

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work Included:
 - 1. Common Motor Requirements for HVAC Equipment
 - 2. Variable Frequency Drives
 - 3. Hangers and Supports for HVAC Piping and Equipment
- C. Related Sections:
 - 1. Division 01 -- Commissioning
 - 2. Section 23 00 10 – HVAC General Requirements
 - 3. Section 23 05 48 – Vibration and Seismic Controls for HVAC Systems
 - 4. Section 23 05 53 – Identification for HVAC Piping and Equipment
 - 5. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
 - 6. Section 23 09 00 – Instrumentation and Control for HVAC
 - 7. Section 23 20 00 – HVAC Piping and Pumps
 - 8. Section 23 30 00 – HVAC Air Distribution
 - 9. Section 23 70 00 – Central HVAC Equipment
 - 10. Section 23 80 00 – Decentralized HVAC Equipment

1.2 REFERENCES

- A. General: The following standards or codes form a part of this specification to the extent indicated by the reference thereto.
- B. American Society of Mechanical Engineers (ASME):
- C. ASME 95 Boiler and Pressure Vessel Code
- D. B16.3 Malleable Iron Threaded Fittings
- E. B16.4 Cast Iron Threaded Fittings
- F. B31.9 Building Services Piping
- G. National Electrical Manufacturers Association (NEMA)

- H. Underwriters Laboratories, Inc. (UL)

1.3 COMMISSIONING OF HVAC SYSTEMS:

- A. The Contractor shall provide contact information to the Commissioning Agent indicated in Division 1 for all major items of Equipment.
- B. Provide additional submittal copy of major equipment for Commissioning Agent specified in Division 1.

1.4 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Division 1 and Section 23 00 10.
- B. Shop drawings, diagrams, catalog data and such other data necessary to fully describe and substantiate compliance with these specifications shall be submitted for all equipment and materials marked with notation set forth in Section 23 00 10.
- C. Operation and maintenance data shall be submitted in accordance with Division 1, for all items of equipment and materials marked with notation set forth in Section 23 01 00.

PART 2 - PRODUCTS

2.1 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

- A. Motors shall be provided in place as an integral part of the driven equipment, ready for electrical connections. Motors shall be in accordance with NEMA Standards and of design suitable for the starting and running characteristics of the driven equipment. Motors over 5 HP shall be “premium” efficiency as defined by NEMA MG-1, latest edition.
- B. All three phase motors over 5 HP shall be provided with minimum power factor of 90%. Power factor correction capacitors shall be provided if required and shall be furnished to the electrical subcontractor for installation. Shop Drawing submittals for motors over 5 HP shall list efficiency and power factor. Unless specified otherwise, all motors shall have continuous duty classification, 40° Centigrade ambient temperature, shall have enclosure suitable for indicated application and shall be wound for 120 volt, single phase, 60 cycle current, except motors above 1/2 horsepower (unless indicated otherwise) shall be wound for 200V or 230V/460V as required by the secondary voltage specified for main service in Division 26. Each motor shall be selected and rated at the voltage indicated so that the driven load does not exceed the nameplate rating and service factor of the motor. All motors 460V/480V 20 HP and above and 208V/230V 10 HP and above shall be wound for wye-delta (6 or 12 lead) starting with capabilities of being wired for across-the-line starting.

- C. Motors for use with variable frequency drives (VFD) shall be wound for across-the-line type starting and shall be rated for “VFD-duty” or shall be Premium Efficiency type with Class F (1500 volt) insulation and thermal overload protection. Motors for VFD applications shall meet or exceed IEEE 519-1992. Motors for VFD applications shall have maximum 4:1 speed range corresponding to 60 Hz and 15 Hz. Power factor correction is not required when motor is used with VFD. Motors for VFD service shall be Invert
- D. er Duty Rated with internal shaft grounding to prevent common mode voltage (shaft current) bearing failures.
- E. Where 2-speed motors are indicated for motors above 1/2 horsepower, motors shall have two separate windings.
- F. Motor starters and motor protective switches shall be provided under Division 26 except where specified to be furnished specifically with the driven equipment. Accessories such as auxiliary contacts, hand-off-automatic switches, start-stop switches, pilot lights, control power transformers and other similar items shall be provided in or on the controllers as required by the control sequence indicate
- G. d. Starting equipment, unless factory mounted on the equipment, shall be installed under Division 26.

2.2 VARIABLE FREQUENCY DRIVES [S] [O/M]:

- A. Variable Frequency Drives (VFD) shall convert primary power to adjustable voltage/frequency three phase AC power for stepless motor control from 5% to 105% of motor base speed. Units shall be pulse-width-modulation (PWM) type. Units shall be UL listed and suitable for installation in return air plenums, complete with Hand/Off/Auto switch, Run or Stop switch and display to indicate unit status, frequency and fault diagnostics. Unit shall have automatic soft restart after power outage, soft start/stop, and interface provisions for start/stop and control from the DDC system specified in Section 23 09 00 interconnections. Unit shall have all motor protective devices as required by NEC. Unit shall have line circuit breaker, motor thermal overload relay, phase-loss protection, ground-fault protection, harmonic compensated load side reactor and control transformer.
- B. All drives provided for the project shall be supplied by the same manufacturer, including those installed with equipment at the factory. The VFD shop drawing shall be inclusive of all drives on the project.
- C. Drives shall be suitable for operation without damage to the connected motor. Drives shall have multiple, adjustable deadbands across the entire speed range for operation of connected equipment without vibration. Units shall have display on each drive to indicate all faults and diagnostics.
- D. Drives shall be matched to driven motors in accordance with motor and drive manufacturers’ recommendations.

- E. Drives shall be suitable for speed control by the DDC System specified in Section 23 09 00 using any of the following signals, 3-15 psi, 0-5 vdc, 0-10 vdc or 4-20 ma dc.
- F. Drives shall be provided with current sensing device to indicate abnormal conditions such as broken belt.
- G. Where wiring to the driven motor exceeds 150 feet or as otherwise recommended by the manufacturer, a load side drive filter shall be furnished and installed. Where drives have remote disconnects at the driven motor, a run contact shall be provided to stop the drive without harm if the remote disconnect is opened.
- H. Drives shall be installed in NEMA classified cabinets suitable for the location in which installed. Units located outdoors shall be NEMA 3R or NEMA 4.
- I. Harmonics: The drives provided shall not add significant voltage harmonic distortion to the electrical system. If voltage harmonic distortions exceed 5%, line reactors or isolation transformers shall be provided in a separate enclosure.
- J. VFD shall be provided with communication interface to allow two-way communication with the DDC System specified in Section 23 09 00.
- K. Warranty: Provide parts and labor warranty for a period of five (5) years.
- L. Installation and Start-up:
 - 1. The services of a qualified manufacturer's technical representative shall supervise the contractor's installation, testing, and start-up of all the drives furnished under this specification. A maximum total of one (1) supervision day (8 hours) shall be provided by the manufacturer's representative.
 - 2. System start-up shall include a checkout of vibration at various frequencies through field observation and manufacturer's data on the driven equipment. Frequency deadbands shall be set-up for each point of equipment vibration.
 - 3. Upon acceptance of the drive equipment, training of the operators shall consist of one (1) training day (8 hours).

2.3 HANGERS AND SUPPORTS FOR HVAC DUCTWORK, PIPING AND EQUIPMENT

- A. Suspended horizontal piping shall be supported by adjustable wrought steel clevis hangers except that straight runs of hot piping (>100°F) with 40 ft. or more between anchor and expansion device shall be supported on roller type hangers or supports. See Section 23 07 00 for calcium silicate hanger inserts at clevis hangers. All piping connected to motor driven reciprocating or rotating equipment shall have vibration isolation hangers as specified in Section 23 05 48. Protection saddle, welded to pipe, shall be provided at each roller support except on chilled water lines, saddle shall be external metal shield with calcium silicate preformed section as specified in Section 23 07 00, vapor sealed. Calcium silicate inserts may be omitted for pipe smaller than 2

inches. Where supports bear on copper pipe they shall be copper plated. Chain, strap or other makeshift devices will not be permitted as hangers of supports.

- B. Vertical steel piping shall be guided or supported in the center of each riser and not over 15 feet on center, copper or brass tubing shall be supported at not over 10 feet on center; and supported at the base of each riser and/or at the top of each riser as required by the piping run. All vertical piping shall be guided or braced where required to prevent lateral movement. Bracing shall include auxiliary stanchions where piping is not in close proximity to suitable structure.
- C. Refrigerant piping smaller than 3/4" shall be supported using B-Line Armafix clamps by Cooper Industries or equal.
- D. Rigid support sway bracing shall be provided at changes in direction greater than 45 degrees for all pipe 4 inches and larger.
- E. Pipe and suspended equipment hanger rods shall be attached to the top chord only on steel joists and beams by joist or beam clamps without welding. Welding of support rods and connection at any place other than the top chord will not be permitted unless written approval is granted by the Engineer and the Architect. C-clamp hangers shall be limited to 50 lb. or less when used at joists. Threaded rod shall be used through joist chords for loads greater than 50 lb.
- F. Duct supports shall consist of not less than 1" by 1/16" galvanized strap iron hangers spaced not over 4 feet on center, except medium and high pressure flat-oval ducts wider than 48 inches shall be supported by trapeze angles. Straps shall be lapped across the bottom ducts a minimum of 1 inch. Ductwork shall be supported from the building structure. Ductwork shall not be supported from the ceiling system or any other building services. Heavy ductwork such as medium or high pressure duct supported by hanger rods, shall be attached to the top chord only on steel joists and beams by joist or beam clamps without welding. Welding of support rods and connection at any place other than the top chord will not be permitted unless written approval is granted by the Engineer and the Architect. All ductwork shall be braced as required to prevent lateral movement.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's recommendations.
- B. Support riser piping independently from the connected horizontal piping.
- C. Hangers shall be spaced so that the supported load does not exceed the load recommended by the manufacturer. The supported load shall not overstress the building structural members. Where required hangers for the suspension of heavy items do not

correspond with the building structural members, provide supplemental steel members fastened to the building structural members.

END OF SECTION 23 05 00