

SECTION 23 05 10 - MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

1.2 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Divisions 22 and 23.
- D. Section 01 33 00 - Submittals.
- E. Section 01 45 00 - Quality Control.
- F. Section 01 77 00 – Contract Closeout and Final Cleaning
- G. Section 01 78 23 – Operation and Maintenance Data.
- H. Section 01 78 36 – Warranties.
- I. Section 01 78 39 – Record Documents.
- J. Section 01 78 00 – Demonstration and Training.
- K. Section 01 91 13 – General Commissioning Requirements
- L. Section 01 91 23 – Commissioning Plan.

1.3 DEFINITIONS

- A. Following is a list of abbreviations generally used in Division 23:
 - 1. ADA Americans with Disabilities Act
 - 2. AHJ Authority Having Jurisdiction
 - 3. ANSI American National Standards Institute
 - 4. ARI Air-Conditioning & Refrigeration Institute
 - 5. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 6. ASME American Society of Mechanical Engineers
 - 7. ASTM American Society for Testing and Materials
 - 8. ASSE American Society of Sanitary Engineering

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9.	AWWA	American Water Works Association
10.	CBC	California Building Code
11.	CEC	California Electrical Code
12.	CMC	California Mechanical Code
13.	CPC	California Plumbing Code
14.	CGA	Canadian Gas Association
15.	CISPI	Cast Iron Soil Pipe Institute
16.	CSA	Canadian Standards Association
17.	ETL	Electric Testing Laboratories
18.	FM	FM Global
19.	HI	Hydraulic Institute Standards
20.	HVAC	Heating, Ventilating and Air Conditioning
21.	MSS	Manufacturers Standardization Society
22.	NEC	National Electric Code
23.	NEMA	National Electrical Manufacturers Association
24.	NFPA	National Fire Protection Association
25.	NFGC	National Fuel Gas Code
26.	NRCA	National Roofing Contractors Association
27.	NSF	National Sanitation Foundation.
28.	OSHA	Occupational Safety and Health Administration
29.	SMACNA Sheet Metal and Air Conditioning Contractors' National Association, Inc.	
30.	TEMA	Tubular Exchanger Manufacturers Association
31.	TIMA	Thermal Insulation Manufacturers Association
32.	UL	Underwriters Laboratories Inc.
33.	UPC	Uniform Plumbing Code

- B. Provide: To furnish and install, complete and ready for the intended use.
- C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly and installation.
- D. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site as required to complete items of work furnished by others.

1.4 REFERENCES

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.
- H. See detailed References that are listed in individual sections.

1.5 DESCRIPTION OF WORK

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Mechanical System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of mechanical work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

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1.6 DRAWINGS AND SPECIFICATIONS

- A. A. Where Contract Documents are at variance with applicable codes governing work, code and local jurisdiction requirements take precedence, and include cost necessary for code compliance or local jurisdiction compliance in bid price. Machinery and equipment to comply with Occupational Safety and Health Act of 1970, as currently revised, as interpreted for equipment manufacturer requirements.
- B. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, ductwork and other mechanical work. Drawings are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., ducts and piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than basis of design, including but not limited to architectural, structural, electrical, HVAC, fire sprinkler, and plumbing. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- C. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.
- D. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- E. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.7 INDUSTRY STANDARDS AND CODES

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
 - 1. California Building Code, 2019.
 - 2. California Mechanical Code, 2019.
 - 3. California Plumbing Code, 2019.
 - 4. California Electrical Code, 2019.
 - 5. National Fire Protection Association.
 - 6. California Fire Code, 2019.
 - 7. California State Fire Marshal.
 - 8. Occupational Safety and Health Administration, including CAL-OSHA.
 - 9. State of California Energy Conservation Standards.
 - 10. State of California Code of Regulations, Title 24.
 - 11. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.
- D. No material or product installed as a part of the Work shall contain asbestos in any form.

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- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.9 PERMITS, FEES AND UTILITY SERVICES

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.10 COORDINATION OF WORK

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions. Install this work in harmony with other crafts and at proper time to avoid delay of work.
- C. Arrange mechanical work in a neat, well-organized manner with the piping, ductwork and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.
- D. Verify the location of all equipment, air distribution devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.
- E. Execute any work or apparatus shown on the drawings and not mentioned in the specifications, or vice versa, the same as specifically mention by both. Omission from drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve this contractor from furnishing same in place complete.
- F. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.
- G. Furnish materials and work at proper time to avoid delay of the work.

1.11 PROGRESS OF WORK

- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill-timed work performed under this section shall be borne by this Contractor.

1.12 EXISTING SOILS CONDITIONS

- A. Understand existing soils conditions before submitting bid on work. No additional allowance will be granted due to lack of information for existing conditions of subsurface soils.
- B. Submission of a bid will be considered acknowledgment of review/understanding of project geotechnical soils report.

1.13 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Mechanical systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.

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- B. Contractor shall design seismic bracing for all mechanical equipment and systems to comply with the 2019 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
 - 1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
 - 2. Drawings, details and calculations shall be submitted to the Engineer for review. Compliance documents shall be approved by the Engineer prior to installation.
- C. Mechanical systems and equipment shall include, but are not limited to, all ductwork, piping, air conditioning equipment, heating and ventilating equipment, air handlers, fans, electrical and control panels, conduits and other components.
- D. Supports, anchorage and restraints for all piping and ductwork for standard installation details that comply with the latest edition of the latest edition of the Mason Industries "Seismic Restraint Guidelines", or equal, shall be used wherever possible. The Contractor shall provide all supporting documentation required for the Engineer and the reviewing authorities. If compliance with one of these standards is demonstrated, separate structural calculations are not required.
- E. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.14 SUBMITTALS

- A. See Section 01 33 00 - Submittals, for additional submittal procedures.
- B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Notice to Proceed.
 - 2. For products specified only by reference standards, list applicable reference standards.
- C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Shop Drawing Submittals: Prepared specifically for this Project.
- E. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
- F. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- G. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- H. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
- I. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

1.15 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

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- B. Architect will consider requests for substitutions only per the requirements and procedures indicated in the general and special conditions of these specifications.
- C. Substitutions will not be considered when a product becomes unavailable through fault of the Contractor.
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.
- I. Substitution Submittal Procedure:
 - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. The Architect will notify Contractor in writing of decision to accept or reject request.
 - 4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

1.16 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 78 23 Operation and Maintenance Data requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
 - 1. Ventilating Systems.
 - 2. Air Conditioning Systems.
 - 3. Temperature Controls Systems.
 - 4. Motors.
 - 5. Air Balance and Test Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of mechanical equipment furnished as a part of the Work.
- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.
- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.

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- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.17 PROJECT MODIFICATIONS

- A. During the progress of construction, if such conditions arise that require revisions, modifications, or relocations to any mechanical equipment or materials incorporated in this project, such alterations shall be immediately called to the attention of the Architect. Contractor shall then prepare necessary drawings showing proposed changes. Submit proposed changes for review by the Architect prior to actual revision work in the field.
- B. Two sets of drawings showing all revisions shall be immediately presented to the Architect for his records. Maintain additional copies on the project as necessary to comply with "RECORD DRAWINGS" requirement of the General Requirements.
- C. Incorporate all revisions into record drawings.

1.18 PROJECT RECORD DOCUMENTS

- A. See Section 01 77 00 - Closeout for Project Record Document requirements.
- B. Record Drawings:
 - 1. Show changes and deviations from the Drawings. Include issued Addendum and change order items.
 - 2. Make changes to the Drawings in a neat, clean, and legible manner.

1.19 QUALITY ASSURANCE

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step-in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.
- H. Permits and Inspections:
 - 1. Unless otherwise distinctly hereinafter specified, apply and pay for necessary permits, plans check, and inspections required by public AHJ.
 - 2. Refer to General and Supplementary Conditions for payment of water and sewer service connection fees.
 - 3. Obtain certificates of inspection from AHJs and deliver to Owner before final acceptance.
 - 4. Each trade to consult local building department and utility companies prior to commencement of work to ascertain existence and location of existing underground utilities. Protect existing service against damage and interruption of use, and reroute as

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may be necessary to accomplish new work. Include costs for materials and installation for rerouting as specified for new work in bid price.

- I. Regulatory Requirements:
 1. UL and CSA Compliance: Provide units which are UL and CSA listed.
 2. ASME Compliance: Provide units which are ASME listed when water heaters and boilers which exceed 200,000 BTUH, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

1.20 WARRANTY

- A. See Section 01 78 36 - Warranties, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 QUALITY AND CARE

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. Materials are to be UL or CSA approved or acceptable by state, county, and city authorities. Equipment supplier is responsible for obtaining state, county, and city acceptance on equipment not UL approved or not listed for installation. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. HAZARDOUS MATERIALS
 1. Do not use products containing asbestos, lead, arsenic, or any other material defined by EPA as hazardous to human or animal life.
- C. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.
- D. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- E. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- F. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- G. Inspect and report concealed damage to carrier within their required time period.
- H. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
- I. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.2 ACCESS DOORS

- A. Coordinate access door requirements with Section 08 31 13. The more stringent requirements shall govern.
- B. Provide access doors where access through floors, walls or ceilings is required to access mechanical, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.
 1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.

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2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
 1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
 2. Concealed hinges to allow 175 degree opening.
 3. Locks: flush, screw driver operated cam lock(s).
 4. Provide anchoring devices suitable for the construction into which the doors are framed.
- D. Application (as applicable):
 1. In gypsum drywall walls and ceilings: Type DW.
 2. In ceramic tile walls: Type MS (stainless steel).
 3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self-closing, 250 F in 30 min. temperature rating.

PART 3 EXECUTION

3.1 NOISE AND VIBRATION

- A. Install vibration isolators, flexible connectors, expansion joints, and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.
- B. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.

3.2 SEISMIC CONTROL

- A. Provide the following:
 1. General:
 - a. Earthquake resistant designs for mechanical equipment, i.e., air handling units, water heaters, blowers, motors, ductwork, mechanical and plumbing piping, to conform to regulations of CBC.
 - b. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment piping, ductwork, and the like, to withstand a force in direction equal to value defined in CBC.
 - c. Retain licensed structural engineer to provide shop drawings of seismic bracing and seismic movement assemblies for piping/ ductwork/ equipment/ water heaters, and the like. Engineer to design and provide stamped shop drawings for equipment, ductwork, water heaters, piping seismic bracing, and the like. Submit shop drawings along with equipment submittals.
 - d. Retain licensed structural engineer to provide shop drawings of seismic flexible joints for piping/ductwork and the like crossing building expansion or seismic joints. Engineer to design and provide stamped shop drawings for piping/ductwork flexible seismic joints. Coordinate actual design deflection or travel with project structural engineer. Submit shop drawings along with seismic bracing details. Coordinate exact design requirements from project structural engineer.
 2. Piping and Ductwork:
 - a. Use "Seismic Restraints Manual Guidelines for Mechanical Systems," published by SMACNA.
 - b. Sway bracing is not required for pipes that are installed on very short individual hangers (12 inch or less).
 - c. As approved by code authority, use a bracing system manufactured by Tolco, Superstrut, Mason, or Pipe Shields Inc. or approved.

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3. Equipment:
 - a. Provide a means to prohibit excessive motion of mechanical equipment during earthquake.
 - b. Provide mechanical equipment, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to 0.5 of equipment operating weight.

3.3 REVIEW BY ENGINEER

- A. Notify Architect/Engineer, in writing, at following stages of construction so that Architect/Engineer may, at their option, visit site for review and construction observation:
 1. Plumbing:
 - a. Underground piping installation prior to backfilling.
 - b. Prior to covering walls.
 - c. When ceiling installation is started.
 - d. When main systems, or portions of, are being tested and ready for inspection by AHJ.
 2. HVAC:
 - a. When ductwork installation starts.
 - b. When installation starts for each different major type of equipment.
 - c. When ceiling installation is started.
 - d. When lines or ducts are to be permanently concealed by construction or insulation systems.
 - e. When balancing and testing is started.

3.4 MUTILATION

- A. Repair mutilation of building around pipes, ducts, fixtures, and the like.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.
- B. Maintain design intent where equipment other than as shown in Contract Documents is provided. Where equipment requires piping arrangement, control diagrams, or sequencing different from that indicated in Contract Documents, provide electrical motors, wiring, controls, or other required electrical components at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and equipment in a manner to prevent damage and deterioration. Store in original container which identifies manufacturer's name, brand and model number. Do not store indoor equipment outdoors unless provided with a waterproof protective cover.
- B. Replacement: In event of damage, immediately make repairs and replacements necessary.

3.7 CLEANING

- A. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated by this work.

3.8 INSTALLATION

- A. A. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level, firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- B. Access Doors
 1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
 2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.

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3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.10 TESTING AND INSPECTION

- A. See individual specification sections for additional testing and inspection required.
- B. Testing Agency Duties:
 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified standards.
 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 5. Perform additional tests and inspections required by Architect.
 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.11 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic, duct and gas piping testing.

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1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
 2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
 3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
- B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
1. Refrigerant Liquid: Pressure=300 Psig. / Medium=Dry Nitrogen / Duration=4 Hours.
 2. Refrigerant Suction: Pressure=150 Psig. / Medium=Dry Nitrogen / Duration=4 Hours.

3.12 CUTTING AND PATCHING

- A. Submit written request in advance of cutting or alteration which affects:
1. Structural integrity of any element of Project.
 2. Integrity of weather exposed or moisture resistant element.
 3. Efficiency, maintenance, or safety of any operational element.
 4. Visual qualities of sight exposed elements.
 5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new Products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements, to full thickness of the penetrated element.
- I. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.13 PRIMING AND PAINTING

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted.
1. Primer shall be as recommended by the paint manufacturer for each specific application.
 2. Acceptable Products include: Rust-Oleum product, or equal. See Section 09 90 00 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except ductwork and piping, or factory primed or finished.
- C. Preparation:

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1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
 2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
 3. Remove or protect hardware, electrical plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings which are adjacent to surfaces to receive coatings.
 4. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
 5. Galvanized Surfaces:
 - a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
 - b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
 6. Uncoated Steel And Iron Surfaces:
 - a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
 - b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
 7. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.
- D. Application:
1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
 2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
 3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.
- E. Finish Painting: See Section 09 90 00.
- ### 3.14 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING
- A. For commissioning requirements see Section 01 91 00.
- B. Start equipment and systems in accordance with manufacturer's written instructions.
- C. Provide manufacturer's field representative to prepare and start equipment and systems.
- D. Adjust for proper operation within manufacturer's published tolerances.
- E. Demonstrate proper operation of equipment to Owner's designated representative.
- F. Description:
1. Comply with all startup of mechanical and electrical equipment systems as required in the various sections and herein.
 2. Coordinate all testing and startup procedures with all other trades so that all non-mechanical and non-electrical work is completed and operational so that the specified testing can be performed.
- G. Preliminary Work:
1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
 - a. Proper motor and fan/pump rotation.
 - b. Flushing and cleaning of the system.

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- c. Wiring
 - d. Auxiliary connections
 - e. Lubrication.
 - f. Venting.
 - g. Controls.
 - h. Installation of filters and strainers.
 - i. Setting of relief and safety valves.
2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
 3. The Contractor shall submit at least 30 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Mechanical equipment. This schedule shall include work on a system by system, floor by floor basis.
 4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
 - a. The startup checklist will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment for equipment startup.
 5. The Contractor shall schedule a tour with the Owner's representative to review startup conditions prior to equipment startup. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Owner's representative will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Owner's representative prior to attempting an equipment startup.
 6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestart up check sheet.
- H. Startup and Commissioning:
1. System Startup and Operation:
 - a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
 - b. The Contractor and the factory representative shall provide for the services of qualified factory representatives for all major equipment prestart setup, startup and initial operation. Such periods shall be sufficient to insure the proper operation of systems and equipment. Major equipment to include, but not limited to rooftop units, modular cooling units, temperature controls, fan systems, electrical systems, emergency power, fire alarm systems, and fire sprinkler, etc.
 - c. The Contractor shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, no overloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for air and/or water flows throughout without blockages. Air handling systems shall be checked for proper damper connections and positions, aligned and adjusted belt drives, proper lubrication, temporary air filters installed, no excessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.
 - d. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
 - e. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, filter replacement, bearing lubrication, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of

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proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

I. System Acceptance:

1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Owner requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.

J. Operation Test:

1. Provide all labor, equipment, and materials required to perform test.
2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
 - a. Ability to control to new set point.
 - b. Interface between systems, fire alarm/fire sprinkler systems.
 - c. Proper sequence and operation.
 - d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72-hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

3.15 GUARANTEE

- A. Be responsible for work done and materials installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, materials, or part which may show itself within one year of filing of Notice of Completion and be responsible for damage to other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.
- B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section.
- C. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

3.16 ACCEPTANCE

- A. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 1. Testing and balancing reports.

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2. Cleaning.
3. System balancing and balancing logs.
4. Operating and Maintenance Manuals.
5. Training of operating personnel.
6. Record Drawings.
7. Guaranty certificates.
8. Start-up and test document.
9. Letter of conformance.

3.17 LETTER OF CONFORMANCE

- A. Provide letter and copies of extended warranties with a statement in letter that mechanical items were installed in accordance with manufacturer's recommendations. Include letter of conformance and warranties in operating and maintenance manuals.
- B. Warranties to begin at date of substantial completion.

END OF SECTION