Sections of Specifications so that no interference shall occur and in order that grade lines may be established for the work.
 - 2. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Engineer.
 - 3. No extras will be allowed for changes made necessary by interferences with the work of other trades.

1.13 EMERGENCY REPAIRS: The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibility during the bonding period.

1.14 DAMAGE RESPONSIBILITY: The Contractor shall be responsible for damage to the grounds, buildings, or equipment, and the loss of refrigerants, fuels, gases caused by leaks or breaks in pipes of equipment furnished and installed under this work.

1.15 SPARE PARTS AND SPECIAL TOOLS:

- A. Spare parts shall be provided to the Owner as follows and receipts obtained and included with Service Manuals.
 - 1. None Required
- B. Special Tools: Not required.
- C. Acceptance shall be contingent on:
 - 1. Completion of the installation of all system required under the Contract Documents.
 - 2. Submission and acceptance of Service Manuals.
 - 3. Completion of identification program.
 - 4. Completion of cleaning program, water treatment and balance.
 - 5. Satisfactory operation of all systems for a period of one week.
 - 6. Completion of final review and correction of all deficiencies.
 - 7. Satisfactory completion of the acceptance tests which shall demonstrate compliance with all performance and technical requirements of the Contract Documents.
 - 8. Satisfactory completion of the training program and submission of all manuals and Drawings required by the Contract Documents.

1.16 PRELIMINARY OPERATION AND EMERGENCY REPAIRS: The Owner reserves the right to operate portions of the mechanical system on a preliminary basis or make emergency repairs without voiding the guarantee or relieving the Contractor of his responsibilities.

PART 2 - PRODUCTS

- 2.1 GENERAL: Products and materials shall be as described in the pertinent Section of the Mechanical Specifications.
- 2.2 MATERIALS AND EQUIPMENT: Wherever possible, all materials and equipment used in the installation of this work will be of the same brand of manufacture for each class of material or equipment.

PART 3 - EXECUTION

- 3.1 QUALITY ASSURANCE:
 - A. For each Section of work under this Contract, the Contractor shall furnish the service of:
 - 1. A supervisor experienced in the work who shall be in constant charge of the progress of the work.
 - 2. All necessary journeymen, helpers and laborers required to properly unload, erect, adjust, start, operate, and test the work involved.

3.2 PROTECTION, CARE, AND CLEANING:

- A. Protection: Provide adequate means for, and fully protect, all finished parts of the materials and equipment against physical damage from whatever cause during the progress of this work and until final completion.
 - B. Care: During construction, properly cap all lines and equipment nozzles so as to prevent the entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or other work of other trades by covering it with polyethylene sheets.
 - C. Cleaning: After installation has been completed, the Contractor shall clean all systems as follows:
 - 1. Ductwork, Piping and Equipment To Be Insulated: Clean exterior thoroughly to remove rust, plaster, cement, and dirt before insulation is applied.
 - 2. Ductwork, Piping, and Equipment To Be Painted: Clean exterior of equipment exposed in complete structure, removing rust, plaster, cement and dirt by wire brushing. Remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
 - 3. Motors, Pumps, and Other Items With Factory Finish: Remove greases and oil and leave surfaces clean and polished.
- 3.3 LUBRICATION: Upon completion of the work and before turning over to the Owner, clean and lubricate all bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by the manufacturer and as listed in the Service Manual. Contractor is responsible for maintaining lubrication of all mechanical equipment under his Contract until work is accepted by the Owners.
- 3.4 PAINTING:
- A. Touch-Up: If factory finish on any equipment furnished by the Contractor is damaged in shipment or during construction of the building, the equipment shall be refinished by the Contractor to the satisfaction of the Owner. One can of touch-up paint shall be provided for each different color factory finish which is to be the final finished surface of the product.
- 3.5 CUTTING AND PATCHING:
- A. Sleeves and Inserts: Provide all sleeves, inserts, and openings necessary for the installation of the Mechanical Work.
 - B. Openings: Special forming, recesses, chases, and curbs, as necessary for the proper reception and installation of the mechanical equipment, as shown on Drawings, shall be provided in these Divisions. Contractor shall examine all Drawings to ascertain that proper provisions have been made for the work. If such provisions are not made in time, the Contractor shall bear all extra costs incurred in later cutting and patching to accommodate this work.
- 3.6 CONCRETE WORK:

- A. General: Concrete required under this Division shall be provided under this Division. The design is based on reuse of existing concrete housekeeping pads. If the contractor destroys any concrete in the course of this work, then contractor shall replace with new.

3.7 OPERATIONAL TESTS:

- A. General: Before acceptance test are performed, the Contractor shall demonstrate to the Owner that all systems and components are complete and fully charged with operating fluid and lubricants. Systems shall be operable and capable of maintaining continuous uninterrupted operational service during the operating and demonstrating periods of operation. All control systems shall be completely operable with calibration and setting properly set and adjusted. All rotating equipment shall be in dynamic balance and alignment.
- B. Tests: Pressure tests shall be performed as specified in Section 230593 - Air and Water Test and Balance. After systems have been completely installed, connections made and tests completed, Contractor shall make arrangements with the Owner to operate the systems for a period of five working days during the hours of a normal working day. The Contractor shall notify the Owner in writing when the operational period may start, and the time for this period shall be scheduled by mutual agreement. During this operational test, the Contractor shall instruct the Owner's operating personnel. Perform tests as specified and as requested by the Architect to prove installation is in accordance with Contract requirements. Perform tests in presence of Engineer, and furnish test equipment, facilities, and technical personnel required to perform tasks.

END OF SECTION 230500

SECTION 230501**BASIC MECHANICAL MATERIALS AND METHODS****PART 1 - GENERAL**

1.1 DESCRIPTION: Provide basic mechanical materials and methods, complete.

A. Work In This Section: Principal items include:

1. Construction, installation, materials and equipment described are generally common to the various Sections of this Division as listed in Section 230500 - Mechanical General Provisions.
2. Refer to individual Mechanical Section for piping schedule required for each particular piping system.
3. Refer to Approved Manufacturers List herein for acceptable manufacturers for piping accessories.
4. Requirements of this Section are in addition to any similar or more comprehensive requirements in other Sections of this Division.
5. Requirements of this Section apply to all Sections in this Division, except as may be specifically modified in those Sections.

1.2 SUBMITTAL REQUIREMENTS: In addition to the requirements of Section 230500 - Mechanical General Provisions, the submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, the following:

A. Descriptive Data:

1. Flow switches provided under Mechanical Work.
2. Pressure switches.
3. Lists of material manufacturers.
4. Flexible couplings.
5. Valves.

B. Shop Drawings:

1. Pre-wired control panels.
2. Belt guards.

C. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings

submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

1.3 SPECIFIC ELECTRICAL REQUIREMENTS:

- A. General: Except where modified by specific requirements of an individual Mechanical Section of the Specifications, the electrical work required by this Division is included under Division 26 - Electrical.
- B. Contractor's Responsibility:
 - 1. Changes: If the Contractor for this Division furnished equipment requiring changes in electrical work, included under Division 26 - Electrical, or otherwise requests such changes, it shall be the Contractor's responsibility to arrange and pay for such changes at no increase in cost to the Owner.
 - 2. Coordination: Contractor is responsible to coordinate all electrical requirements for mechanical equipment with Electrical Contractor at no increase in cost to the Owner.
 - 3. Wiring Diagrams: Contractor for this Division shall provide all wiring diagrams and information needed to complete installation of electrical work. Wiring diagrams shall correctly indicate conditions of this specific job and shall be free from confusing optional methods that do not apply. All wiring diagrams shall be submitted for approval.
 - 4. Pre-wired Control Panels: Where Pre-wired control panels or equipment are furnished under this Division, internal wiring shall extend neatly to a terminal strip which shall have the same designations for terminals that are shown on the wiring diagrams. Pre-wired panels shall be UL labeled.
 - 5. Factory or Field Wiring: Where work of this Division includes either factory or field wiring materials and workmanship shall conform to requirements of Division 26 - Electrical, of this Specification, and to all governing codes.
- C. Power Supply: Power supply for the project is listed as 120 volts, single phase, and 480/277 volts, 3 phase. Contractor of this Division shall be responsible for verifying the power requirements before ordering equipment.

PART 2 - PRODUCTS

2.1 PIPING SCHEDULE "B":

- A. Typical Service: Chilled water and condenser water.
- B. Pipe: Schedule 40 black steel, ASTM A120, or A53, Grade A or B, continuous welded.
- C. Fittings:
 - 1. 2" and Smaller: 150 lb. black malleable iron screwed fittings, ANSI B16.3.
 - 2. 2-1/2" and Larger: Standard weight seamless carbon steel standard radius butt welding pattern ASTM A106, Grade A.

- D. Unions: 150 lb. black malleable iron with brass to iron seating, on piping 2" and smaller.
- E. Flanges:
1. 150 lb. forged steel, slip-on or weld-neck, raised face ANSI B16.15, ASTM A181, Grade I, on piping 2-1/2" and larger.
 2. Gasket: 1/16" gasketing.
- F. Ball Valves:
1. 2" and Smaller: 400 lb. WOG, bronze body, screwed, stainless steel ball and handle, Teflon seats, packing and gasket; Jenkins Fig. 32AS.
- G. Butterfly Valves:
1. 2-1/2" and Larger: Butterfly valves:
 - a. 200 lb. iron body of the lug type with Type 316 stainless steel upper and lower stems and disc, EPT (EPOM) liner and stem "O" rings, Jenkins Fig. 231EL.
 - b. Valves shall be designed for installation between 150 lb. raised face steel flanges, and socket weld slip-on and lap joint flanges meeting ANSI Standards. Lug holes shall be threaded.
 - c. Valves 6" and smaller shall be provided with lever operator with position indicator.
 - d. Valves larger than 6" shall be provided with gear operator.
 - e. Valves on insulated piping shall have a neck extension 2" above outside diameter of flanges to accommodate full thickness of insulation.
 2. Operating Stem Extensions: Provide to clear insulation thickness.
- H. Check Valves:
1. Swing Checks:
 - a. 2" and Smaller: 125 lb. SWP bronze screwed with regrinding bronze disc and screw-in cap, Jenkins Fig. 92A.
 - b. 2-1/2" and Larger: 125 lb. SWP iron body bronze trim with regrinding bronze disc and seat ring and bolted cover, Jenkins Fig. 625.
 2. Spring Loaded Checks at Pump Discharge (Non-Slam):
 - a. 2" and Smaller: 125 lb. SWP bronze body, screwed center guided bronze disc and ring. Spring Type 302 stainless steel. Miller No. 162.
 - b. 2-1/2" and Larger: 150 lb. SWP iron body, flanged, center guided stainless steel disc and ring. Disc and ring Type 304 stainless steel spring Type 302 stainless steel. Miller No. 162.
- I. Strainers:
1. 2" and Smaller: 250 lb. Y-pattern bronze, screwed, with machined and gasketed strainer screen retainer cap, Bailey No. 100A.

2. 2-1/2" and Larger: 125 lb. Y-pattern cast-iron, flanged with bolted strainer cap with offset blow-down connection, Bailey No. 100A.
 3. Strainer screen, Monel with 3/64" perforations (225 per sq. in.).
- J. Automatic Air Vents: 150 lb. cast-iron or bronze body with stainless steel trim and float, Hoffman No. 792 or equal by Sarco or Bell & Gossett.
- K. Ball Joints:
1. Body steel, 250 psi suitable to 525 deg. F service with flanged ends.
 2. Capable of 360 degree rotation and minimum 15 degree angular flexing movement similar to Barco Type N.

2.2 PIPING SCHEDULE "D":

- A. Typical Service: Domestic water inside building and concealed condensate drains from cooling coils, and chilled and heating hot water alternate.
- B. Pipe:
1. Seamless copper tubing Type L, cold drawn, hard temper ASTM B88.
 2. Exposed to view at plumbing fixtures and finished equipment satin finish CP brass pipe with threaded cast bronze fittings.
- C. Fittings: Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18.
- D. Flanges: Standard weight brass castings bronze, ANSI B16.24
- E. Control Valves:
1. 3" and Smaller: 125 psi WSP, bronze ring stem gate type:
 - a. Threaded ends similar to Jenkins No. 47-U.
 - b. Solder joint type ends, similar to Jenkins No. 1242.
 2. 4" and Larger: 200 lb. WOG, wafer type butterfly valve with lugs, bronze disc molded-in seat, twist-lock lever operation, Jenkins 231EL.
- F. Check Valves:
1. Swing Checks:
 - a. 2" and Smaller: 125 lb. SWP bronze screwed with regrinding bronze disc and screw-in cap, Jenkins Fig. 92A.
 - b. 2-1/2" and Larger: 125 lb. SWP iron body bronze trim with regrinding bronze disc and seat ring and bolted cover, Jenkins Fig. 624.
 2. Spring Loaded Checks at Pump Discharge (Non-Slam):

- a. 2" and Smaller: 125 lb. SWP bronze body, screwed center, guided bronze disc and ring. Spring Type 302 stainless steel. Miller No. 162.
- b. 2-1/2" and Larger: 150 lb. SWP iron body, flanged center guided stainless steel disc and ring. Disc and ring Type 304 stainless steel spring Type 302 stainless steel. Miller No. 162.

G. Strainers:

1. 2" and Smaller: 250 lb. Y-pattern bronze, screwed, with machined and gasketed strainer screen retain cap, Bailey No. 100A.
2. 2-1/2" and Larger: 125 lb, Y-pattern cast-iron, Flanged with bolted strainer cap with offset blow-down connection, Bailey No. 100A.
3. Strainer screen, Monel with 3/64" perforations (225 per sq. in.).

2.3 PIPING SCHEDULE "F":

A. Soil, waste and vent piping to 5' outside the building may be one of the following:

- a. Hubless cast iron soil pipe and fittings, CISPI - 301, ASTM A888, with stainless steel clamp and shield couplings, CISPI - 301
- b. Hubless cast iron soil pipe, CISPI- 301, ASTM A888 with hub and spigot cast iron fittings CISPI - 301, ASTM A74 with the A.B. & I. "Best" cast iron coupling and rubber gaskets, ASTM C564.
- c. Hubless cast iron soil pipe, CISPI-301, ASTM A 888 with M.G. mechanical joint couplings.
- d. Schedule 40 ABS or PVC DWV pipe and drainage pattern fittings. Solvent cement joints.

B. Soil piping from 5' outside the building may be one of the following:

- a. Certainteed Corp. "fluid tight" p.v.c. gravity sewer pipe and fittings or approved equivalent.
- b. Extra heavy bell and spigot vitrified clay pipe and fittings with compression joints.
- c. Same as specified to 5' outside building.

2.4 PIPING SCHEDULE "I" (NOT REQUIRED):

2.5 PIPING SCHEDULE "G":

A. Typical Service: Fire protection inside building.

B. Pipe: Standard weight (Schedule 40), seamless or welded mild steel ASTM A120 or A53. Galvanized pipe for drain, test piping, between siamese and check valve, pump suction and test and relief piping.

C. Fittings

1. Extra Heavy Cast-Iron Threaded: 250 lb.

2. Cast-Iron Flanged Fittings and flanges: 250 lb.
3. Malleable iron as specified for 4th floor and above.
4. Grooved end iron fittings as specified above.

2.6 PIPING SCHEDULE "H":

- A. Typical Service: Natural Gas, Compressed Air, Vacuum
- B. Pipe: Schedule 40 black steel, seamless or welded, ASTM A120 or A53.
- C. Fittings: 150 lb. malleable iron, banded, screwed ANSI B16.3.
- D. Valves: Bronze rising stem split wedge, gate type 125 psi WSP similar to Walworth No. 5.
 1. Gate Valves 2" and Smaller: IBBM OS&Y type, 250 psi WSP, similar to Walworth No. 785F.
 2. Check Valves 2" and Smaller: As specified for 4th floor and above.

2.7 DIELECTRIC ISOLATORS:

- A. Unions: For piping 2" and smaller, unions shall be brass solder sweat to IPS union with ground-joint and micarta sleeving.
- B. Flanges: For piping 2-1/2" and larger, flanges shall be flanged sets with neoprene gasket for flat face flanges with bolt holes punches to receive bolt sleeves of 1/32" micarta with 1/8" thick micarta washers.
- C. Manufacturer: Dielectric isolator shall be as manufactured by Maloney or EPCO.

2.8 INSTRUMENTS:

- A. General: Thermometers, duct thermometers, pressure gages, and draft gages shall be as scheduled herein. Thermometers and pressure gages for temperature control shall be as specified in Section 230923 - HVAC Instrumentation and Controls. Where panel-mounted instruments are scheduled, they need not be duplicated by pipe-mounted instruments.
- B. Panel-Mounted Instruments: Instruments shall be flush mounting type with chrome rings. Features shall be as specified herein for thermometers and pressure gages.
- C. Piping Thermometers: Thermometers shall be vapor actuated Fahrenheit reading type, March Instrument Co. Type 58, or equal. Thermometers shall have 4-1/2" dial face, white with black numbers and graduations, steel case with double-strength glass and nickel-plated ring. Movement shall be of the phosphor bronze seamless Bourdon tube type with recalibrating bushed rotary gear movement and link fitted with a black aluminum pointer. Accuracy shall be +1% of the total dial range. Thermometers mounted 8-feet and higher shall have multi-angle mounting attachment with positive positioning locking device. Separable sockets shall be copper with 3/4" NPT brass connector. Remote reading thermometer shall have flexible capillary tube jacketed with a double sheath of braided copper wire.

- D. Pressure Gages: Gages shall be of the Bourdon tube type, March Instrument Co., "Quality Gauge" or equal. Gages shall have 4-1/2" dial face, white with black numbers and graduations, steel case with double strength glass and nickel-plated ring. Movement shall be of the phosphor bronze seamless Bourdon tube type with recalibrating bushed rotary gear movement and link fitted with a black aluminum pointer.

2.9 INSTRUMENT PANELS: Panels shall be fabricated of 12 gage furniture steel over structural frame. Framing may be omitted for panels less than 24" square. Nameplates identifying panel and instruments shall be as specified in Section 230502 - Identification. Finish shall be gray hammertone lacquer. Panels provided under the work of Section 230923 - HVAC Instrumentation and Controls shall be of standard construction by the Temperature Control Contractor.

2.10 PIPE MOUNTED THERMOMETER SCHEDULE:

LOCATION	RANGE (F)
In water inlets and water outlets	30 to 100

2.11 PRESSURE GAGE SCHEDULE:

LOCATION	PRESSURE RANGE
Hot Water Pumps: Between suction and discharge,	psi 0 to 100
Chilled water pumps: Between suction and discharge,	psi 0 to 100
Water Coils: Between inlet and outlet connections,	psi 0 to 100
Coil Control Valves: Inlet header,	psi 0 to 100
Domestic water,	psi 0 to 150

2.12 HANGERS AND SUPPORTS:

- A. General: Hanger and supports shall be factory fabricated units with published load limits. Hangers and supports shall be Grinnell as specified or equal by Carpenter and Patterson, Elcen, or Fee & Mason. Hangers and supports for fire protection installation shall be in accordance with NFPA Standard 13.
- B. Horizontal Piping: Hangers shall be of the following types:

1. For Piping 2" and Smaller: Adjustable malleable iron split ring type, Grinnell Fig. No. 104.
 2. For Piping Larger Than 2": Adjustable steel clevis type Grinnell Fig. No. 260.
 3. Rod lengths shall be adjustable.
 4. Trapeze hangers may be used for parallel piping arrangements. Submit detail Shop Drawings for review.
 5. Hang hanger rods for both single and trapeze hangers from suitable clips, beam clamps or joist "U" brackets.
- C. Vertical Piping: Clamps shall be Grinnell Fig. No. 261.
- D. Rods: Minimum size shall be as required by SMACNA Guidelines, vibration isolators or a minimum:
1. 2" and smaller pipe 3/8" diameter rod
 2. 2-1/2" to 3-1/2" pipe 1/2" diameter rod
 3. 4" to 5" pipe 5/8" diameter rod
 4. 6" pipe 3/4" diameter rod
 5. 8" to 12" pipe 7/8" diameter rod
- E. Sway Bracing of Non-Resiliently Supported Pipe: Restraints shall be malleable iron bracket and pipe end assembly, Grinnell Fig. No. 296.
- F. Trapeze or Framing: For four or less 2" pipes shall be unistrut or equal by F & S Control, Elcen, Kindrol or Superstrut selected to support five times the weight or thrust. Submit details or other trapeze or framing for approval.
- G. Protection Shield and Insert Sections: Shields shall be 16 gage galvanized steel for all piping and shall be preformed to proper radius. Insert sections shall be as specified in Section 230700 - Insulation.
- H. Vibration Isolators: Vibration isolation and restrains shall be as specified in Section 237401 - Vibration Isolation and Seismic Restraints. Where isolation elements are required on hangers, provide 2 piece rods. Install metal back felt isolators under hangers of all uninsulated water piping, Trisolator S-100 or equal by Prisolator for copper pipe less than 2 1/2" only.
- 2.13 SLEEVES, CORE DRILLING, AND ESCUTCHEONS:
- A. General: Sleeves shall be permanently installed type where waterproofing is required cast-in-place or dry-packed in core drilled hole. Escutcheons shall be prime coated steel type except for escutcheons specified in Section 223000 - Plumbing Equipment.
- B. Sleeves shall be as follows:
1. Exterior Walls and Floor Slabs Below Grade: Cement asbestos on concrete pipe dry-packed in place with annular space calked watertight.
 2. Roof Slab: Cast-iron sleeves with integral flashing clamp, Smith No. 1722 or equal by Josam, Zurn or Wade.
 3. Floor Slab with Waterproof Membrane: Cast-iron sleeve with integral flashing clamp, Smith No. 1722 or equal by Josam, Zurn or Wade.

C. Escutcheons shall be as follows:

1. 6" and Smaller: Prime coated steel with set screw, Beacor No. 13 or equal by F & S Manufacturing Co.
2. Larger Than 6": Prime coated brass with set screw, Beacor No. 3 or equal by F & S Manufacturing Co.
3. Raised Sleeves in Floor Slabs: Deep drawn prime coated steel or brass F & S Manufacturing Fig. 605.

D. Caulking shall be as follows:

1. Watertight: Products Research Co. "Rubber Caulk" No. 150 heavy type or equal by DAP, Dow Corning or General Electric.
2. Fireproofing: ProSet pipe sleeves.
3. Sound Attenuating: Caulk with a compressible polyurethane foam strip saturated with polybutylene, Poly-Tite or Compri-band.

2.14 FLASHING shall be 4-lb. seamless lead flashing with 10" skirt, steel reinforcing boot and caulk type counterflashing sleeve. Flashing assembly shall be Stoneman S-1310-4.

2.15 ACCESS PANELS:

A. General: Size as required for complete access, minimum size 12" x 12". Turn over for setting under Architectural Division. Direct location and setting after review.

B. Doors:

1. No. 13 USSG steel door and trim.
2. No. 16 USSG steel frame.
3. Metal wings for keying into construction.
4. Concealed hinges, screwdriver operated stainless steel cam lock.
5. In plaster ceilings, similar to Karp DSC-211 FRT or equal by Inryco or Higgins Mfg. Co.
6. In wallboard, similar to Karp DSC-214M or equal by Inrycor Higgins Mfg. Co.

C. Access Tile Identification: Buttons, tabs and markers to identify location of concealed work. Submit for review.

2.16 VALVE OPERATORS:

A. Chain Operators: Valves 4" and larger installed 8-feet and higher in equipment rooms shall be provided with chain operators with chains swaged to 5'6" above the floor and hooked up out of the way.

B. Wrenches: Plug valves cocks: Provide 12" wrench for valves 2" and smaller, 18" wrench for 4" valves, and 36" wrench for valves 6" and larger.

- C. Solenoid Valves: 125 lb. bronze bodied, screwed, stainless steel trim, normally closed 2-way, and 120 volts, 60 Hertz, General Controls K-15 or equal by ASCO.

2.17 PIPE WRAPPING: (NOT REQUIRED)

2.18 FLOW-CONTROL VALVES:

- A. Valves shall be Griswold Controls Series 3000 and shall be factory set to limit the flow rate to each coil to not more than 5% more than the flow rate scheduled on the Drawings. Operating pressure to match valves specified for the piping system.
- B. Valve shall fit the pipe size noted for the coil connection, or shall have reducing fittings or flanges as required.
- C. Valve shall require no external adjustment and shall be tamperproof when installed.
- D. Body pressure tappings with quick disconnect valves, suitable for pressure gage installation and verification of minimum flow rate availability shall be provided. Provide tag as specified under Section 230502 - Identification for valve giving zone identification, valve model number, and rated flow GPM.
- E. All valves 4" and larger shall fit between flanges and gaskets furnished by the Contractor. Valves 3" and smaller shall have screw connections.
- F. Provide a portable differential meter kit, Griswold Model No. 3424, consisting of a pressure indicating gage (-14.7 - 150psi) with a quick connector and conversion chart with operating instructions and carrying case. The kit shall be provided on a temporary basis used to check pressure drop across the valve orifice and prove proper flow and control.
- G. Pressure drop through the valve shall be as scheduled on the Drawings at design flow.

2.19 FLOW MEASURING DEVICES:

- A. Venturi type for quantitative measurement of water flow in piping systems.
- B. Sizes 1/2" through 2" shall be one-piece brass with female threaded connections.
- C. Sizes 2-1/2" and larger shall be plated steel with flanged ends, 150 lb.
- D. Each Ventura station shall be complete with quick disconnect valves and safety shut-off valves. Metal identification plate with chain shall list pipe size. Ventura series, station identification, specified point and meter reading.
- E. Ventura shall be selected for meter readings between 10 and 40".
- F. Master Meter: On a temporary basis provide one dry type master meter with 6" round dial, 0-50" scale complete with carrying case and two 20-foot hoses with quick disconnect ends for

meter and Ventura connections. Provide complete instructions for meter use to determine and adjust proper flow.

- G. Provide one complete set of plastic laminated capacity curves covering all installed Venturis.
- H. System components shall be Barco or Gerand.
- I. Provide flow measuring devices where indicated on Drawings.

2.20 ELECTRIC MOTORS:

- A. General: Electric motors shall be open drip proof, continuous duty, 40 degrees C rise type with Class "F" insulation and Class "B" (80 degrees C) use, unless specified otherwise. Provide "weather protected" motors, NEMA Type I, with special Class "A" moisture resistant insulation. Three phase motors shall have regreaseable ball bearings. Motors shall be General Electric, US Electric, Century, Sterling or Westinghouse.
- B. Motors that are not directly exposed to the weather and are located in non-hazardous spaces shall have drip proof enclosures and shall have continuous duty ratings of 40 degrees C.
- C. Motors installed in unguarded outdoor locations shall be totally enclosed, fan cooled and continuous duty rating at 55 degrees C.
- D. Where motor is an integral part of equipment, motor manufacturer shall be as recommended by the equipment manufacturer.
- E. Motors shall in all cases have adequate starting torque to bring driven equipment up to rated speed in a time interval acceptable to the Architect.
- F. Motors 1/2 HP and Larger: 480 volt, 3 phase, 60 Hz, ball bearing, of NEMA design B, NEC Code F or lower in-rush.
- G. Motors smaller than 1/2 HP shall be 120 volt, single phase, 60 Hz of NEMA design B, NEC Code F or lower with internal thermal protection.
- H. Control Panels: Where specified, panels shall be NEMA 12 enclosure Pre-wired for one point feeder supply connection, and shall include the following:
 - 1. Across-the-line magnetic type starter with overhead protection and HOA switches.
 - 2. Fused switches with dual element fuses.
 - 3. Control transformer with fused primary and fused secondary protection.
 - 4. For monitoring and alarm circuit, provide a two pole relay with N/O and N/C contacts for monitoring by the Building Alarm System.

2.21 COUPLINGS:

- A. Couplings for direct drive equipment shall be flexible, self-aligning, non-lubricating type, rated at least 125% of motor rated horsepower.

- B. Coupling halves shall be keyed and locked on shafts.
- C. Manufacturer: Couplings shall be Fast's Standard.

2.22 BELT DRIVES:

- A. General: Belt drives shall be V-belt type with appropriate sheaves. Drives requiring one or two belts shall be provided with variable pitch sheaves. Drives requiring three or more belts shall have non-adjustable drive sheave. Sheave and belts shall be Browning, Dodge, or Gates.
- B. Sheaves: Shall be cast-iron, machined and balanced. Variable pitch sheaves shall be selected for mid-point of equipment operating capacity. Sheaves shall be keyed and located on shafts, with allen head set screws. On fractional horsepower motors on NEMA frame size 48 and smaller sheaves may be secured to shaft with set screws only.
- C. Ratings: Belt drives for one and two cylinder reciprocating compressors. Minimum horsepower rating, at design speed, of 1.7 times the motor nameplate horsepower rating. All other belt drives, minimum horsepower rating, at design speed, of 1.5 times the motor nameplate horsepower rating.

2.23 GUARDS:

- A. General: All rotating elements on equipment shall have protective devices in accordance with the California Administrative Code Title 8, Division of Industrial Safety and General Industry Safety Orders and OSHA requirements.
- B. Coupling guards shall completely enclose the rotating coupling and shall be constructed of heavy gage steel in accordance with OSHA requirements.
- C. Belt guards shall totally enclose the belts and sheaves. Guards shall be fabricated of galvanized expanded sides, solid galvanized steel band, and an adequately sized galvanized angle iron frame. Adequate room for the belt adjustment shall be provided. Tachometer holes with covers shall be provided for both sheaves.

2.24 APPROVED MANUFACTURERS:

- A. General: Manufacturer's products named in this Section were selected for desired type, quality, performance are listed herein.
- B. Approved manufacturers shall be as follows:
 1. Grooved End Fittings:
Victaulic
Gustin-Bacon
 2. Shut-Off Valves (Gate and Ball Valves):
Nibco-Scott Crane
Lunkenheimer Walworth

Jenkins

3. Globe Valves:
Jenkins Lunkenheimer
Crane Hammond
Walworth
4. Butterfly Valves:
Jenkins Mission
Crane Centerline
Posi-Seal Deming
Lunkin Victaulic
Pratt Keystone
5. Check Valves - Non-Slam:
Mueller Steam Specialty
Miller
Williams-Hager
Smolensky
6. Check Valves:
Crane Lunkenheimer
Jenkins Nibco-Scott
Walworth
7. Air Vent:
Sarco Bell & Gossett
Hoffman Armstrong
Marsh
8. Throttling Valves (Globe):
Nibco-Scott Crane
Lunkenheimer Walworth
Jenkins
9. Plug Cocks:
Crane Walworth
Lunkenheimer DeZurik
Rockwell-Nordstrom
10. No-Hub Piping Couplings:
"MG" Coupling
Tyler Pipe
11. Instruments:
Marsh Palmer
Weiss US Gauge
Tetrice

PART 3 - EXECUTION

3.1 GENERAL:

- A. Rough-In Work: Proceed as rapidly as building construction will permit; completed, tested, and have approval before enclosing.
- B. Conceal all piping within finished rooms unless otherwise noted on Drawings.
- C. Cleaning: Thoroughly clean piping before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections made.
- D. Cut pipe accurately to measurements established at the building; work into place without springing or forcing; properly clear all windows, doors, and other openings. Cutting or other weakening of building structure to facilitate piping installation will not be permitted.
- E. Pipe Damage: Show no tool marks or threads on exposed plated, polished or enameled connections from fixtures. Tape finished surfaces to prevent damage during plastering.
- F. Make changes in direction with fittings and changes in main sizes through eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of pipe.
- G. Pitch pipe lines as required for proper drainage and elimination of air as follows:
 - 1. Heating Hot Water: Upwards in direction of flow.
 - 2. Waste: 1/4 in./ft. downwards toward mains.
 - 3. Vents: 1/3 in./ft. upwards away from fixture trap.
- H. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping system, whether shown or not on Drawings.
- I. Support piping independently at pumps, coils, tanks, and the like so that its weight will not be supported by the equipment.
- J. Pipe drains from pump glands, drip pans, relief valves, air vents, etc., to spill over an open sight drain, floor drain, or other acceptable discharge points, and terminate with a plain end, unthreaded pipe, 1" above the drain or overflow of the receptacle.
- K. Securely bolt in place to building structures, all equipment, isolators, hangers, etc.
- L. Provide clamps and/or concrete thrust blocks on all dead ends, angles or at other points where separation may occur from hub and spigot pipe or no-hub piping.
- M. Provide union and shut-off valves suitably located to facilitate maintenance and removal of all equipment or apparatus.

- N. Acid-Resisting Piping: Install according to manufacturer's recommendations. Furnish manufacturer's certificate stating the installation has been made correctly.
- O. Equipment By Others: For rough-ins and final connections to equipment furnished by others, ascertain exact sizes, services, and locations, before starting work. Verify accuracy of work shown on Drawings before starting work. The Contractor is responsible for providing proper installation.
- P. Dissimilar Metals: Provide complete dielectric isolation between all ferrous and non-ferrous materials.
- Q. All floor mounted equipment shall be provided with 4" thick concrete housekeeping pad unless otherwise noted.

3.2 HANGERS AND SUPPORTS:

A. Installation:

1. Securely fasten all piping to building construction with approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment and prevent sagging, noise and excessive strain due to uncontrolled movement under operating conditions.
2. Relocate any hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.
3. Supporting of piping by wire, rope, wood or other makeshift devices will not be permitted.
4. Burning of holes in beam flanges or narrow members will not be permitted.
5. Sway bracing of non-resiliently supported piping shall be in accordance with SMACNA Guidelines for Seismic Restraint of Mechanical Systems, except that fire protection piping shall be supported per NFPA requirements. Piping more than 6-feet below structure shall be restrained by a Type IV System - refer to Section 237401 - Vibration Isolation and Seismic Restraints.
6. Fasten hanger rods to structural steel members with suitable beam clamps.
7. Protect pipe insulation at every hanger, support or guide of insulated piping with inserts and shields.
8. Piping within equipment rooms shall be vibrationally isolated and restrained by a Seismic Restraint System - refer to Section 237401 - Vibration Isolation and Seismic Restraints.

B. Manifolding:

1. Parallel runs of piping, except for fire protection piping, may be supported on trapeze hangers, spaced as required for the smallest pipe carried.
2. Piping in chases shall be supported on channel framing.
3. Channel framing shall be selected to support 5 times weight or thrust of the piping without failure in accordance with the manufacturer's standard ratings. Submit details for approval by the Architect.

C. Hanger Spacing:

1. Maximum spacing for horizontal piping supports shall be as follows:

MATERIAL	SIZE	SPACING
Steel pipe	1-1/4" and Smaller	8 ft.
Steel pipe	1-1/2" to 3"	8 ft.
Steel pipe	4" and larger	8 ft.
Copper pipe	2" and smaller	6 ft.

2. Where building structure does not permit the specified spacing then Contractor shall provide additional adequate support. Location and details shall be submitted to the Engineer for approval.

3.3 ANCHORS FOR SUPPORTS:

- A. In Concrete Floor: Steel plates and rebar as detailed on the Drawings. Anchor bolts shall be in accordance with Uniform Building Code.
- B. Hangers: From steel joists and beams shall be with approved beam clamps.

3.4 PIPE JOINTS:

- A. Copper Tubing: Cut square, remove burrs and clean inside of female fitting to a bright finish with steel wool, wire brush, sandpaper or emery cloth. Apply solder flux with brush to tubing. Remove internal parts of solder-end valves prior to soldering. Provide dielectric unions at points in connection of all copper tubing and any ferrous and equipment joining for copper pipes shall be as follows:
 1. Water Piping 3" and Smaller: Sil-Fos brazing.
 2. Water Piping Larger Than 3": Sil-Fos brazing.
 3. Condensate: 95-5
- B. Screwed Piping: Cut with machine cutter, hand pipe cutter or carborundum pipe wheel. Deburr with file or scraper or pipe reamer. Do not ream to exceed I.D. of pipe and thread to ANSI B2.1 requirements. Use Teflon tape on male thread prior to joining other services. No more than two full threads shall remain exposed after joinings. Use litharge and glycerin on joint prior to joining for air piping.
- C. Brass Screwed Pipe: Cut threads, remove burrs, and apply red lead or approved pipe dope as specified for steel screwed pipe. Makeup pipe with surface of chrome plated pipe and fittings. Do not mark surface of chrome plated and fittings.
- D. Welding:

1. Before proceeding, submit for approval:
 - a. Proposed procedures conforming to:
 - (1) ANSI B31.1, Code for Pressure Piping, Chapter V.
 - (2) ANSI A49.0, Safety in Welding and Cutting.
 - b. List of Welders:
 - (1) Qualified per Section IX for ASME, Boiler and Pressure Vessel Code.
 - (2) Certified by Los Angeles City.
2. Field Procedures:
 - a. Pipe cleaned free from rust, scale and oxide.
 - b. Pipe beveled each end.
 - (1) Per approved procedures.
 - c. Backing rings:
- E. Leaky Joints: Remake leaky joints with new material. Remove all leaking sections and/or fittings as directed. Do not use thread cement or caulking to make joint tight.

3.5 ACCESS TO EQUIPMENT:

- A. General: All piping, equipment, and accessories shall be installed to permit access for maintenance. Any relocation of piping, equipment, and accessories required to provide maintenance access shall be accomplished by the Contractor at no additional cost to the Owner.
- B. Access: Supply access doors where any valves, fire dampers, motors, and equipment requiring access for servicing, repairs or maintenance are located in walls, chases, above ceilings, or in ductwork. The location of access panels shall be coordinated with the applicable trades installing walls or ceilings. Contractor shall arrange for the necessary openings in the building to allow for admittance of all apparatus. Access doors or panels shall be installed by the trade furnishing the surface on which the panels are to be installed.

3.6 INSTRUMENTS:

- A. Installation of Thermometers: Thermometers installed on insulated lines shall be provided with extension necks. Locate thermometers for ease of reading and removing. Install thermometer with separable sockets. Where thermometers are required but are not readily visible to view install remote reading instruments.
- B. Installation of Pressure Gages: Pressure gages installed on insulated pipe or equipment shall be installed with extension nipples. Locate gages for ease of reading and removing. Install all gages with shut-off cocks. Install one gage between the suction and discharge lines of pumps with shut-off cock on each side and interconnecting piping made up with flexibility.

3.7 SLEEVES, CORE DRILLING, AND ESCUTCHEONS:

- A. Sleeves: Provide sleeving, for all pipes that penetrate walls and floors.
 - 1. Cast-Iron Sleeves: Secure waterproofing membrane under flashing clamp. Caulk annular space watertight.
 - 2. Steel or Concrete Sleeves: Dry pack in place and caulk annular space.
 - 3. Sleeves in floor shall extend 2" above finish floor with annular space caulked watertight.
- B. Escutcheons: Provide escutcheons on all piping that penetrates floors, walls, and ceilings where exposed to view.

3.8 VALVES:

- A. General: All valves shall be first quality of approved manufacture, shall have proper clearances, and shall be tight at the specified test pressure. Each valve shall have the maker's name or brand, the figure or list number and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or shall be provided with other means of easy identification. Valves shall be minimum working pressure and materials as fittings specified for the service except as herein modified. All gate and globe valves shall be suitable for repacking under pressure. Regardless of service, valves shall not be designed for less than 125 lb. per square inch steam working pressure.
- B. Arrangement: Valves shall be installed in systems so located, arranged and operated as to give complete regulation of all apparatus, equipment, and fixtures.
- C. Installation: Valves shall be installed in the following locations:
 - 1. In branches and/or headers of water piping serving group of fixtures.
 - 2. On both sides of all apparatus and equipment.
 - 3. For shutoff of risers and branch mains.
 - 4. For flushing and sterilizing the systems.
 - 5. Where shown on the Drawings.
 - 6. Valves shall be installed for accessibility and easy maintenance.

3.9 STRAINERS:

- A. General: Bronze bodied strainers shall be installed in common piping systems. Blow-out connections shall be valved with valve sized same as the blow-out connection.
- B. Valves: Valves shall be gate or ball type.

- 3.10 FLASHING: Provide flashing assembly with counterflashing on each pipe passing through roof. Provide necessary counterflashing.
- 3.11 EQUIPMENT SUPPORTS: Provide all necessary steel framing supports for piping and equipment for a complete and satisfactory installation. Coat all concealed or inaccessible supports as specified under Painting. Submit Drawings of miscellaneous supports for approval.
- 3.12 PIPE WRAPPING (UNDERGROUND PIPING STEEL): Surface shall be cleaned and primed with a solution recommended by the tape manufacturer, field wrap with two layers, half-lapped, polyvinyl chloride tape with tape identification visible. Pipe may be machine wrapped as specified for asphalt and kraft paper.
- 3.13 TEMPERATURE CONTROL DEVICE INSTALLATION:
- A. The following incidental work shall be furnished under the supervision of the Temperature Control Contractor:
1. Install automatic valves and separable wells that are specified or required.
 2. Furnish and install all necessary pressure taps, water, drain and overflow connections and piping.
 3. Furnish and install all necessary piping connections required for flow devices.
- 3.14 INSTALLATION OF PREWIRED CONTROL PANELS:
- A. General: Prewired electrical control panels provided under the work of this Division shall be delivered to the location of installation under the work of this Division. Installation and electrical hook-up shall be under the work of Division 26 - Electrical.

END OF SECTION 230501

SECTION 230502**IDENTIFICATION****PART 1 - GENERAL**

1.1 DESCRIPTION:

Provide identification, complete. For all new piping installed as a part of this project.

A. Work in This Section: Principal items include:

1. Valves (new)
2. Control panels.
3. Piping.
4. Apparatus.

B. Related Word Not in This Section:

1. Section 230501 - Basic Mechanical Materials and Methods.

1.2 SUBMITTAL DATA: In addition to the requirements of Section 230500 - Mechanical General Provisions, the submittal material shall include six copies of descriptive data for all products and material including, but not limited to, the following:

A. Descriptive Data:

1. Apparatus identification.
2. Labels.

B. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

PART 2 - PRODUCTS

2.1 APPARATUS IDENTIFICATION: Apparatus nameplates shall be black lamacoid plates with white lettering (1/2" high) engraved through the black layer. Equipment identification shall be embossed aluminum or engraved plastic plates securely attached to the equipment.

2.2 PIPE IDENTIFICATION: Piping stencils shall be brass with 3/4" high lettering.

PART 3 - EXECUTION

3.1 GENERAL: All valves shall have an identification tag identifying valve number and service. Secure tags to valves with plated No. 18 gage jack chain. Valves that are equipped with chain operators shall have an additional tag secured to the hook or clip that supports the swagged chain.

3.2 APPARATUS IDENTIFICATION: Nameplates shall be for the following types of apparatus:

- A. Starters, disconnects, and switches provided under work of Division 15.
- B. Panel mounted instruments.
- C. Panel mounted controls.

3.3 IDENTIFICATION

A. Identification shall be provided for the following types of equipment:

- 1. HVAC Equipment.
- 2. All Control Panels.
- 3. All Sensors (not thermostats).
- 4. All Piping, Valves, etc., new under this work.
- 5. All Ductwork.
- 6. Plumbing Equipment

B. Equipment out of view behind access doors in unfinished rooms shall also be identified on the face of the access door.

3.4 PIPE IDENTIFICATION: (New Pipe Only)

A. General: All exposed and above-ceiling piping, whether insulated or not, shall be identified by content, size of pipe, and the direction of flow, indicated by means of stenciled legends and flow arrows. Identifying markers shall be installed near all valves on each piping system.

B. Furred Spaces: Piping installed in furred spaces will not require identification except at valve access panels where valves and piping shall be identified.

C. Stenciling: Piping identification markers shall be located so as to be readily visible from any reasonable point of observation. Where two or more pipes run parallel, the printed legend and other markets shall be applied in the same relative location. All identification located at eye level shall be along center line of pipe; identification located above eye level shall be on the lower quarter of pipe; identification located below eye level shall be on the upper quarter of pipe.

- D. Lettering: All lettering shall be 3/4" high and shall be black, except where background is black, in which case white or aluminum shall be used.
- E. Pipe contents and direction of flow shall be marked using Seton pipe markers.
- F. Ceiling Marker: In areas where removable tile ceilings occur, install appropriate ceiling tile markers to indicate location of valves and other equipment. Refer to Architectural Drawings and Specifications for the type of tile marker and color code for each trade.

3.5 SCHEDULE:

A. Legend:

CONTENTS NOTE	LEGEND	COLOR
Chilled Water Supply	CHWS	G*
Chilled Water Return	CHWR	G*
Condenser Water Supply	CWS	G*
Condenser Water Return	CWR	G*
Heating Hot Water Supply	HHWS	G*
Heating Hot Water Return	HHWR	G*
Domestic Cold Water	DCW	
Domestic Hot Water	DHW	
Domestic Hot Water Return	DHWR	
Deionized Water	DI	
Industrial Cold Water	ICW	
Industrial Hot Water	IHW	G*
Industrial Hot Water Return	IHWR	G*
Supply Ductwork		
Fume Hood Exhaust		
General Exhaust		
Vacuum	VC	G*
Compressed Air	CA	G*
Sanitary Waste	W	G*
Acid Waste	AW	Y*
Sanitary Vent	V	G*
Acid Vent	AV	Y*
Instrument Air	I	G*
Natural Gas	GAS	Y*
Fire Protection	FIRE	R*

B. Notes on Schedule:

1. Symbol * indicates Flow Arrow required.

C. Background Colors:

1. Symbol Y indicates yellow background color (dangerous materials).
2. Symbol G indicates green background color (safe materials).

3. Symbol R indicates red background color (fire protection equipment).
- D. In lieu of stencils and painting, contractor may submit on Seton markers, Engineer may approve depending on type.

END OF SECTION 230502

SECTION 230593**AIR AND WATER TEST AND BALANCE****PART 1 - GENERAL**

1.1 DESCRIPTION: Division 1 Conditions apply to this Section. Provide air and water test and balance, complete.

A. Work in This Section: Principal items include:

1. Pressure testing of piping systems.
2. Pressure testing of ductwork.
3. Balancing water systems.
4. Balancing air distribution systems.

B. Related Work Not in This Section:

1. Section 220100 - Domestic Water System.
2. Section 221300 - Drainage System.
3. Section 233100 - Ductwork.

1.2 SUBMITTAL REQUIREMENTS: In addition to the requirements of Section 230500 - Mechanical General Provisions, the submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, the following:

A. Descriptive Data:

1. Air flow measuring device.
2. Pressure gages.
3. Thermometers.
4. Other testing instruments.
5. Certificates of calibration of test instruments.

B. Sample Forms: Complete forms proposed for use in compiling and recording test and balance data.

C. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractor's convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

- 1.3 A discussion of the scope of the air balance is as follows:
- A. Reports shall be provided for each piece of equipment, diffuser, etc. on a per building basis. Final acceptance will be withheld until receipt of the air balance reports. Reports shall be provided in bound copies with drawings. (CAD files can be provided for a charge of \$ 300 if requested seven days ahead of time.)
 - B. Notify the engineer of any discrepancies of the equipment during the balancing period. Co-ordinate with the EMS contractor for any piece of equipment that is controlled by the EMS system.

PART 2 - PRODUCTS

- 2.1 PRODUCTS AND MATERIALS shall be as described in the pertinent Sections of the Mechanical Specifications.

PART 3 - EXECUTION

3.1 REQUIREMENTS:

- A. General:
 - 1. Contractor shall, at time of bid preparation, examine all Drawings and existing ductwork and call to attention deficiencies of balancing devices required. Additional devices required for proper testing and balancing shall be provided by the Contractor at no additional cost to the Owner.
 - 2. Contractor shall notify the Architect when any test is ready to be performed. The Architect is to be present for all tests.
 - 3. Contractor shall provide all equipment required for testing including fittings for additional openings and all openings required inside and outside the building.
 - 4. After the inspection has been approved, or portion thereof, the Contractor shall certify in writing the time, date, name and title of the person approving the test. This shall also include the description and what portion of the system has been approved. The person making the inspection shall sign the certification.
 - 5. A complete record shall be maintained of all testing that has been approved and shall be made available at the project site to all authorities concerned.
 - 6. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Architect before final payment is made.
 - 7. Defective work or material shall be replaced or repaired as necessary at no additional cost to the Owner and the inspection and test repeated. Repairs shall be made with new materials. No caulking of screwed joints or holes will be acceptable.
 - 8. No part of any work shall be covered or concealed until after it is inspected, tested, and approved.
 - 9. Isolate all equipment subject to damage from test pressure. Make no test against a service valve or meter.

- B. Timing of Tests: Two weeks before expected completion date, put all systems and equipment into operation and continue operation of same during each working date, but not less than five 8-hour periods, until all adjusting, balancing, and testing demonstration required have been approved.
- C. Operational Tests: After installation, all bearings of all equipment shall be oiled or greased as recommended by the manufacturer. Perform operational tests on all machinery and devices to determine compliance with Specifications. Equipment shall function quietly and efficiently. Before acceptance, repair or correct piping and equipment causing noise or vibration.
- D. Functional Tests: Any installed items not meeting the schedule and/or specified performance shall be removed and replaced with items whose performance is in accordance with the Drawings and Specifications at no additional cost to the Owner.

3.2 PIPING PRESSURE TEST:

- A. Wet Heat Transfer Piping: Piping systems shall be pressure tested as follows. Test shall show no loss in pressure and no visible leaks after a minimum duration of 4 hours with pressurization source removed. Allowance may be made for water added or discharged to maintain pressure loss or gain due to temperature change.

System	PSIG	Test With
Chilled Water Supply & Return	150	Water
Condenser Water Supply & Return	150	Water
Heating Hot Water Supply	150	Water
Heating Hot Water Return	150	Water
Industrial Cold & Hot Water Systems	150	Water

- B. Domestic & Industrial Water Distribution Systems: Test the system with water at a hydrostatic pressure of not less than 150 psi. Provide a pressure gage located at the highest point of the system being tested, with a shut-off valve and bleeder valve so arranged to check gage operation. When the piping system operates at higher pressure than 75 psi, the hydrostatic test pressure shall be 50 psi above the operating pressure. The test shall be applied not less than 1 hour prior to inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately as specified for the entire system. There shall be no drop-in pressure at the end of 4 hours with pressurization source disconnected.
- C. Drainage, Waste, Vent, and Storm Systems: The water shall be applied to the system either in its entirety or in sections. The piping shall be tightly plugged and submitted to a 10-foot head of water located at the highest point. Provide a separate standpipe above the highest point being tested or extend the system to obtain the required 10-foot head of water. The water shall be kept for at least 30 minutes before the inspection starts. System shall hold water for 4 hours without loss.
- D. Sectionalizing: Parts of system may be isolated for the purpose of testing. Each isolated part shall be specifically identified and certified.

3.3 DUCT PRESSURE TEST: Required for medium pressure duct - no exceptions.

- A. General: Test all ductwork and plenums for leaks, using a portable high-pressure blower and necessary instruments. Ducts may be tested in sections, but not less than 1/2 of a floor per section.

Isolate and provide temporary caps as required. Make tests before sections are concealed. Conduct as follows, and as recommended in SMACNA Balancing Manual.

- B. Procedure: Seal all openings in duct and plenum section to be tested. Connect test apparatus to test section using a flexible duct connection or hose. Close damper on blower suction side, to prevent excessive buildup of pressure. Start blower and gradually open damper on suction side of blower. Build up pressure in test section to 4" W.C. in medium pressure duct and 2" W.C. in low pressure duct. Determine amount of air leakage by make-up air flow measurements and make repairs as required. Determine total leakage allowable of 1% per minute based upon the total operating CFM of system being tested. Total leakage determined by summation of leakage for each section of system tested. Visually mark tested sections with certification sticker and initials of field test inspector.

3.4 AIR AND WATER BALANCE:

- A. General: Balancing and testing shall be performed by an independent firm specializing in balancing and testing and approved by the Architect. Such firm shall be a member of Associated Air Balance Council or certified by the National Environmental Balancing Bureau. Air and water systems shall be balanced in accordance with standards and procedures of Associated Air Balance Council or National Environmental Balancing Bureau. Use instruments accurately calibrated and maintained in good working order. If requested, conduct tests in presence of the Architect.
- B. Balancing and Adjusting Air Systems:
 - 1. Procedures: After completion of systems or of a complete department space:
 - a. Adjust all grilles, registers, and diffusers for optimum air distribution and minimum noise and drafts, starting with all elements in wide open position.
 - b. Adjust all fan speeds and manually operated dampers to supply exhaust and/or return quantities of air specified or indicated.
 - c. In cooperation with control manufacturer's representative, set the adjustment of all automatically operated dampers to operate as specified, indicated and/or noted. Make all required tests associated with damper adjustments.
 - d. Make any changes in pulleys and belts as necessary for correct balance at no additional cost to the Owner.
 - e. Final balance tolerances for air and water are +10% to -3%
 - 2. Test: Perform the following tests, compile information, and submit copies of this information for evaluation by the Architect. Submit in report form with suitable 3-ring binder cover.
 - a. Air Handling Equipment:
 - (1) Make, size, model number, designation and location of all fans and units.
 - (2) Motor size, voltage, phase, rated and actual current readings for above equipment.
 - (3) Air handled in CFM.
 - (4) Outlet velocities in FPM.
 - (5) Inlet, outlet, and total static pressure of each unit.
 - (6) Recirculated and outside air quantities, if applicable.
 - (7) Fan speed.

- (8) Motor pulley sizes and speeds.
- b. Diffusers, Grilles, and Registers:
- (1) Location, size, make, model number and total free area of each or manufacturer's air flow factors.
 - (2) Required and test resultant velocity in FPM of each.
 - (3) Required and test resultant quantity of air in CFM of each.
 - (4) Sound levels in decibels in occupied areas having a diffuser, grille, or register with noticeable sound level. Measure sound levels at approximately 45 degrees to center of diffuser, etc., on the "A" and "C" scales of a General Radio Company Sound Level Meter, or similar instrument.
 - (5) Without air handling equipment operating measure, the ambient sound levels of rooms with noticeable sound level in which above diffusers, etc. are located and included measurements in the report. Also, include in the report any noise caused by mechanical vibration which is at an intensity deemed objectionable. Items 4 and 5 conducted only at the request of the Architect.
- c. Heat Exchange Coils:
- (1) Average face velocity (average of 12 readings).
 - (2) Static pressure drops.
 - (3) Entering and leaving air temperature (db and wb).
 - (4) Entering and leaving water temperature.
 - (5) Water pressure across coil.
 - (6) Water quantities through coils.
- d. Exhaust Fans:
- (1) Make, size, model number, designation and location of all fans and units.
 - (2) Motor size, voltage, phase, rated and actual current readings for above equipment.
 - (3) Air handled in CFM.
 - (4) Outlet velocities in FPM.
 - (5) Inlet, outlet, and total static pressure of each unit.
 - (6) Fan speed.
 - (7) Motor pulley sizes and speeds.
- e. VAV Boxes:
- (1) CFM both minimum and maximum air quantities
 - (2) Verify correct model number and size for each room per the design documents.
 - (3) Heating coil temperatures and setpoints.
- f. Chilled Water System:
- (1) Water volumes and flows throughout the system.
 - (2) Flows at each pump operating individually as well as total flows.
 - (3) Provide flow data to control contractor for verification of flow sensors.

- g. Condenser Water System:
 - (1) Water volumes and flows throughout the system.
 - (2) Flows at each pump operating individually as well as total flows.
 - (3) Provide flow data to control contractor for verification of flow sensors.
- h. Heating and Domestic Hot Water Systems:
 - (1) Water volumes and flows throughout the system.
 - (2) Flows at each pump operating individually as well as total flows.
 - (3) Provide flow data to control contractor for verification of flow sensors.

C. Balancing and Adjusting of Water Systems:

1. Procedure: Check for proper operation and the setting of all valves, strainers, pump rotations, air vents, and control valves. Set all temperature controls so all coils are calling for full cooling or full heating. Set heating hot water pumps to proper gallons per minute delivery. Check water temperature at inlet side of cooling and heating coils. Note rise or drop of temperature from source. Measure and adjust flow at each heating hot water coils. Upon completion of flow readings and adjustments at coils, mark all settings and record data.
2. Record and check the following items at each coil:
 - a. Temperature of inlet medium.
 - b. Temperature of leaving medium.
 - c. Pressure drops of each coil.
 - d. Pressure drop across flow control device.
 - e. Pump operating suction and discharge pressure and final TDH.
 - f. List all mechanical specifications of pumps.
 - g. Rated and actual running amperage of pump motor.
3. Reports: Upon completion, insert all information on a sheet listing all items required by specifications on approved forms and include in test and balance report. Type all sheets.
4. Contractor shall, upon completion of the air and water balance reports, and after they have been properly submitted, shall be prepared for the engineer of record to verify balance accuracy. This may include the contractor providing balancing personnel and equipment for the use of the engineer for a minimum of one day. The engineer, with the contractor's personnel and equipment, may request spot readings to verify conformance to the specifications and drawings. Should 5% of the readings taken vary more than 10% of design values, the contractor shall re-balance the complete project. This cycle shall continue until the project balancing is approved by the engineer. The time and expense of these inspections shall be included by the contractor as previously described herein.

END OF SECTION 230593

SECTION 230700**INSULATION****PART 1 - GENERAL**

1.1 DESCRIPTION: Division 1 Conditions applies to this Section. Provide insulation, complete.

A. Work In This Section: Principal items include:

1. Insulation of piping systems.
2. Insulation of ductwork.
3. Insulation of equipment.

B. Related Work Not In This Section:

1. Section 230501 - Basic Mechanical Materials and Methods.

1.2 SUBMITTAL DATA: In addition to requirements of Section 230500 - Mechanical General Provisions, submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, following:

A. Descriptive Data:

1. Piping insulation.
2. Equipment insulation.
3. Insert sections.

B. Shop Drawings:

1. Removable type insulation.

C. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

PART 2 - PRODUCTS

- 2.1 GENERAL: Installed products shall be in accordance with the requirements of NFPA Standards No. 90A and No. 90B.
- 2.2 TYPE P-1 INSULATION - PIPE:
- A. Insulation shall be one-piece preformed glass fiber insulation (4 PCF) with all purpose fire retardant jacket and "K" factor of 0.23 maximum at 70 degrees F mean temperature.
 - B. Manufacturer: Insulation shall be Johns-Manville "Flame-Safe" or equal by Owens-Corning Fiberglass or Certain Teed. Adhesive shall be Benjamin Foster 84-20 or equal.
- 2.3 TYPE P-2 INSULATION - PIPE (VAPOR SEAL):
- A. Insulation shall be one-piece preformed glass fiber insulation (4 PCF) with all purpose fire retardant vapor barrier jacket and "K" factor of 0.23 maximum at 70 degrees F mean temperature.
 - B. Manufacturer: Insulation shall be Johns-Manville "Flame-Safe" or equal by Owens-Corning Fiberglass or Certain-Teed. Adhesive shall be Benjamin Foster 85-20 or equal.
 - C. Pipe located on roof exposed to roof: Insulation shall be covered and protected with corrugated aluminum pipe insulation covering. Aluminum shall be stapled and fastened in accordance with manufacturer's instructions, but not less than 6 inch on centers. Cover all fittings.
- 2.4 TYPE P-3 INSULATION - PIPE:
- A. Insulation shall be preformed sectional pipe covering for asbestos free hydrous calcium silicate, 13 pounds per cubic foot. Insulation shall have "K" factor of 0.42 maximum at 200 degrees F mean temperature.
 - B. Manufacturer: Insulation shall be Johns-Manville Thermo-12 or approved equal.
- 2.5 TYPE P-4 HANGER INSERT SECTION - PIPE:
- A. Insert sections shall be asbestos free hydrous calcium silicate pipe insulation (14 PCF) in sections 2" longer than protection shield being used.
- 2.6 TYPE D-1 INSULATION - DUCTWORK CONCEALED:
- A. Insulation shall be inorganic glass fiber flexible blanket (1 1/2" thick 3/4 PCF). Insulation shall have "K" factor of 0.25 maximum at 75 F mean temperature. Provide vapor barrier.
 - B. Manufacturer: Insulation shall be Johns-Manville "Microlite" or equal by Owens-Corning Fiberglass or Certain-Teed. Adhesive shall be Benjamin Foster 85-20 or equal.
 - C. Insulation to have an outer layer of foil, for vapor barrier protection.
- 2.7 TYPE D-2 INSULATION - DUCTWORK EXPOSED:
- A. Insulation shall be 3 lb. density inorganic glass fiber nonflexible. Insulation shall have "K" factor of 0.25 maximum at 75 degrees F mean temperature.

- B. Manufacturer: Insulation shall be Johns-Manville Series 800 "Spin-glas" or equal by Owens-Corning Fiberglass or Certain Teed. Adhesive shall be Benjamin Foster 85-20 or equal.

2.8 TYPE E-1 INSULATION - EQUIPMENT:

- A. Insulation shall be semi-rigid fiberglass board, suitable for temperatures up to 850 degrees F, 3 lb./cu.ft. density minimum with maximum "K" factor of 0.56 at 500 degrees F mean temperature, shall have a 22 gage aluminum jacket.
- B. Manufacturer: Insulation shall be Johns-Manville 1000 Series "Spin-glas" board or equal by Owens Corning Fiberglass or Certain Teed. Adhesives shall be Benjamin Foster 30-36 or equal.
- C. Coordinate with chiller manufacturers to insulate hot & cold surfaces of CH 1 and 2.

2.9 TYPE E-3 INSULATION - ENGINE MUFFLER SYSTEM:

- A. Insulation shall be calcium silicate, asbestos free, suitable for temperatures up to 1500 degrees F, 13 lb./cu.ft. minimum density with maximum "K" factor of 0.45 at 300 degrees F mean temperature. Provide vapor barrier and aluminum covering where exposed to weather.
- B. Manufacturer: Insulation shall be Johns-Manville Thermo-12 or equal by Owens-Corning Fiberglass or Certain Teed.

2.10 SERVICE AND TYPE: As follows:

SERVICE	THICKNESS	TYPE
Chilled Water Supply and Return	1.5"	P-2
Heating Hot Water Supply and Return	1.5"	P-2
Domestic Hot Water Supply and Return	1.0"	P-2
Industrial Hot Water Supply and Return	1.0"	P-2
Concealed Duct	1.5"	D-1
Exposed Duct	1.0"	D-2
Engine Muffler	3.0"	E-3

2.11 FIRE RATING FOR DUCT INSULATION

Insulation applied to the exterior surface of ducts shall have a flame spread rating of not more than 25, and a smoke-developed rating of not more than 50 when tested as a composite assembly including insulation. Facing materials, tapes and adhesives as normally applied (Sec. 1005, CMC)

2.12 FIRE RATING FOR PIPE AND TUBING

Insulation and covering on pipe and tubing shall have a flame spread rating of not more than 25, and a smoke-developed rating of not more than 450 when tested in accordance with UBC Standard 42-1 [1714 (b) CBC].

PART 3 - EXECUTION

3.1 APPLICATION OF PIPING AND DUCT INSULATION:

- A. Follow manufacturer's recommendations when they are more stringent than this specification.
- B. Type P-1: Insulation shall be applied as follows:
 - 1. All joints shall be tightly butted together.
 - 2. Exposed piping insulation shall be secured by applying a brush coat of fire retardant adhesive to the longitudinal lap and butt strips.
 - 3. Concealed piping insulation shall be secured with 9/16" coated flare type, staples on 4" centers on the longitudinal lap and butt strips.
 - 4. Fittings and valve bodies smaller than 4" shall be insulated with insulating cement, hand molded to a thickness equal to the adjoining insulation and covered with a smooth coat of insulating cement and canvas jacket.
 - 5. Fittings and valve bodies 4" and larger shall be insulated with fitted segments of the molded insulation secured with 20 gage annealed galvanized wire and finished with a smooth coat insulation and finishing cement.
 - 6. Flange bolts shall not be insulated but left accessible for valve or fitting removal without disturbing the insulation.
 - 7. Strainer bodies shall be insulated with readily removable sections of insulation for removal of strainer screens.
 - 8. Piping outdoor insulation shall be protected with corrugated aluminum covering.
- C. Type P-3: Insulation shall be applied as follows:
 - 1. Insulation shall be applied similar to P-1 for heating applications and similar to P-2 for cooling application.
 - 2. Insulation shall be finished with jackets similar to P-1 and P-2 for similar service.
- D. Type P-2: Insulation shall be applied as follows:
 - 1. All joints shall be tightly butted together.
 - 2. Exposed and concealed piping insulation shall be secured by applying a brush coat of fire retardant adhesives to the longitudinal lap and butt strips.
 - 3. Butt ends shall be sealed off at all valves, fittings, and flanges and at every 20-feet in straight runs.
 - 4. Fittings and valve bodies smaller than 4" shall be insulated with 1 pound density fiberglass blanket, wrapped firmly and secured with 20 gage annealed galvanized wire and finished with glass cloth embedded between two 1/16" layers of Benjamin Foster 30-35 lagging cement and overlapping adjoining insulation a minimum of 2".
 - 5. Fittings and valve bodies larger than 4" shall be insulated with mitered sections of pipe insulation secured in place with 20 gage annealed galvanized wire and finished with glass cloth embedded between two 1/16" layers of Benjamin Foster 30-35 lagging cement and overlapping adjoining insulation a minimum of 2".
 - 6. Flange bolts shall not be insulated but left accessible for valve or fitting removal without disturbing the insulation, except for chilled water applications which the entire flange shall be insulated with removable sections.
 - 7. Strainer bodies shall be insulated with readily removable sections of insulation for removal of strainer screens.

E. Type P-2: Insert Sections:

1. Install insert sections on insulated piping located centrally under each hanger. Vapor barrier and jacketing shall be continuous over insulation.
2. Extend vapor barrier and jacketing continuously over insert.
3. Fabricate inserts of the same thickness as the adjoining insulation.

F. Type D-1: Concealed insulation shall be applied as follows:

1. Insulation shall be cut long enough to avoid the reduction of insulation thickness at the duct corners.
2. Edges shall be butted together closely with no gaps.
3. Secure insulation in place with heat sensitive foil tape. Tape all seams. Tape to be compatible with insulation material.
4. All cuts and tears shall be neatly patched.

G. Type D-2: Exposed insulation shall be applied as follows:

1. Insulation shall be cut to the exact size to fit the duct without overlaps, buckles, and/or reduction of thickness at the corners.
2. Longitudinal seams and butt edges shall be tightly butted together.
3. Secure insulation to ducts with weld pins spaced on 12" centers with a minimum of two rows per side.
4. Clip protruding pins ends flush with clip.
5. Insulation shall be cut to fit snugly between standing duct joints and stiffener angles. Cover joints or angles with an additional layer of insulation.

H. Type E-1: Insulation shall be applied as follows:

1. Adhere insulation to surface with speed clips and stick pins.
2. Cover insulation with aluminum jacket banded in place with aluminum bands 16" on centers.

I. Type E-3: Insulation shall be applied as follows:

1. Calcium silicate blocks shall be cut to the sizes required.
2. Secure insulation with 3/4 inch wide stainless steel bands on 9 inch centers.

END OF SECTION 230700

SECTION 233100**DUCTWORK****PART 1 - GENERAL**

1.1 DESCRIPTION: Division 1 Conditions applies to this Section. Provide ductwork, complete.

A. Work In This Section: Principal items include:

1. Ductwork, plenums, and casing.
2. Diffusers, registers, and grilles.
3. Dampers.

B. Related Work Not In This Section:

1. Section 230593 - Air and Water Test and Balance.
2. Section 230700 - Insulation.
3. Section 233200 - Duct and Plenum Lining.
4. Section 230923 - HVAC Instrumentation and Controls.

1.2 SUBMITTAL REQUIREMENTS: In addition to requirements of Section 230500 - Mechanical General Provisions, submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, following:

A. Descriptive Data:

1. Grilles, registers, and diffusers.
2. Dampers.
3. Flexible ducts.
4. Ductwork accessories.
5. Doors and hardware.
6. Duct sealing.
7. Certified acoustical test performance data shall be submitted for diffusers, registers, grilles, terminal air units, and structural metal casings.
8. Variable Air Volume Units

B. Shop Drawings:

1. Ductwork typical construction.
2. Riser duct details.

C. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the

design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

PART 2 - PRODUCTS

- 2.1 GENERAL: Galvanized steel sheets shall be first quality cold rolled, galvanized, open hearth soft steel sheets, capable of double seaming without fracture, meeting ASTM A526. Stainless steel sheets shall be Type 304 18-8 stainless.
- 2.2 CIRCULAR DUCTS: Circular ducts and fittings shall be galvanized steel of spiral construction as manufactured by United Sheet Metal, Peabody & Wind, Spiromatic, or approved equal. Provide only if shown on drawings as circular duct. Do not convert exposed rectangular duct to circular duct without express approval. Corrugated or flexible metal duct will not be acceptable.
- 2.3 ACCESS DOOR: Access doors for circular ducts shall be United Sheet Metal Type AR-W, Peabody & Wind, Spiromatic, or approved equal.
- 2.4 MATERIALS: Medium pressure ductwork shall be galvanized steel. Low pressure ductwork shall be galvanized steel. All bracing, angles, bars, and straps shall be steel. Screws and bolts shall be cadmium plated.
- 2.5 INSULATED FLEXIBLE DUCTWORK:
- A. General: Insulated flexible ductwork shall be factory pre-insulated, spiral helix spring permanently bonded to an interior liner, and sheathed in an exterior vapor barrier jacket. Flexible ductwork shall be Glass-Flex IHP-1, or equal by Wiremold or Thermaflex.
 - B. UL Requirements: The entire flexible duct assembly shall be labeled in accordance with UL-181 Class 1 air duct requirements, and not have a flame and smoke spread rating in excess of 25/50. Installation must conform with factory supplied and UL approved printed installation instruction sheets. Submittals will be required to include product data sheets and installation instruction sheets in order to assure awareness of the proper installation techniques.
 - C. Thermal Conductance: Insulation must achieve a minimal conductance $K - 0.25$ (R4 rating) and must be completely shielded from the airstream at all times.
 - D. Duct shall be rated for 7" w.c. pressure.
- 2.6 CONTROL DAMPERS:
- A. Manual Volume Control Dampers:

1. Single Blade Butterfly Dampers: Damper shall be 16 gage, minimum galvanized steel with 3/8" square rod and secured in place with a self-locking regulator. Regulator shall be Ventlock No. 641 or equal by Duro Dyne.
 2. Opposed Blade Dampers: Frames shall be 12 gage, minimum, steel channel, 2" wide with 1/2" web welded to frame. Blades shall be steel reinforced with triple 1" diameter heading secured to square or rectangular shafts which turn in teflon or bronze bearings. Seals shall be neoprene applied to the sealing edge of the blade sealing blade to frame. Finish shall be black enamel.
- B. Mixing Dampers: Single blade butterfly damper as specified in control dampers. Opposed blade damper as specified in control damper. The hot duct and cold duct damper shall be linked with common control rod. Damper shall be provided with mounting for automatic damper operator.
- C. Backdraft Dampers: Backdraft dampers shall be extruded aluminum construction with vinyl blade edge seals and blade ends overlapping frame.
- D. Automatic Damper Operators: Damper operators and automatic dampers shall be as specified under Section 230923 – HVAC Instrumentation and Controls.

2.7 FIRE DAMPERS AND SMOKE DAMPERS:

- A. General: Fire and smoke dampers shall be designed and constructed in accordance with NFPA Standard 90A and UL Standard 555, and shall be so labeled with a permanent identification.
- B. Fire Dampers and Smoke Dampers: Dampers shall be rated for rating of separation walls. Damper frames shall be permanently attached to a 18 gage mounting sleeve. Fusible link shall be rated for 160 degrees F. Complete assembly shall be galvanized.
1. Ceiling Smoke/Fire Dampers: Damper blades shall be out of air stream, interlocking shutter type. Square or rectangular duct type shall be as specified on the drawings or approved equal.
 2. Smoke Dampers: Damper blades shall be louver type minimum 16 gage steel. Damper frame shall be a minimum of 16 gage. Bearing shall be bronze or stainless steel. Damper shall be provided with mounting support for damper operator outside the airstream. Smoke dampers shall be as specified on the drawings or approved equal.

2.8 AIR DISTRIBUTION EQUIPMENT:

- A. General: Equipment shall provide required air flow, throw, and spread without excessive drafts or noise in the ventilated or air conditioned areas. Provide all accessories required to effect these conditions. Grilles, registers, extractor, dampers or diffusers causing excessive drafts or noise shall be replaced at no additional cost to the Owner. Performance rating shall be certified by the ADC. Noise level ratings shall be in accordance with ADC Test Code No. 1062R1, and ASHRAE Standards 36-62 and 368-63. Test room and test instrument shall be ADC approved. Air distribution equipment shall be of specified types as manufactured by Price or approved equal.

B. Types:

1. Lay-in Ceiling Diffusers: Perforated face modular type. Price Model PDMC or approved equal Paint core flat black. Off white exterior.
2. Lay-in Ceiling Return: Square and constructed of light weight aluminum grilles perforated, T-bar. Finish shall be baked enamel prime coat. Model PDDR or approved equal.
3. Sidewall Diffuser: Sidewall diffuser shall be aluminum with double deflection adjustable pattern, vertical face bars, horizontal rear bars, opposed blade volume control damper. Diffuser shall be Price Model 620 DAL or approved equal. Finish shall be off-white baked enamel.
4. Sidewall Return Register: Aluminum with fixed horizontal fins at 45 degree spaced on 3/4" centers and opposed blade volume control dampers, off-white baked enamel, Price Model 600 or approved equal.
5. Ceiling Grille: Aluminum with 1-1/4" overlap margin, horizontal fixed fin, off-white baked enamel. Gypsum board ceiling diffusers: Price Model SMCD or approved equal.
6. Return Air: Price Model 80 or approved equal.

2.9 TERMINAL AIR UNITS VARIABLE AIR VOLUME UNITS:

- A. General: Terminal air units shall be factory assembled constant/variable volume units with adjustable volume control, factory set for design conditions. Units shall be classed as low pressure drop, resettable constant/volume and pressure independent. Terminal units shall be as manufactured by Enviro-Tech, Trane, Krueger, or approved equal.
- B. Variable/Constant Air Units:
 1. Terminal units shall be single inlet pressure independent variable volume type. Unit shall include a variable volume damper capable of varying volume from maximum setting to zero or to minimum setting and maintain set volume discharge regardless of upstream pressure. Unit shall be capable of delivering specified maximum air volume at 0.5" W.C. pressure drop.
 2. Construction: The terminal unit casings shall be manufactured of heavy gage galvanized steel lined as described below. Quick opening access doors in the casing shall permit adjustment or replacement of volume controllers and damper operators. Leakage through the unit casing shall be less than 1% of design volume.
- C. ITEM OMITTED
- D. DDC Controls and operators shall be furnished by Control Contractor, mounted by box manufacturer.
- E. Reheat coils shall be as specified for "Coils" in other Section. Provide two row coils on all boxes.
- F. Lining: Casings shall be lined with thermal and sound attenuating glass fiber, matte faced and of long fiber to limit erosion, with all surfaces and edges coated and sealed with neoprene coatings. Lining and facing shall conform with NFPA Bulletin 90A and shall be approved by the Architect. Approval shall be made from random samples of assembled units. Provide minimum three foot sound attenuator plenum on end of box.

G. Acoustical Requirements:

1. Terminal units shall be tested to and comply with all requirements of this Specification. Representative Samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has previous certified test results that can be made applicable to this project.
2. Measurements shall be made in accordance with Air Diffusion Council test Code No. 106R1, ASHRAE Standard 36-62 and ASHRAE Standard 368-63.
3. Test conditions and procedures shall be as specified in applicable standards cited above and in the schedule.
4. The results of the tests shall be certified by the testing agency, and submitted to the Architect for approval. The submittal shall include a complete description of the test conditions and the measurement procedure.
5. The sound power level (PWL) re 10-12 watts of casing and discharge noise of the unit shall not create room noise levels above the following values:

Public corridors, lobbies, restrooms, etc.	NC-40
Offices	NC-35
Conference Rooms	NC-30
Classrooms	NC-30

2.10 AIR FILTERS:

- A. General: Filters shall be furnished complete with media, retainer frames, and housing certified to meet design requirements. Filters shall be types as specified by Farr Co., Cambridge, American Air Filter, or approved equal. See Air Handler Specification for types.

2.11 FLEXIBLE CONNECTIONS: At each point of connection of ductwork or plenum to a fan, provide a flexible connection not less than 8" in length, with a suitable frame at each end arranged for bolting to inlet or outlet of fan and ductwork. Flexible connection shall be one pound per square foot lead powder loaded, vinyl coated glass fabric. Flexible connection shall be Consolidated Kinetics KNM-1008 or equivalent.

2.12 DUCT SILENCER

- A. Type: Rectangular with angle flanges suitable for mounting between duct sections.
- B. Capacity and pressure drop: As shown.
- C. Performances:
 1. Acoustical ratings shall be determined by the "duct-to-reverberation room" method as recommended in 1960 by the S1W42 Subcommittee of the American Standards Association. Tests shall be run both with and without air flowing through silencer at not less than three different flow rates. All ratings shall be based on test data from a nationally known qualified independent laboratory. Test method shall eliminate effects due to end reflection, vibration, flanking transmission and standing waves in the

reverberant room. Airflow and pressure loss data taken in accordance with A.M.C.A. procedures shall be obtained from the same silencer used for acoustic performance tests. Upon request, evidence will be shown of an airflow pressure drop calibration check with an independent laboratory certified by A.M.C.A.

2. Silencer shall provide the following minimum attenuation values in terms of dB Insertion Loss.

Dynamic Insertion Loss* (dB)

Sound trap

Types:	125	250	500	1K	2K	4K	8K
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5' long	6	13	19	28	21	14	10
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7' long	8	15	28	30	21	14	10
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* Measured at face velocity of 2000 fpm in the direction of sound propagation.

3. Sound power level generated by airflow through silencer in dB, re: 10-12 watts (PWL12) shall not exceed the following values at design flow rating.

Self-Noise PWL re: 10-12 W*

Frequencies (Hz)

Sound trap

types	125	250	500	1K	2K	4K
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5' & 7' long	57	55	55	56	56	55
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* Measured on the downstream side at face velocity of 2000 fpm and a face area of 4' square feet.

4. Static pressure drop: The static pressure drop, inches W.C. for sound trap shall not exceed 0.30 for a face velocity of 2000 fpm.

- D. Construction: Out casings shall be 22 gauge or heavier galvanized steel standard with the manufacturer for high pressure ductwork with lock formed seams, mastic filler, and interior partitions of 24 gauge galvanized perforated steel. Filter material shall be inorganic material of density sufficient to obtain specified performance. The unit shall be airtight when subjected to differential air pressure of 8" W.C.. The combustion rating for the silencer acoustic fill shall be not more than the following fire hazard classification values when tested in accordance with the Standard ASTM E84, NFPA 255 or UL-723 test methods:

Flame spread:	25
Fuel contributed	20
Smoke development	0

- E. Acceptable manufacturers: On the basis of data presented by the manufacturer demonstrating compliance with the above, the following units will be considered:

Industrial Acoustics Type L or ML
 Koppers
 Rink

PART 3 - EXECUTION

3.1 SHEET METAL DUCTWORK:

- A. General: Install ductwork of sizes, runs, and connections as shown on the Drawings. Contractor may utilize equivalent round ductwork in place of rectangular ductwork as long as all required clearances are maintained. Verify all dimensions at the site, making all field measurements and Shop Drawings necessary for fabrication and erection of sheet metal work. Dimensions shown are net free areas. Make allowances for beams, pipes, or other obstructions in building construction and for work of other crafts. Check Drawings showing work of other trades and consult with the Architect in the event of any potential interference. Fabricate ductwork in workmanlike manner with airtight joints, presenting smooth surfaces on inside, neatly finished on outside, construct with curves, bends, turning vanes to aid in easy flow of air. Make internal ends of slip joints in direction of airflow. All ducts and duct fittings shall conform to SMACNA recommended practice. Support and brace ducts and air plenums to prevent sagging and minimize vibration when fans are operating. Provide seismic bracing per Section 237401 - Vibration Isolation and Seismic Restraints. Dimensions of acoustical lined ductwork are clear inside dimensions. Increase size of duct by thickness of acoustic lining. Blow out all dirt and foreign matter from ductwork, and clean diffusers, registers, and grilles, prior to operating system. Medium pressure duct construction shall be provided for ductwork serving systems, with terminal air units extending from the discharge of the fan to the inlet of terminal air units. Other ducts shall be low pressure duct construction.
- B. Construction of Low Pressure Rectangular Galvanized Steel Ductwork. Wall thickness shall be as scheduled by ASHRAE Equipment Handbook for Duct Construction. Construction shall be as follows:
1. Longitudinal Seams: Grooved or Pittsburgh.
 2. Transverse Joint Connections: For ducts sized as follows:
 - a. Up to 18": Drive slip, S-slip, or 1" pocket lock.
 - b. 19" Through 30": Hemmed S-slip, 1" bar slip, or 1" pocket lock - 5-foot centers.
 - c. 31" Through 42": 1" bar slip, 1" reinforced bar slip, or 1-1/2" pocket lock. 4-foot centers.
 - d. 43" Through 60": 1-1/2" bar slip, 1" reinforced bar slip, or 1-1/2" pocket lock. 4-foot centers.
 - e. 61" Through 84": 1-1/2" reinforced bar slip, or 1-1/2" angle reinforced slip, or 1-1/2" angle reinforced pocket lock. 4-foot centers.
 - f. 85" Through 96": 1-1/2" companion angle, 1-1/2" angle reinforced slip, or 1-1/2" angle reinforced pocket lock. 4-foot centers.
 - g. Over 96": 2" companion angle, 2" angle reinforced slip, or 2" reinforced pocket lock. 4-foot centers.
- C. Construction of Medium Pressure Rectangular Galvanized Steel Ductwork: Wall thickness shall be as scheduled by ASHRAE Equipment Handbook for Duct Construction. Construction shall be as follows:
1. Sealant: Liquid type sealant applied to seams and joints before assembly to make airtight construction. Fill drilled holes prior to inserting rivets or screws.
 2. Longitudinal Seams: Grooved or Pittsburgh.

3. Transverse Joint Connections and Reinforcing for duct sized as follows:
 - a. Up To 12": Inside Slip or double S-slip.
 - b. 13" Through 18": Inside slip or double S-slip, with 1" x 1" x 16 gage angle.
 - c. 19" Through 36": 1-1/2" pocket lock, 4-foot centers.
 - d. 25" Through 36": 1-1/2" pocket lock, 4-foot centers.
 - e. 37" Through 48": 1-1/2" reinforced standing seam with 1-1/2" x 1-1/2" x 1/8" angles, 30" centers.
 - f. 49" Through 60": 1-1/2" reinforced standing seam with 2" x 2" x 1/8" angles, 24" centers.
 - g. 61" Through 84": 1-1/2" reinforced standing seam with 2-1/2" x 2-1/2" x 3/16" angles, 24" centers.
 - h. 85" Through 96": 1-1/2" companion angle, 1-1/2" angle reinforced slip, or 1-1/2" angle reinforced pocket lock. 4-foot centers.
 - i. Over 96": 2" companion angles, 2" angle reinforced slip, or 2" angle reinforced pocket lock. 4-foot centers.
 - j. Ductmate approved as per SMACNA. Submit on details.

- D. Bracing: Shall be provided for all rectangular ductwork. It shall be attached to duct with rivets, bolts or spot welded, and spaced to comply with SMACNA Guidelines for Seismic Restraints for Mechanical Systems dated April 1976 and SMACNA Duct Manual.

- E. Construction of Circular Galvanized Steel Ductwork (Low and Medium Pressure): Wall thickness for circular ducts shall be as scheduled by ASHRAE Equipment Handbook for Duct Construction.

- F. Fittings and Connections for Circular Ducts:
 1. Fittings shall be factory fabricated with radius of elbows and angles minimum of 1-1/2 times diameter or maximum width of duct. Tee fittings shall be of conical change in shape from round to rectangular mode with transformation joint with minimum of 1 to 7 taper.
 2. Joints between two ducts shall be made with beaded sleeve joint as scheduled, with duct sealer applied to male end, mechanically fastened with sheet metal screws or pop rivets. Over joint and screw or rivet heads, apply coating of duct sealer.
 3. Duct fitting shall be joined by slipping the projecting collar of the fittings into the pipe. Insertion length shall be a minimum of 2". Apply duct sealer and mechanically fasten, seal and tape per paragraph above.

- G. Duct Supports: Support horizontal ducts with hangers of scheduled sizes and spacing. Install hangars at each change in direction of duct. Extend strap hangers down both sides of ducts, turn under bottom 2" minimum. Metal screw hangers to bottom of duct and to upper and lower sides of ducts at not more than 12" on center. Provide angle hangers formed by extended vertical bracing angles or by rods connecting to bottom angles if size or bracing angles conform to hanger schedule. Support vertical ducts at every floor with angles or channels riveted to ducts. Reset angles or channels on floor slab or structural steel members placed in opening, unless otherwise noted. Hangers shall be constructed of galvanized steel. Seismic restraints shall be as specified in Section 237401 - Vibration Isolation and Seismic Restraints.

- H. Sealing Ducts: All longitudinal and transverse joints shall be sealed with sealant prior to assembly of the entire ductwork system. Sealant shall be DP 1020.

- I. Plenum Construction: Plenums shall be constructed of 18 gage galvanized sheet metal with galvanized angle bracing as required, riveted or bolted to sheet metal. Seams shall be 3" standing seams spaced at 16" on centers. Reinforcing shall consist of 2" x 2" x 1/3" galvanized angles riveted or bolted to back of sheet metal, perpendicular to standing seams. Angles run at floor, walls, ceiling, and around all openings. Plenums shall be fastened to concrete floors, ceilings, and walls with expansion shields and sealed with mastic. All seams and joints sealed and made airtight. All connections to equipment shall be made with flanged and gasketed joints. Minimum 16 gage.
 - J. Tapers: Pitch sides of duct in a "diverging" airflow maximum of 1 to 4 taper. Pitch sides of duct in a "converging" airflow maximum of 1 to 4 taper.
 - K. Elbows: Shall be designed for minimum friction with inside radius not less than width of duct. When required radius elbows cannot be obtained, use radius of 1/3 width of duct with an internal radius vane at the third point. Special vaned elbows shall be as detailed on the Drawings. Shop drawings must show radius elbows and be approved prior to installation.
 - L. Flexible Duct Connection: Install with metal collar frames at each end of connections. Attach fabric tightly to ducts. Allow at least 1" slack in connections. Make fabric connections minimum 8" long.
 - M. Flashing Ducts Through Roof: Install flashing to cover top and sides of curb and fit closely around duct. Cover top edge of base flashing with collar soldered to duct and turned down over base flashing from 24 gage galvanized steel.
 - N. Access Doors in Rectangular Ducts: Construct with galvanized sheet metal of same gage as duct, with frame, galvanized steel hinges, handles, clamping devices, gasketed for airtight fit. Fabricate double skinned with insulation core where ducts are insulated. Sizes as shown, minimum 12" x 12". Provide where required for access to dampers and other equipment requiring service or inspection, and for cleanouts.
 - O. Duct Liner: Ducts and plenums shall be lined as specified in Section 233200 - Duct and Plenum Lining.
 - P. Dampers: Furnish and install balancing dampers at all branch ducts. Balancing dampers shall be placed in return air and exhaust branches as well as supply outlets. Dampers shall follow specification including locking devices.
- 3.2 FLEXIBLE AIR DUCT:
- A. Installation: Insulated flexible ducts shall be continuous, single pieces not over 3-feet in length for medium pressure and 7-feet in length for low pressure, and shall be adequately supported and shall not be installed with an inside radius or bend less than two duct diameters. Flexible ducts shall be installed in as straight a manner as possible. Cut ducts to lengths required rather than create bends to take up excess lengths. Hanger strap to be 3 inches wide minimum.
 - B. Joining: Where flexible ducts join other ductwork and air terminals, duct sealer and sheet metal bands shall be used to secure flexible duct and make the joint airtight.

3.3 DIFFUSERS, REGISTERS, AND GRILLES INSTALLATION:

A. Coordination With Ceiling Features:

1. All diffusers, plenum boxes, linear grilles, shall be fully coordinated to fit into the ceiling materials shown on the Architectural Drawings.
2. In Drywall-Plaster Ceilings: Diffuser, register, or grille trim shall overlap the plaster line with overlapped margins.
3. In Ceilings: In ceilings with concealed spline or acoustic tile adhesively applied to drywall or plaster ceilings, diffusers, registers, or grilles shall be furnished with overlapped margins.
4. In Lay-In T-Bar Systems: Square or rectangular diffuser and grille edge trim shall be flush with the finished ceilings. Unit frames shall be sized to fit T-bar module or 1/2 module.

3.4 TERMINAL AIR UNITS shall be hung above ceiling from structure. Support for terminal air units shall withstand 1.0 g force. Submit details per Section 237401 - Vibration Isolation and Seismic Restraints.

3.5 AIR FILTERS:

- A. Certification: The Contractor shall include in his submittal an individual test report prepared by an independent testing laboratory with test equipment specified in ASHRAE Standard 52-76 using a 24-1/2" x 24-1/2" duct section for the filter under test. The test report shall include filter descriptive information and assurance that the construction and performance is in accordance with the Specifications. All filters tested shall have been procured by the independent of the manufacturer for these filters, and a statement of this fact must accompany the submittal along with the test report.
- B. Completion: After completion of the testing of the air handling equipment and systems and approval of same, but before final acceptance of the project, this Contractor shall replace all air filters.
- C. Spare Filter Units: After completion and final acceptance of the project, deliver to the Owner one filter unit for each filter installed.

END OF SECTION 233100

SECTION 233200**DUCT AND PLENUM LINING****PART 1 - GENERAL**

1.1 DESCRIPTION: Division 1 Conditions applies to this Section. Provide duct and plenum lining, complete.

A. Work In This Section: Principal items include:

1. Duct lining.
2. Plenum lining.
3. Casing lining.

B. Related Work Not In This Section:

1. Section 237500 - Air Moving Equipment.
2. Section 233100 - Ductwork.

1.2 SUBMITTAL REQUIREMENTS: In addition to requirements of Section 230500 - Mechanical General Provisions, submittal material shall include six copies of descriptive data for all products and materials including, but not limited to, following:

A. Descriptive Data:

1. Lining Materials: Properties and sound ratings.
2. Fasteners.
3. Adhesives.

1.3 CLASSIFICATION: All products shall conform to NFPA Section 90A, with special regard to the fire hazard classification requirements of NFPA No. 255, latest revision, including vapor barriers and adhesives. All products shall possess a flame spread rating of not over 25, fuel contributed rating of not over 50, and a smoke developed rating of not over 50.

A. Conflicts in Shop Drawings or Submittals:

Contractor agrees that shop drawing submittals processed by the Architect do not become contract documents and are not change orders, that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractors convenience in organizing his work and to permit the Architect to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not the purpose of testing the Architect's perception. If deviations, discrepancies or conflicts between shop drawings submittals and contract documents are discovered either prior to or after the shop drawings submittals are processed by the Architect, the contractor agrees that the contract documents shall control and shall be followed.

PART 2 - PRODUCTS

2.1 DUCT LINING:

- A. Type DL Lining: Lining shall be 1" thick, 1-1/2 lb./cu.ft. density semi-rigid fiber glass blanket coated on side with a fire resistant black neoprene coating resistant to surface fiber blow off. Lining shall have a "K" factor of 0.25 maximum at 75 degrees F mean temperature and fire hazard classification of 25-50-50. Lining shall be Johns-Manville "Micro-Lite" or equal by Owens-Corning Fiberglas, Certain-Teed, or PPG Industries.

2.2 PLENUM LINING:

- A. Type PL-1 Lining: Plenum lining shall be semi-rigid board insulation 2" thick, 3 lbs./cu.ft. density glass fiber, with coating to prevent erosion and flaking of the lining, and to prevent harboring of germs. Liner shall have a maximum "K" factor of 0.26 at 75 degrees F mean temperature and fire hazard classification of 25-50-50. Liner shall be Johns-Manville "LinaAcoustics" or equal by Owens-Corning Fiberglas, Certain-Teed or PPG Industries.

2.3 CASING LINING:

- A. Type PL-2 Lining: Casing fill shall meet the classification requirements of this Section and shall have thickness and density required to meet conditions specified in Section 233100 - Ductwork.

PART 3 - EXECUTION

3.1 APPLICATION OF DUCT LINING:

- A. Type DL Lining: Duct liner shall be adhered to drywall surface with 100% coverage of fire resistant adhesive. On ducts over 20" in width or depth additionally secure the liner with mechanical fasteners, weld pins with clips, on 12" maximum centers. Fasteners shall be located within 2" of lining leading edge of each section and within 3" of all cross joints. All exposed edges and the leading edge of all cross joints of the liner shall be heavily coated with fire resistant adhesive. The liner shall be accurately cut to assure snug closing corners and tightly butting joints. Coated surface shall face the air stream. Repair breaks and abrasions with adhesive and mechanical fastening to assure a continuity of the surface.

3.2 APPLICATION OF PLENUM AND CASING LINING:

- A. Type PL-1 Lining: Plenum liner shall be adhered to metal surface with 100% coverage of adhesive and mechanical fasteners, weld pins with clips, on 16" centers. Mechanical fasteners shall be located within 2" of lining edges. All exposed edges and all butt joints of the lining shall be heavily coated with fire resistant adhesive. The liner shall be accurately cut to assure snug closing corners and tightly butted joints. Coated surface shall face the air stream. Repair minor breaks and abrasions with adhesive and mechanical fasteners to assure a continuity of the

surface. Major breaks or tear shall be cut out and replaced with new liner. All built up plenums or casings at coils, fans or filters shall be lined, except where structural metal casings are used. See Section 233100 - Ductwork. No lining shall be installed in diffuser plenums serving sensitive areas.

- B. Type PL-2 Lining: As specified for Casings under Section 233100 - Ductwork.

END OF SECTION 233200

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
 - 6. Touchup painting.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.04 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. Coordinate chases, slots, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
- E. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

- F. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.
- G. Coordinate connecting electrical service to components furnished under other sections, include connections for equipment specified in other Sections.

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated “wall pipe,” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

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

2.04 TOUCHUP PAINTING

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- G. Tighten electrical 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 and UL 486B.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.

- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

3.05 CONNECTIONS TO EQUIPMENT

- A. For each electrical connection indicated or otherwise required, provide complete assembly of materials, including but not necessarily limited to pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.

- B. Install in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

3.06 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work. Replace damaged or faulty components.

END OF SECTION 260500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.03 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

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Insulated Wire Corp.; a Leviton Company.
 - 2. General Cable Corporation.
 - 3. Senator Wire & Cable Company.
 - 4. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN & SO.
- D. Multiconductor Cable:
 - 1. Type MC, 600V copper wire, with a full size green insulated copper grounding conductor. The insulated circuit and grounding conductors shall be cabled together and wrapped with a binder tape bearing the print legend. Light weight galvanized steel interlocked armor is applied over the assembly. The minimum size of MC cable

shall be #12 AWG unless specified otherwise. The use of MC cable is restricted by the requirements of local codes. Comply with NEMA WC 70.

2. Type SO with ground wire, Comply with NEMA WC 70.
3. Armored cable, Type AC, is not allowed.

2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AFC Cable Systems, Inc.
 2. Hubbell Power Systems, Inc.
 3. O-Z/Gedney; EGS Electrical Group LLC.
 4. 3M; Electrical Products Division.
 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Wire sizes No. 6 and smaller shall be coded using factory-colored insulation. Wire size No. 4 or larger shall be coded with approved wrap-around permanent colored tape markers at each end and at every point where the conductor is accessible. Green wire shall be used as an equipment grounding conductor only.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway. Metal-clad cable, Type MC shall be permitted for temporary fixture installations only.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Type THHN-THWN, in raceway; Power-limited cable, concealed in building finishes; or Power-limited tray cable, in cable tray.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- 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 cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Seal around cable penetrating fire rated elements.

3.04 CONNECTIONS

- A. Tighten electrical 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 and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. 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.
- D. Remove and replace malfunctioning units and retest as specified above

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Methods and materials for grounding systems and equipment, plus the following special applications:

1.03 SUBMITTALS

- A. Field quality-control test reports.

1.04 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.02 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING BUS

- A. Main Power Grounding Bus (MGB): Rectangular bars of annealed copper, size as indicated on drawings; with insulators.
- B. Main Telecommunications Grounding Bus (MTGB): Rectangular bars of annealed copper, 1/4-inch by 4-inch by 12-inch; with insulators. Cooper #SBTMGB12, or equal.
- C. Telecommunications Grounding Bus (TGB): Rectangular bars of annealed copper, 1/4-inch by 2-inch by 12-inch; with insulators. Cooper #SBTGB, or equal.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, 3/4 inch by 10 feet in diameter where connected above grade. All other rods which are completely buried may be 5/8 by 96 inches.

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. MGB will be installed as indicated on the drawings. TMGB will be installed at the Main Telecommunications Backboard 'MTTB' and bonded to the MGB as directed on the drawings. A TGB will be installed at each supplementary telecommunications backboard and bonded to the TMGB as directed on the drawings.
 - 2. Install bus on insulated spacers 1 inch minimum from wall, and 12 inches above finished floor, unless otherwise indicated.

3. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- D. Conductor Terminations and 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. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 8. Connections to Ground Rods: Bolted connectors.
 9. Connections to Structural Steel: Bonding plate.

3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at or above 120 V. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus. Refer to Section 3.1 (D) (1) above.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches above finished floor or final grade.

- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Raceways.
 - 2. Fittings.
 - 3. Boxes.
 - 4. Enclosures.
 - 5. Cabinets for electrical wiring.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.04 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.

1.05 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate layout and installation of raceway and boxes with other construction elements to ensure maximum headroom, working clearance, and access.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Provide products that comply with requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Fittings for EMT: Steel or die-cast, set-screw or compression type.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Aruco Corporation.
 - 4. CANTEX Inc.
 - 5. Electri-Flex Co.
 - 6. Lamson & Sessions; Carlon Electrical Products.
 - 7. RACO; a Hubbell Company.
 - 8. Thomas & Betts Corporation.
- B. LFNC: UL 1660.
- C. Fittings for LFNC: UL 514B.

2.03 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 2. EGS/Appleton Electric.
 3. Erickson Electrical Equipment Company.
 4. Hoffman.
 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 6. O-Z/Gedney; a unit of General Signal.
 7. RACO; a Hubbell Company.
 8. Robroy Industries, Inc.; Enclosure Division.
 9. Spring City Electrical Manufacturing Company.
 10. Thomas & Betts Corporation.
 11. Walker Systems, Inc.; Wiremold Company (The).
 12. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch.
 1. Metal Enclosures: Steel.
- G. Cabinets:
 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.

2.05 FACTORY FINISHES

- A. Finish: For enclosure or cabinet components, provide manufacturer's standard finish inside and grey paint applied to exterior of enclosures and cabinets before shipping.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit or IMC.
 - 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed and Subject to Physical Damage: Rigid steel conduit. Including but not limited to raceways in the following locations:
 - a. Corridors.
 - b. Mechanical rooms.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 5. Damp or Wet Locations: Rigid steel conduit.
 - 6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

- C. Minimum Raceway Size: 1/2-inch trade size.

- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

- B. 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.

- C. Complete raceway installation before starting conductor installation.

- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

- G. Conceal conduit within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. 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.
- J. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with 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.
- K. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- L. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.03 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.04 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.

END OF SECTION 260533

SECTION 260548

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Channel support systems.
 - 2. Restraint cables.
 - 3. Hanger rod stiffeners.
 - 4. Anchorage bushings and washers.

1.03 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: **D**
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: **II**
 - a. Component Importance Factor: **1.0**
 - b. Component Response Modification Factor: **2.5**
 - c. Component Amplification Factor: **1.0**
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): **2.879g**
 - 4. Design Spectral Response Acceleration at 1.0-Second Period: **1.003g**

1.05 QUALITY ASSURANCE.

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 SEISMIC-RESTRAINT DEVICES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
- B. **Basis-of-Design Product:** Subject to compliance with requirements, provide a comparable product by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 4. Hilti Inc.
 - 5. Loos & Co.; Seismic Earthquake Division.
 - 6. Mason Industries.
 - 7. TOLCO Incorporated; a brand of NIBCO INC.
 - 8. Unistrut; Tyco International, Ltd.
- C. **General Requirements for Restraint Components:** Rated strengths, features, and application requirements shall be as defined in reports by agency acceptable to authorities having jurisdiction.
 - 1. **Structural Safety Factor:** Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- D. **Channel Support System:** MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. **Restraint Cables:** ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. **Hanger Rod Stiffener:** Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.
- G. **Bushings for Floor-Mounted Equipment Anchor:** Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- H. **Bushing Assemblies for Wall-Mounted Equipment Anchorage:** Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- I. **Resilient Isolation Washers and Bushings:** One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- J. **Mechanical Anchor:** Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

- K. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items

are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and control cable.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.

1.03 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.04 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.02 CONDUCTOR AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color code secondary service, feeder, and branch circuit conductors with field applied identification where factory applied color is not readily available.
- B. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.

- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14.

2.04 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength: 50 lb (22.6 kg), minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A. Identify with orange self-adhesive vinyl label or snap-around label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:
 - 1. Fire Alarm System: Red.
 - 2. Fire-Suppression Supervisory and Control System: Red and yellow.

3. Combined Fire Alarm and Security System: Red and blue.
 4. Security System: Blue and yellow.
 5. Mechanical and Electrical Supervisory System: Green and blue.
 6. Telecommunication System: Green and yellow.
 7. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor and Conduit Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Identify both ends of spare conduits and conduit stubs with source and destination locations.
 3. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 4. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 2. Equipment to be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.

- c. Electrical switchgear and switchboards.
- d. Transformers.
- e. Emergency system boxes and enclosures.
- f. Disconnect switches.
- g. Enclosed circuit breakers.
- h. Motor starters.
- i. Contactors and relay panels.
- j. Fire-alarm control panel and annunciators.
- k. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- l. Monitoring and control equipment.

3.02 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for feeder and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Grey.
 - e. Ground: Green.
 - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or

taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

END OF SECTION 260553

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Lighting Control System

1.03 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. SPST: Single pole single throw.

1.04 SUBMITTALS

- A. Product Data: Lighting control panel system and devices.
- B. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.05 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.

1.06 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL SYSTEM

1. Lighting control system shall be Acuity N-Light with devices as specified in the Construction Documents. Equivalent systems may be submitted for review and approval by the Engineer.

2.02 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.
- B. nLight Communications Cabling: CAT5 for RS485 system with 115200 Baud rate.
- C. 0-10V Cabling: Stranded-copper twisted-pair 18AWG wiring, non-shielded. Runs exceeding 300-feet shall be increased to 16 AWG.

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLATION

- A. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- B. Size conductors according to lighting control device manufacturer's written instructions.
- C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 1. Identify controlled circuits in lighting contactors.
 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing lighting control system, and after electrical circuitry has been energized, Contractor shall engage a factory-authorized nLight representative to provide start-up of the lighting control system, to verify that all system components are operating correctly, and to make any required adjustments.
 - 2. Factory representative shall provide a written report indicating that all system components are performing per design parameters.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements. Test for compliance with requirements.

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Dry-type transformers rated 600 V and less, with capacities up to 1000 kVA.

1.03 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ACME Electric Corporation; Power Distribution Products Division.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; Schneider Electric.

2.02 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Aluminum.
- D. Finishes:
 - 1. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.
 - 2. Finish Color: ANSI 61 Gray

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Windings: One coil per phase in primary and secondary.
- D. Enclosure: Ventilated, NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
- F. Taps for Transformers 15 kVA to 300 kVA: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

- G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- H. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- I. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
 - 3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
 - c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
- J. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.04 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.05 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Division 26 Section “Vibration and Seismic Controls for Electrical Systems.”

3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section “Grounding and Bonding for Electrical Systems.”
- B. Connect wiring according to Division 26 Section “Low-Voltage Electrical Power Conductors and Cables.”

3.04 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Remove and replace units that do not pass tests or inspections and retest as specified above.
- C. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed “Satisfactory Test” label to tested component.

3.05 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.
- C. Occupancy Adjustments: Once building has reached 75% occupancy, and within 6 to 12 months of date of Substantial Completion, provide on-site assistance in readjusting transformer tap settings to suit actual occupied conditions. Provide up to 2 visits to Project site for this purpose, coordinated with Owner, without additional cost.
 - 1. Voltage Recordings: Contractor performed. Provide up to 48 hours of recording on the low-voltage system of each medium-voltage transformer.
 - 2. Point of Measurement: Make voltage recordings at load outlets selected by Owner.

3.06 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.04 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.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports including the following:
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 - E. Panelboard Schedules: For installation in panelboards.
 - F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 1. Ambient Temperature: Not below -22 deg F (-30 deg C) and not exceeding 104 deg F (40 deg C).
 2. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet (2000 m).

1.07 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.01 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. Siemens Energy & Automation, Inc.
 - c. Square D.

2.02 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush and surface mounted cabinets. NEMA PB 1, Type 1.
 - 1. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 6. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
 - 1. Material: Phase Bus - Tin-plated aluminum; Grounds Bus - Hard-drawn copper.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 - 3. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Compression type.
 - 2. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 3. Feed-Through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.03 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 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 for protection of personnel: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- 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 filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit. Obtain approval before installing. Use a computer to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, and feeder.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. 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.

3.04 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Wall switches.
 - 4. Communications outlets.
 - 5. Poke-through assemblies.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.06 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-15R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5261 (single), 5262 (duplex).
 - b. Hubbell; HBL5261 (single), HBL5262 (duplex).
 - c. Leviton; 8088 (single), BR15 (duplex).
- B. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
 - c. Leviton; 5361 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Device shall fit in a 2-3/4 inch deep outlet box without an adapter.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Leviton; 6598.

2.04 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

- C. Pilot Light Switches, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - 2. Description: Single pole, with neon-lighted handle, illuminated when switch is “ON.”
- 2.05 LOW VOLTAGE SWITCHES:
- A. Switches: Acuity nLight per Construction Documents, or equal.
 - B. Comply with Division 26 Section “Lighting Control Devices”
- 2.06 WALL-BOX DIMMERS
- A. Dimmer Switches: Acuity nLight per Construction Documents, or equal.
 - B. Comply with Division 26 Section “Lighting Control Devices”
- 2.07 OCCUPANCY SENSORS
- A. Wall-Switch Sensors: Acuity nLight per Construction Documents, or equal.
 - B. Ceiling Sensors: Acuity nLight per Construction Documents, or equal.
 - C. Comply with Division 26 Section “Lighting Control Devices”
- 2.08 COMMUNICATIONS OUTLETS
- A. Telephone Outlet:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.
 - 2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6. Comply with UL 1863.
 - B. Combination TV and Telephone Outlet:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
 - 2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6; and one Type F coaxial cable connector.
- 2.09 WALL PLATES
- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws:
 - a. Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic
 - 3. Material for Unfinished Spaces: Galvanized steel

- B. Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in “wet locations.”
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover that is weatherproof whether or not the attachment plug cap is inserted.

2.10 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
 - 3. Wiremold Company (The).
- B. 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 four simplex receptacles and space for four 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.

2.11 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Protect devices and assemblies during painting. Remove any paint that accidentally comes in contact with devices and assemblies.
 5. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 6. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 7. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 9. Tighten unused terminal screws on the device.
 10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing..
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

3.02 CONNECTIONS

- A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- B. Tighten electrical 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 and UL 486B.

3.03 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
 - 3. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
 - 4. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 3. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 4. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 5. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Replace damaged or defective components.

3.05 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 262726

SECTION 265100

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

1.03 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast.
 - 4. Lumen output, color temperature, and optical distribution.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.05 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.06 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Special Warranty for LED Fixtures: Manufacturer's standard form in which manufacturer agrees to repair or replace fixtures that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for LED Fixtures: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. 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.
- E. 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.
 - 4. Laminated Silver Metallized Film: 90 percent.

- F. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.03 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. 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.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.04 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type, with minimum 10-year nominal life.
 - 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. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

PART 3 - EXECUTION

3.01 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section “Hangers and Supports for Electrical Systems” for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) 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 steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) 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.

3.02 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 2. Support Clips: Fasten to lighting 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 (20-mm) metal channels spanning and secured to ceiling tees.
 4. Install at least one independent support rod or wire 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 Lighting Fixture Support:
 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 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.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.

- D. Tests: As follows:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 - 3. Verify normal transfer to battery source and retransfer to normal.
 - 4. Report results in writing.

- E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.04 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

END OF SECTION 265100