

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. This sections is a Division 26 Basic Electrical Materials and Methods section and is part of each Division 26 section making reference to electrical connections for equipment specified herein.

1.02 SCOPE OF WORK

- A. Motor starters and controllers which are not an integral part of equipment provided by Other Trades shall be provided as part of the electrical work.
- B. The work shall include, but not be limited to, the following:
 - 1. Combination circuit breaker/fused disconnect/magnetic motor starters for equipment requiring manual and automatic control.
 - 2. Manual motor starters shall be provided for equipment requiring manual control only.
 - 3. Provide variable frequency drives for all motors shown on the drawings as variable speed.

1.03 SUBMITTALS

- A. Submit shop drawings of all starters and variable frequency drives. Submittals shall include dimensioned drawings, wiring diagrams, and catalog cuts as necessary to document all features and accessories necessary for conformance to this specification.
- B. Furnish copies of approved variable frequency drives wiring diagrams to the Automatic Temperature Control contractor for coordination.

PART 2 - PRODUCTS

2.01 COMBINATION STARTERS

- A. Starters generally shall be full voltage non-reversing units consisting of a fused disconnect, horsepower rated contactor and thermal overload relay mounted in a NEMA TYPE I common enclosure.
- B. Starter units shall be furnished with external operating handle, control circuit transformer (120V. Secondary), pilot light, thermal overloads and, unless otherwise indicated, a Hand-Off-Automatic Selector Switch. Auxiliary contacts shall be provided as required.
- C. Combination starters shall be Allen Bradley Bulletin 512, or approved equal suitable for the voltage and horsepower indicated on the drawings. Starter units shall be minimum NEMA Size "0".

2.02 MANUAL MOTOR STARTERS

- A. Manual starting switches generally shall be full voltage non-reversing units consisting of a motor rated toggle switch and thermal overload relay mounted in a common enclosure.
- B. Starter units shall be furnished with a Neon pilot light. Units in mechanical areas or otherwise unfinished areas shall have a NEMA TYPE I surface mounted enclosure. Units in finished areas shall be mounted in a recessed box with flush cover plate.
- C. Manual motor starters shall be Allen Bradley Bulletin 600 or approved equal suitable for fractional horsepower motors at 120 Volts, 60 Hertz.

2.03 VARIABLE FREQUENCY DRIVE (VFD)

- A. The variable frequency drive shall convert three-phase, 60 Hz utility power to adjustable voltage and frequency, three-phase, AC power for stepless motor speed control from 10% to 100% of the motor's 60 Hz speed. Input voltage shall be as specified on the drawing schedules.
- B. The VFD shall include a rectifier and an inverter section. The rectifier section shall rectify fixed frequency and voltage AC utility power to a DC voltage.
- C. The inverter section of the VFD shall invert the DC voltage into a pulse width modulated wave form, adjustable voltage and frequency output for stepless motor speed control.
- D. The VFD and options shall be tested to ANSI/UL Standard 508 and listed by a nationally recognized testing agency such as UL or ETL.
- E. The VFD and options shall comply with the applicable requirements of the latest standards of ANSI, IEEE, and the National Electrical Code.
- F. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1992, Guide for Harmonic Control and Reactive Compensation of Static Power Converters.
- G. The VFD shall not emit either conducted or radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15, Subpart J.
- H. The VFD shall include the following basic features:
 - 1. The VFD shall be housed in a NEMA 1 enclosure.
 - 2. The following operator controls shall be located on the front of the enclosure:
 - a. Hand/Off/Auto selector switch to start and stop the motor. In the auto position, the drive will start/stop from a remote contact closure.

- b. Auto/Manual selector switch. In the auto position, motor speed is determined by the proportional signal provided by the ATC Contractor. In the manual position, motor speed is determined by the manual speed potentiometer or keypad.
 - c. Manual speed potentiometer or keypad.
 - d. Power on pilot light to indicate that the VFD is being supplied by the power line.
 - e. Fault pilot light to indicate that the VFD has tripped on a fault condition.
 - f. Digital meter to indicate speed in rpm.
- 3. A set of form C, dry contacts to indicate when the VFD is in the run mode.
 - 4. A set of form C, dry contacts to indicate when the VFD is in the fault mode.
 - 5. A set of form C, dry contacts to indicate when the VFD is in hand mode.
 - 6. When input power returns to normal following a fault trip for under-voltage, over-voltage, or phase loss, the VFD shall automatically restart. The VFD shall not automatically restart following fault trips due to overload or overcurrent.
 - 7. The VFD shall include a door interlocked, padlockable, input power circuit breaker.
- I. The VFD shall include the following protective features:
- 1. Protection against input transient voltage spikes.
 - 2. Separate overload protection for each motor controlled.
 - 3. Protection against input power under-voltage, over-voltage, and phase loss.
 - 4. Protection against output current overload and overcurrent.
 - 5. Protection against over temperature within the VFD enclosure.
 - 6. Protection against over-voltage on the DC bus.
 - 7. The VFD shall be capable of being started into a rotating motor.
 - 8. DC bus discharge circuit for protection of service personnel.
 - 9. Insensitive to incoming power phase sequence.
 - 10. Resonant frequency avoidance.

- J. The VFD shall include the following adjustments inside the enclosure:
1. Maximum speed, adjustable 50-100% base speed.
 2. Minimum speed, adjustable 10-50% base speed.
 3. Acceleration time, adjustable 3 to 60 seconds.
 4. Deceleration time, adjustable 3 to 60 seconds with override circuit to prevent nuisance trips if deceleration time is set too short.
 5. Current limit, adjustable 0-100%.
- K. The VFD shall be designed to operate within the following service conditions:
1. Ambient temperature, 0 to 40°C (32 to 104°F).
 2. 0 to 95% relative humidity, non-condensing.
 3. Elevation to 1,000 meters (3,300 feet) without derating.
 4. AC line voltage variation, -15% to +10% of nominal.
- L. The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.
- M. VFDs shall be Yaskawa model E7, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. The contractor shall coordinate with Other Trades to determine the quantity and size of motor starters required in accordance with approved shop drawings. Motor thermal overload units shall be provided in accordance with the actual motor nameplate.
- B. Group mounted motor starters and controllers shall be mounted in a neat arrangement on a Unistrut frame.
- C. Tighten all connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values or to those specified in U.L. Standard 486A.

3.02 VFD INSTALLATION

- A. To ensure quality and minimize failures at the job site, the VFD shall be burned in by the manufacturer. The VFD shall operate a dynamometer at full load and the load and speed shall be cycled during the test. All optional and special features shall be functionally tested at the factory for proper operation.
- B. The manufacturer shall provide a factory trained service technician for startup. The service technician shall verify correct installation, start up the drive, and check for proper operation. Coordinate startup with ATC Contractor. VFD shall be tested for proper operation under ATC control. Test all safeties in both the controller mode and bypass mode. Demonstrate at startup that the drive will return to normal automatic operation after any external fault condition has returned to normal.
- C. Do not run VFD input and output wiring in the same raceway or wireway. Do not run output wiring of multiple VFDs in the same raceway or wireway. Keep all control wiring in raceways separate from VFD input and output wiring.

END OF SECTION 262913