

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

- A. All Provisions of this Section 230500 shall apply to all Sections of Division 23.
- B. The work of Division 23 includes providing all labor, material and equipment required to produce the various systems complete and operating.
- C. All work under this Division shall be subject to all applicable requirements of the Project Manual.
- D. The commissioning responsibilities found elsewhere in this project manual are applicable to this section.

1.2 CONTRACTOR'S INSTALLATION DRAWINGS

- A. Submit under provisions of Section 013300 for Architect's review six copies of Contractor's coordination and installation drawings coordinating plumbing, HVAC, sprinklers and equipment layouts and equipment rooms, mechanical shafts or any crowded location where there is a possibility of conflict among trades.
- B. Only drawings bearing Architect's stamp shall be used for construction. Keep drawings on job at all times.

1.3 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. ALL products used on the project must be Asbestos FREE. Note, imports from Canada can contain asbestos and may state it is asbestos free but if the ingredients are checked it may contain chrysotile or Canadian fibers which is not considered asbestos in Canada but is considered asbestos here in the United States. This can be found in mastics, flooring products, and sheetrock. The Contractor shall be required to be aware of the products their company, and their subcontractors supply for the project. Contractor's shall be required to prudently check material MSDS sheets. Key words to look for include: asbestos, Canadian fibers, and Chrysotile mineral fibers.
- B. No materials or equipment shall be used in the work until reviewed and accepted for such work by the Engineer. Prior to submission of shop drawings, and within the time specified in Section 013300, the Contractor shall submit to the Engineer, a complete list of materials and equipment which he intends to furnish, giving manufacturer and catalog numbers. Shop drawings will not be considered for review until the complete list of the manufacturers of all materials and equipment has been accepted.
- C. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them after installation. All applicable materials and equipment shall be such as found in the approved list of the National Board of Fire Underwriters. Where applicable, all materials and equipment used shall bear the label of the Underwriter's Laboratories, Inc. securely attached.

- D. All equipment shall be supplied to the job in sections which can readily pass through the openings provided. If necessary, sections shall be assembled and connected at the site, within the space which they occupy.
- E. Only those materials and equipment named in the specifications by giving the name of the manufacturer, or by brand or trade name or catalog reference, shall be used as a basis for the preparation of the base proposal, and only those materials shall be furnished under the Contract.
- F. Should the bidder desire to use any materials or products other than those specified by name, he shall submit the proposed substitution to the Engineer for review ten (10) days prior to the date of the proposal.
- G. Where substitutions are allowed herein, any equipment so accepted shall meet all specified requirements in all aspects of design, space requirements, electrical characteristics, power consumed, and suitability to system design. Any changes in wiring, controls, etc., from that shown on the contract drawings necessary to accommodate the equipment substituted shall be made by the Contractor at his expense. Where substitutions require change in the work under other sections, the Contractor shall make all such changes at his expense. Acceptance of the shop drawings of the substitution does not relieve the Contractor of this responsibility.
- H. Material list shall be submitted within thirty (30) days after award of contract.

1.4 SUBMITTALS

- A. Submittals shall be in accordance with Section 013300.
- B. The Contractor shall submit shop drawings to the Engineer for review before fabrication of any equipment.
- C. Shop drawings, cuts, sheets, and other data shall bear the Contractor's stamp of approval as an indication that he has examined them and found thereon complete information as to the space requirements, electrical characteristics, power consumption, suitability to system design, and considers the material or equipment to fully meet the specifications.
- D. Review of shop drawings will be general and will not relieve the Contractor from the responsibility for quantities, for proper fitting and construction of the work, or from furnishing materials and work required by the contract which may not be indicated on the shop drawings when accepted.
- E. All materials and equipment shall be new, of best quality and grade, all subject to Architect's review. None shall be used until they have been reviewed. Use product of one manufacturer where two or more items of same kind of equipment are required. Reuse existing equipment only where specifically indicated.
- F. Submit under provisions of Section 013300 a list of proposed manufacturer's and suppliers of all items of mechanical equipment for the Architect's review. Submittals will not be processed until this list has been reviewed.

1.5 REGULATIONS AND PERMITS

- A. Perform all work in accordance with the applicable regulations of N.F.P.A., all State and Municipal building ordinances, codes and regulations and any insuring agency having jurisdiction.
- B. Furnish required certificates of approval. Obtain and pay for all required fees, permits and inspections.
- C. Within 30 days after award of Contract, make application for inspection service, simultaneously filing a copy of the application with the Architect as proof of having requested this service.

1.6 GUARANTEES

- A. Guarantee complete mechanical installation free of all defects of material, equipment and workmanship for one year beginning from date of final acceptance of work. During this year be responsible for proper adjustment of all systems, equipment and devices installed by Contractor and correct all defects or maladjustments promptly without additional expense to Owner. This shall not include normal maintenance, care and operation of the systems.
- B. Contractor's attention is directed to guarantee periods greater than one year on certain items of equipment. These requirements are spelled out in detail in the Articles covering the specific equipment.

1.7 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Furnish manual containing a brief description of each system. Include explicit instructions for operating the systems. Provide under provisions of Section 017823.
- B. In addition furnish the following information in each manual:
 - 1. Manufacturer's printed operating and maintenance instructions, parts lists, illustrations and diagrams for each piece of equipment.
 - 2. A complete schedule of periodic servicing and lubrication requirements for all equipment.
 - 3. Manufacturer's data report form U-1 certifying Code compliance for each piece of equipment specified to be constructed in accordance with ASME Code for Unfired Pressure Vessels.
 - 4. One copy of each shop drawing and Contractor's record drawings, and record control diagrams.
 - 5. One copy of each wiring diagram.
 - 6. One copy of testing and balancing report.
 - 7. One copy of Valve chart.
- C. Place these instructions in Architect's hands at least 30 days prior to date system will be turned over to Owner.
- D. After review by Architect, revise as required, and supply copy to Owner and to Architect.

PART 2 PRODUCTS

2.1 ELECTRICALLY OPERATED EQUIPMENT AND CONTROLS

A. Unless otherwise indicated:

1. All starters, all disconnect switches and all work pertaining to equipment power connections are specified under Division 26, Electrical Work.
2. All control circuit wiring, including all electrical interlocking, relay wiring, remote controls and temperature controls shall be provided under Division 23, and shall be in conformance with the requirements of Division 26.
3. Provide all control devices suitable for operation on a maximum of 120 volt service.
4. Where applicable all equipment used shall bear the label of the Underwriter's Laboratories, Inc. securely attached.

2.2 MOTORS

- A. Motors for all equipment specified under this Section of the Specification shall be provided with the equipment.
- B. Unless specifically noted otherwise, all motors 1/2 HP and over shall be suitable for 480 volts, 3 phase, 60 hertz current, and those under 1/2 HP for 120 volts, single phase, 60 hertz current. All motors shall be equipped with grease-packed ball bearings.
- C. Fractional horsepower motors, 1/12 horsepower and larger, shall be permanently split capacitor or split phase. Shaded pole motors will only be acceptable for motors smaller than 1/12 horsepower.
- D. Where a motor supplied differs from the motor indicated for a certain piece of equipment, and the difference requires a change in starter, feeder, branch circuit or other electrical items, include the cost of such electrical changes under the Section of the Specifications wherein the particular piece of equipment is specified.
- E. Design motors in accordance with NEMA standards and affix to each a nameplate accurately listing all pertinent data. Each motor shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at any speed or load which may be obtained by the drive actually furnished. Except as noted, rate all motors for continuous duty at 100% of rated capacity. The NEMA standard service factor may be applied only to motors having water or refrigerant cooling. The indicated motor horsepower are those estimated to be required by the driven equipment when operating at specified duties and efficiencies and are to be used to determine electrical feeder sizes. If the actual horsepower required for the equipment proposed to be furnished is greater than the indicated horsepower, it shall be provided at no additional expense to the Owner; and equally, if it is less, no credit shall accrue to the Owner.
- F. Unless otherwise indicated, polyphase motors shall be NEMA Design B, general purpose, squirrel cage, single speed, open drip proof, induction type, with Class B Insulation, stamped with NEMA Design B letter designation. Motors 20 horsepower and above shall be high efficiency type, 92% efficiency minimum. Motors connected to variable frequency drives shall be inverter duty rated.
- G. Single phase motors, open, capacitor start type.

- H. Provide motors with adjustable V-belt drives with a cast iron or steel base, slide rail and adjustable screw device.
- I. V-Belt Drives: Sheave diameters shall not be less than the drive manufacturer's minimum recommended diameter for various belt cross-sections. Belt velocity must lie within the 2500 fpm to 4000 fpm range. The NEMA minimum sheave diameter is not acceptable.
- J. Alignment of motors and drives and placing motors and equipment on foundations ready for operation shall be included in the work of the Section wherein the particular equipment is specified.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. Install all materials and equipment in a neat and workmanlike manner. When directed, remove, replace, at Contractor's expense, all work not presenting an orderly, reasonable neat or workmanlike appearance or work failing to meet performance requirements.
- B. Coordinate all work and cooperate with other trades in building to facilitate proper and intelligent execution of work.

3.2 MANNER OF INSTALLATION

- C. Install all piping and ductwork to permit easy access to all valves, dampers, traps and other equipment requiring periodic servicing. Provide extension devices and remote operators as necessary for all valves, dampers and lubrication points which require frequent service, adjustment or control and which cannot be located in a readily accessible and safe place.
- D. Unless otherwise directed, or where existing piping or ductwork is exposed, or in mechanical rooms, conceal all piping and ductwork. In all cases, install piping and ductwork to follow lines of building and to allow maximum headroom consistent with proper pitch.

3.3 PROTECTION OF THE WORK:

- A. Cover openings in ductwork, conduits and piping and temporarily seal to protect from contamination.
- B. Protect materials and equipment from damage due to environmental conditions. Use protective cover, and protect from surface water using raised platforms.
- C. Protect unfinished work at the end of each work day from damage contamination and moisture, by the use of plugs, caps, or covers.
- D. Protect piping from freezing conditions during the various stages of construction.
- E. Protect piping and valves from damage pending performance of systems tests.
- F. Protect installed thermometers and gauges from accidental damage by construction activity.

3.4 LOCATION OF EQUIPMENT:

- A. The mechanical sheets of the Contract Drawings are diagrammatical and not intended for use in determining the exact locations of the components of mechanical and electric systems.

- B. Equipment final locations will be determined by the equipment finally approved for installation. Final location of equipment will be determined by tube removal spaces, access and clearances required. Final layout shall be submitted for approval.
- C. Do all cutting and patching required for the installation or demolition of mechanical equipment. Refer to Section 024119 for specific requirements.

3.5 CLEANING OF SYSTEMS

- A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Remove all burrs, cuttings and waste. Blow and flush piping until interiors are free of foreign matter. Remove mill oil from steel piping by flushing with a mixture of detergent and non-foaming agent.
- B. Clean all strainers and dirt pockets prior to test, after tests and as often thereafter as necessary to guarantee no system stoppage, either whole or partial, by end of guarantee period.
- C. Clean all fans, ductwork, enclosures, flues, registers, grilles and diffusers of all rubbish and plaster at completion of work.
- D. Should any system be stopped with refuse, which entered the system during construction is discovered after acceptance, pay for all labor and materials required to locate and remove the obstruction and replace and repair all work in any way disturbed.
- E. Remove all rust and thoroughly clean all surfaces to be insulated or painted.
- F. Leave all systems in clean, perfect condition and in complete running order.

3.6 ACCESS PANELS

- A. Refer to Architectural drawings and specifications for access panel locations, sizes and types.

3.7 START UP AND TRIAL OPERATION

- A. Scope: Start up and put in trial operation all air handling systems, pumps, and related equipment as specified.
- B. Preparation: Before starting any equipment, completely assemble all systems, test for leaks or other defects, connect and test all safety devices, lubricate all bearings, charge refrigeration system with refrigerant and oil, adjust belts and drives, align motors and the equipment they drive, check rotation of all equipment and check that the correct thermal element is installed in each starter.
- C. Time Period: After the preparatory work specified above has been accomplished, start each system and put in trial operation for a minimum period of five 8 hour days.
- D. Corrections: Repair or replace any device which may prove defective during the trial operation period and re-run.
- E. Costs: Electrical energy for the tests will be provided by the Owner.

- F. Scheduling: Schedule trial operations in coordination with Adjusting and Balancing work. If permitted by the Architect more than one system may be operated at the same time. Submit schedule for Architect's review.
- G. Extension of Time: If, during the trial operation period, any part of a system is inoperative for any reason, extend the trial operation period by the amount of the downtime. Instruction time is in addition to trial operation time.

3.8 FIELD INSTRUCTION

- A. Upon completion of work, furnish services of a competent representative to instruct Owner's representative in the proper operation and maintenance of all elements of the mechanical systems. Instructor must be approved by Architect.
- B. Spend not less than two (2) four-hour days in such formal instruction and if necessary, to fully prepare the owner to operate and maintain the systems, such additional time as may be directed by the Architect.
- C. One of the specified days of instruction shall occur after thirty days operation by the Owner's representative.
- D. The specified two (2) days shall be in addition to time required for instruction purposes for automatic controls.
- E. Contractor shall provide video tapes of the operating instruction to the Owner.

3.9 CUTTING AND PATCHING

- A. Do all cutting and patching necessary to install mechanical work.
- B. The cutting of walls, floors, partitions, slabs and decks for the passage and/or accommodation of ductwork and equipment, the closing of superfluous openings and the removal of all debris caused by said work under this contract shall be performed by the Contractor.

END OF SECTION 230500