

SECTION 262923 – VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. This Section specifies the motor variable frequency controllers for buildings and structures.
- 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.

- B. Related Sections:

- 1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Shop Drawings

- 1. Variable frequency motor controllers (drives).

1.4 QUALITY ASSURANCE

- A. Comply with requirements of NEC as applicable to motors and ancillary equipment.
- B. Comply with NEMA Std. Pub. No. ICS 2 pertaining to construction, testing, and installation of motor control.
- C. Comply with applicable requirements of U.L. Provide motor starters and ancillary equipment that is U.L. listed and labeled.
- D. Comply with applicable requirements of IEEE Std. 241 pertaining to construction and installation of motor control equipment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All motor starter enclosures shall have interlock defeaters for maintenance purposes.
- B. Variable frequency controllers (drives) shall not be part of a packaged assembly for mechanical equipment. Variable frequency drives shall be a separate unit, and shall be mounted to the building structure or rack affixed to the building structure.

2.2 VARIABLE FREQUENCY MOTOR CONTROLLERS (DRIVES)

- A. Variable frequency drives shall be Rockwell Automation (Allen Bradley) PowerFlex 400 series, ABB ACH550, Eaton type H-Max, or Yaskawa Z1000 and shall meet the following requirements:
 - 1. Any harmonic voltage and transients or impressed continuous waves shall be greater than 80 dB below the fundamental voltage.
 - 2. The voltage depth of any notches shall be less than .01% of the fundamental peak voltage. The time deviation shall be less than .1ms.
 - 3. Provide all necessary input line reactors, filtering, and shielding to meet the requirements. All shielding shall be made of copper.
 - 4. Comply with FCC requirements. Drive shall be labeled 47 CFR Part 15 Class B.
 - 5. Drive shall be able to operate open circuited without causing any damage to any drive components.
 - 6. If a safety disconnect is installed on the load side of the variable frequency drive, then a pre-printed label with the following text shall be affixed to the front of the drive.
 - a. "Unless Emergency, performed controlled shut down of VFD prior to opening safety switch."
 - 7. If safety disconnect is installed on the load side of the variable frequency drive, it shall be of non-fused type.
 - 8. Drive front end shall be a diode bridge with a DC chopper circuit.
 - 9. The drive output shall utilize pulse-width-modulation using transistors in the inverter section.
 - 10. The drive shall have the following features:
 - a. Keypad for operation and programming in the face of the enclosure. Digital output display to show the drive status and parameters including output speed, frequency,

motor amps, motor volts, output load, fault conditions, parameters during programming.

- b. Stall prevention which reduces motor speed during momentary overloads and clears when overload clears.
- c. Speed search to synchronize reapplication of power after momentary power interruption to a spinning motor.
- d. Slip compensation to improve speed regulation by setting no load and full load adjustments.
- e. Adjustable torque limit to limit motor torque to protect connected equipment.
- f. Minimum of eight selectable volt/hertz profiles.
- g. Critical frequency rejection permitting bypass of up to a minimum of three output frequency bands to avoid equipment resonant frequencies.
- h. An RS 232C/485 communications port.
- i. On-board BACnet or Siemens APOGEE FLN (P1) communication card configured to communicate on the building control system. The proper card to use shall be determined by the Temperature Control Contractor or Owner.

Select the appropriate input follower and show on the drawing.

- j. Input signal follower capabilities to accept 0-5, 4-20, or 10-50 mA or 0-5 or 0-10 VDC or 0-5 or 3-15 PSIG input signals as shown on drawing.

Note information to be shown on the drawing.

- k. Preprogrammed NEMA B motor constants to provide for optimum motor performance.
- l. Microprocessor based functions and control.
- m. Independently adjusted acceleration time and deceleration time.
- n. Adjustable DC braking.
- o. Multi-function fault indication which will display up to four faults in sequence of occurrence.
- p. Run and jog speed adjustments, min/max speed adjustments, and reversing all settable by keypad or preset.
- q. Ground fault protection to prevent power semiconductor damage.

- r. Auto restart upon fault. Capability of turning auto restart off.
- 11. Drive shall be of modular construction. Provide complete operating manuals including installation and programming instructions and options, and complete schematics of all components for trouble-shooting, maintenance, and repair.
- 12. Drive shall be able to supply a standard high efficiency NEMA Design B, T frame induction motor.
- 13. Provide a plastic envelope, sized to hold an 8.5" X 11" sheet of paper, with an adhesive back and attach to the side of the variable frequency drive. Insert in the envelope the drive settings typewritten on an 8.5" X 11" sheet of paper.
- 14. When the drive is located adjacent to the equipment being controlled, a disconnect switch shall be included in the enclosure to serve as the motor disconnect switch. Disconnect shall be capable of being locked in the off position.
- 15. Variable frequency drive manufacturer shall provide a five year warranty to Michigan State University. The warranty period shall start at system start-up.

In general the following paragraph shall not be used. When a critical application requires a manual bypass, it shall be noted in the specification or on the drawings.

- 16. When specified and/or shown on drawings, drive shall have manual bypass on critical applications only which includes input drive isolation contactor, output contactor electrically and mechanically interlocked with a bypass contactor, a run relay, control logic, motor overcurrent relay, and an Inverter-Off-Bypass selector switch, all in the same enclosure.

Note information to be shown on the drawing.

- B. Variable frequency drive size, voltage, input control requirements, and enclosure requirements shall be as noted on the drawings.
- C. Variable frequency drive signal wire shall be shielded and shall not be bundled with any power wiring.
- D. Variable frequency drive line and load conductors shall be in their own respective conduit per drive, and control wiring shall be in its own conduit.
- E. Motor branch circuit wiring shall not share the same conduit with any other motor branch circuits.

PART 3 - EXECUTION

3.1 EQUIPMENT SUPPORTS

- A. Electrical equipment shall be mounted on ½" spacers when mounted in a room on a below grade exterior wall.

END OF SECTION 262923