

SECTION 230100 - MECHANICAL GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Division 23 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the air conditioning, ventilating, heating, fire suppression and plumbing systems as specified herein and as shown.
- B. The General Provisions and Division 1, including the general, supplementary and other conditions and other Divisions, as appropriate, apply to work specified in this Division.

1.2 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
- B. The engineering drawings are diagrammatic, intended to show general arrangement and sizes of system components, and shall not be scaled. Rather, the architectural and structural drawings shall govern space constraints, dimensions and finishes. All offsets and fittings which will be necessary to accomplish the finished installation shall be provided at no additional cost or increase in the Contract.

1.3 SPACE PRIORITY

- A. Ensure optimum use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below except as otherwise detailed. Items are listed in the order of priority, with items of equal importance listed under a single priority number.
 - 1. Gravity flow piping systems
 - 2. Vent piping systems
 - 3. Recessed lighting fixtures
 - 4. Concealed HVAC terminals and equipment
 - 5. Air duct systems
 - 6. Sprinkler piping systems
 - 7. Pressurized piping systems
 - 8. Electrical conduit, wiring, control air tubing
- B. Order of space priority does not dictate installation sequence. Installation sequence shall be as required to install all affected trades.
- C. The work of this Division 23 shall not obstruct access for installation, operation and maintenance of the work of any other Division.
- D. All major items of equipment shall be arranged so as to provide a minimum of 28" clear aisle space. Additional space shall be provided between and around equipment for maintenance and proper operation as shown in the equipment manufacturer's literature.

1.4 COORDINATION

- A. Coordinate all work under this Division 23 with work under all other Divisions, providing adjustment as necessary.
- B. Coordination of space requirements with respect to Division 26 shall be performed such that:
 - 1. No equipment, piping or ductwork, other than electrical, shall be installed within 42" of switchboards or panelboards.
 - 2. No piping or ductwork which ever operates at a temperature in excess of 120 degrees F. shall be installed within 3" of any electrical conductor.
- C. All items mounted in or below the ceiling, and all items penetrating the ceiling, shall be coordinated with the architectural reflected ceiling plans. If any items are not shown on these plans, or any items need to be relocated for coordination purposes, prepare a reflected ceiling plan and submit it to the ** Owner ** Architect ** for approval.

1.5 CODE COMPLIANCE

- A. All workmanship and materials provided under this Division 23 shall comply with all laws, ordinances, codes and regulations of all Federal, State and Local Authorities having jurisdiction.
- B. All fire suppression, plumbing, heating, ventilating, and air conditioning materials and workmanship shall comply with all state and local codes and standards as minimum requirements.
- C. Secure and pay all fees associated with all permits and licenses required for execution of the Contract. Arrange for all inspections required by city, county, state and other authorities having jurisdiction, and deliver certificates of approval to the Architect.
- D. The code requirements are strictly a minimum and shall be met without incurring additions to the Contract. Where requirements of the drawings or specifications exceed the code requirements, the work shall be provided in accordance with these drawings or specifications. In the event of conflict or ambiguity between the various codes, the most stringent requirement shall govern.

1.6 ELECTRICAL REQUIREMENTS AND INTERFACE

- A. All electrical equipment and wiring provided under this Division 23 shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.
- B. Electric controls, contactors, starters, pilot lights, push buttons, etc., shall be provided complete as part of the motor, heater or other equipment which it operates. All electrical components shall be in conformance with the requirements of the National Electrical Code and Division 26. **Reference Division 26 and the electrical engineering drawings for those motor starters provided under that Division 26. All starters not shown shall be provided under this Division 23. Unless specified otherwise under other individual equipment Sections, motor starters shall conform to the following minimum requirements:
 - 1. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single-speed, unless otherwise indicated. All other starters shall be magnetic.

2. Each starter for a three-phase motor shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external "HAND-OFF-AUTO" selector switch with red "RUNNING" light. Provide a green pilot light to indicate motor "STOPPED". Each pilot light shall have a legend plate indicating reason for signal.
 3. Each overload relay shall have a normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a "TRIPPED" legend plate.
 4. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. All starters mounted in exterior areas shall have a NEMA 3R enclosure. Each starter shall have a laminated nameplate to indicate equipment unit number, function and circuit number.
 5. All motor starters, push buttons and pilot lights shall be of the same manufacturer as the switchboard and shall be General Electric, Square D, Siemens I.T.E., or Westinghouse.
- C. Motor starters for the following equipment shall be provided under this Division 23 by the manufacturer of the equipment:
1. Packaged air conditioning equipment
 2. Water chillers
 3. Fire pumps
 4. Packaged booster pump systems
 5. Other equipment hereinafter specified in other Sections to be provided with integral starters.
- D. Unless otherwise noted or specified in individual Sections, all 3-phase motors shall be standard NEMA continuous duty "B" type, with Class B insulation, open drip-proof frame for indoor service, TEFC for outdoor service and a service factor of 1.15. All motors 5 HP and larger shall be U.S. Motors Hi-Efficiency Model or Reliance XE Hi-Efficiency Model.
- E. All power wiring and final connections to equipment shall be provided under Division 26.
- F. Control components, all interlocks (motor-operated dampers, fire alarm motors, etc.) and control wiring (120 volt, single phase and less) shall be provided under this Division 23 as required to achieve the specified control sequences.
- G. All control wiring over 30 volts shall be installed by a licensed electrician working under this Division 23.
- 1.7 SLEEVES, SEALS AND ESCUTCHEONS
- A. Sleeves shall be provided through all pipe penetrations of concrete or masonry walls, elevated floors and roofs, except those plumbing piping penetrations for fixtures, vents, etc.
 - B. Sleeves shall be fabricated from Schedule 40 steel pipe through 10" and Standard Wall steel pipe for sleeve sizes 12" and larger. All sleeves penetrating exterior walls, underground walls, pit or vault walls shall be provided with a 3" x 3/8" thick waterstop ring welded completely to the midpoint of the sleeve.
 - C. All sleeves penetrating exterior walls, underground walls, pit or vault walls and elevated floors shall be packed and sealed watertight.

- D. Sleeves through roofs shall extend above the roof surface and be flashed watertight.
- E. Sleeves through walls shall be cut and finished flush with each surface of the wall in which they are installed.
- F. Sleeves shall be sized to provide a minimum of 1/2" clearance between the inside surface of the sleeve and the outside finished surface of the pipe plus any insulation specified.
- G. Fire-stops shall be provided as specified herein. All annular spaces between piping and sleeves, which do not require fire-stops, shall be packed with mineral wool and caulked.
- H. Provide round, chrome-plated escutcheons on all exposed piping penetrations passing through walls, floors, partitions and ceilings.

1.8 FIRE-STOPS

- A. Where ductwork, piping, conduit, etc. pass through fire partitions, fire walls and floors, a fire-stop shall be provided that will ensure an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight and completely fill gaps between the ductwork, piping, conduit, etc. and the perimeter of their rough openings.
- B. Fire-stopping material shall maintain its dimensions and integrity while preventing the passage of flame, smoke and gases under conditions of installation and use when exposed to the ASTM E119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Fire-stopping material shall be noncombustible as defined by ASTM E136; and, for insulation materials, melt point shall be a minimum of 1700 degrees F. for 1-hour protection and 1850 degrees F. for 2-hour protection. Fire-stopping material shall be Dow-Corning RTV Foam or 3M Fire Barrier Products or Sohio Carborundum Fyre Putty.
- C. See Section 224000 for fire stopping of PVC piping.

1.9 CORE DRILLING

- A. Cutting of holes through concrete and masonry shall be by diamond core or concrete saw. Pneumatic hammer, impact electric and hand or manual hammer type drills will not be allowed, except as permitted by the Architect where required by limited working space. Locate holes such that they will not affect structural sections such as ribs or beams. Holes shall be laid out well in advance of the installation. These layout locations shall be approved by the Architect prior to drilling.

PART 2 - PRODUCTS

2.1 BID BASIS AND SUBSTITUTION PROCEDURES

- A. Manufacturers names, series and model numbers, as noted or specified, are for the purpose of describing type, capacity, and quality of equipment, materials and products to be used. Unless "or equal" is specifically stated, bids shall be based only on the specified "basis of design" manufacturer. The listing of a particular manufacturer as an "equal" or "acceptable substitute" manufacturer shall not be misconstrued as approving nor allowing the substitution of that manufacturer's standard product in place of the basis of design. No consideration will be given to a product, which would require dimensional, spatial or aesthetic changes to the project.

"Acceptable substitute" and "equal" manufacturers shall only bid those products, which exactly match the size and other characteristics of the specified basis of design. Any changes to other disciplines and trades of work required by an "or equal" or "substitute" product shall be duly considered and priced accordingly prior to bidding or pricing. The decision as to whether or not a proposed substitute or "equal" product is actually equal to that specified shall rest solely with the Architect.

- B. Requests to provide "equal" products in lieu of those specified shall be submitted to the Architect in writing at least ten (10) days prior to final pricing and execution of the Contract. No consideration will be given to substitute products after final pricing and execution of the Contract.
- C. Any "or equal" product or proposed product substitution which will cause a change in the appearance, dimensions or design of any part of the building, its structure, electrical system or any other engineered systems shall be accompanied by a scaled drawing and written description of the required change(s) for approval by the Architect. If deemed necessary by the Architect, design changes shall be signed and sealed by a registered Professional Engineer, currently licensed in this State.

2.2 MINIMUM STANDARDS

- A. Every piece of energy consuming equipment, all fire suppression products and life safety equipment shall comply with the following standards as applicable; especially in regard to prevailing codes:
 - 1. Factory Mutual Laboratories (FM)
 - 2. Industrial Risk Insurers (IRI)
 - 3. Underwriters Laboratories, Inc. (UL)
 - 4. ADC: Air Diffusion Council
 - 5. AGA: American Gas Association
 - 6. AMCA: Air Moving and Conditioning Association, Inc.
 - 7. ANSI: American National Standards Institute
 - 8. API: American Petroleum Institute
 - 9. ARI: American Refrigeration Institute
 - 10. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
 - 11. ASME: American Society of Mechanical Engineers
 - 12. ASTM: American Society of Testing and Materials
 - 13. AWWA: American Water Works Association
 - 14. IBR: Institute of Boiler and Radiator Manufacturers
 - 15. MSS: Manufacturers Standardization Society
 - 16. NBBPVI: National Board of Boiler and Pressure Vessel Inspectors
 - 17. NEMA: National Electrical Manufacturer's Association
 - 18. OSHA: Occupational Safety & Health Administration
 - 19. PDI: Plumbing Drainage Institute
 - 20. PPI: Plastic Pipe Institute
 - 21. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

PART 3 - EXECUTION

3.1 SUBMITTALS

- A. Before preparing submittals, study all Contract Drawings and specifications in detail, obtain manufacturer's recommended instructions, and have submittals prepared based on specific equipment and material proposed for installation. An officer of the contracting firm shall sign all shop drawings (certifying conformance with plans and specifications) before submitting to the Architect or releasing to the field.
- B. The submittal process shall not be utilized as an avenue to substitute products after the execution of the contract. Should an unspecified or unequal product be submitted, it will be rejected. If a second attempt at substitution is made during the resubmittal of the same product, then no more reviews of that product will be performed without direct compensation to the Engineer being paid for the additional services required for the third review and any further reviews.
- C. All submittals shall be submitted and returned electronically.
- D. Submittals will not be accepted for review unless they:
 - 1. Comply with the requirements of Division 1.
 - 2. Include complete information pertaining to all appurtenances and accessories.
 - 3. Are submitted as complete packages which pertain to all related items in Division 23. Separate packages shall be submitted as follows:
 - a. All HVAC equipment and components
 - b. All plumbing equipment, fixtures and components
 - c. The fire suppression system
 - d. The automatic controls and EMS
 - 4. Are properly marked with equipment, service or function identification as related to the project and are marked with pertinent specification paragraph number.
- E. Submit catalog information, factory assembly drawings, field installation drawings and certifications as required for complete explanation and description of all items of equipment. The submittal data shall provide ample, unquestionable compliance with the Contract Documents.
- F. Review of submittals shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly identified and separately submitted in the form of a letter that is enclosed with the submittals.
- G. Submittals are required on all manufactured equipment, especially energy consuming equipment. Submittals shall include, but are not limited to, the following items of equipment:
 - 1. Piping Specialties
 - 2. Insulation
 - 3. Pumps
 - 4. Heat Tracing
 - 5. Water Heaters
 - 6. Plumbing Fixtures
 - 7. Split Systems
 - 8. Packaged Rooftop Units
 - 9. Air Distribution Devices
 - 10. Ductwork Accessories
 - 11. Centrifugal Fans

- 12. Louvers and Hoods
- 13. Evaporators
- 14. Refrigeration Equipment

3.2 EXCAVATION, TRENCHING AND BACKFILLING

- A. Perform all excavation, trenching and backfilling for underground work under this Division 23. During excavation, the excavated material shall be piled back from the banks of the trench to avoid overloading, slides or cave-ins. Do not exceed the angle of repose unless written approval is obtained in advance from the Architect for shoring, bracing or other alternate excavation methods. All excavated material not used for backfilling shall be removed from the building and disposed of as indicated or directed by the Architect. Take measures to prevent surface water from flowing into trenches and other excavations and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. Tunneling shall not be allowed.
- B. The bottom of all trenches shall be evenly graded to provide firm support and an even bearing surface. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that the barrel of the pipe rests evenly on the bottom of the trench along the entire length of the pipe.
- C. Pipe shall be inspected and tested prior to backfilling. Trench shall be handfilled to a minimum of 12" above the top of pipe with suitable earth (free of rocks, trash, large clods and organic material) and compacted to a minimum 95% proctor. After the first layer is completed, subsequent layers shall be filled and compacted the same as the first layer. Settling the backfill with water shall not be permitted.

3.3 INSTALLATION REQUIREMENTS

- A. All equipment shall be installed in strict conformance with the recommendations of the equipment manufacturer, as indicated on the Drawings and as specified.
- B. Provide installation manuals for each piece of equipment. Submit in separately bound volumes after review of submittals.
- C. Provide supplementary steel framing and welded steel equipment support stands as required for proper hanging and support of the mechanical systems. Steel angles, channels and tubing utilized for such framing shall be selected for a maximum deflection of 1/360th of the span.
- D. All roof curbs shall be a minimum of 12" high and selected for the various roof pitches. Curbs installed on roofs having pitches of not more than 1/4" per foot may be standard curbs shimmed level with steel channels or Zs to provide suitable support and flashing surfaces.

3.4 CLEANING, LUBRICATION AND ADJUSTMENT

- A. The exterior surfaces of all mechanical equipment, piping, ductwork, conduit, etc., shall be cleaned and free of all dirt, grease, oil, paint splatter, and other construction debris.
- B. Ducts, plenums, and air unit casings shall be cleaned of all debris and either vacuumed or blown free of all rubbish, dirt, and dust before installing grilles, registers or diffusers.
- C. Bearings that require lubrication shall be lubricated in strict accordance with the manufacturers recommendations.

- D. All control equipment shall be adjusted to the settings required for the performance specified.
- E. Fans shall be adjusted to the speed indicated by the manufacturer to meet the installed final system pressure at the airflows indicated. Any additional sheaves and belts required for final adjustments shall be provided with no increase in the Contract amount.
- F. Any fans operated during construction shall have temporary filters. Temporary filters shall be changed regularly to minimize contamination of the equipment and duct systems. Permanent filters shall be installed prior to final inspection.
- G. All coils shall be thoroughly cleaned and combed prior to final inspection.

3.5 PAINTING

- A. All uncoated and uninsulated steel surfaces exposed to sight inside the building, such as piping, equipment hangers and supports which are not provided with factory prime coat or galvanizing, shall be cleaned and painted with one coat of rust inhibiting primer. In addition, all surfaces in finished spaces shall also be painted with two coats of finish paint in a color selected by the Architect.
- B. All ductwork surfaces visible through grilles, registers and diffusers in finished areas shall be painted flat black.
- C. Steel items exposed outside the building, such as equipment supports, uninsulated piping and hangers, which are not factory painted or galvanized, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of asphaltic base aluminum paint. Insulated steel pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.
- D. Factory painted equipment that has been scratched or marred shall be repainted to match the original factory color.

3.6 DUCTWORK AND PIPING LEAK TESTING

- A. Underground, concealed and insulated ductwork and piping shall be tested for leaks in place before backfilling, concealing or covering. Tests shall be conducted in the presence of the Architect or his designated representative.
- B. All low pressure ductwork (design operating pressure of 1.0" W.C. E.S.P. or less) shall be tested by the operation of the system to which it is connected.
- C. All visible and audible air leaks from the ductwork systems shall be repaired.
- D. Soil, waste and vent piping shall be tested with water before installing fixtures. Water test shall be applied to the system either in its entirety or to the individual sections. Each opening except the highest opening of the section under test shall be plugged, and the section shall be filled with water and tested with a head of water of at least ten (10) feet above the highest point in the system. The water shall be kept in the portion under test for at least thirty (30) minutes; no drop in the water level will be acceptable.
- E. The water piping systems shall be tested at a minimum pressure of 125 psi and proved tight at this pressure for not less than thirty (30) minutes or longer if required to permit inspection of all joints. No loss in pressure will be permitted.
- F. All gas piping shall be tested pneumatically and proved tight at a pressure of not less than 100

psi for a period of not less than two (2) hours. No loss in pressure will be permitted.

- G. All refrigerant piping shall be 100% tested with a halide torch leak detector.
- H. All leaks shall be repaired by tightening, remaking joints, or replacing pipe and fittings. Caulking of joints shall not be permitted.

3.7 RECORD (AS-BUILT) DRAWINGS

- A. At the completion of the project, provide a set of reproducible sepias to the Architect which reflect all changes, deviations and revisions made to the original design documents. Locations of all underground piping and utilities shall be clearly shown and dimensioned from permanent reference points such as building column lines.

3.8 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Complete operating and maintenance manuals shall be provided to the Owner. Four copies shall be provided. Each copy shall be bound in a separate 3-ring, loose-leaf notebook. Operating instructions shall be provided for each mechanical system, and shall each include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instructions shall be provided for each piece of equipment. A control system wiring diagram shall be included in each operating and maintenance manual.
- B. Prior to final acceptance or beneficial occupancy, provide the services of a competent technician for not less than one 1 day to instruct the Owner in the operation of the mechanical systems.

3.9 TESTING AND BALANCING

- A. Testing and balancing of the HVAC system shall be performed as specified in Section 230430. Note that this work is to be performed under a separate Contract directly under the General Contractor. Submit four (4) copies of the test and balance report directly to the Architect.

3.10 WARRANTY

- A. All work provided under this Division 23 shall be subject to a minimum one year warranty. The warranty shall include prompt repair or replacement of equipment or system failures and shall include all parts and labor. In addition, all reciprocating air conditioning compressors shall carry an additional four year parts-only warranty. Extended warranties shall be provided on all other equipment so specified in other Sections.

END OF SECTION 230100