

SECTION 15765
VARIABLE FREQUENCY DRIVE UNITS

PART 1 GENERAL

1.1 RELATED WORK

- A. Specified Elsewhere:
- B. Drawings and general provisions of Contract, including, but not limited to, General, Special and Supplementary Conditions and other Division-1 Specification Sections, apply to the work of this Section.
 - 1. Division 15 - applicable sections
 - 2. Division 16 – Section 16650 and applicable sections

1.2 In accordance with Division One.

- A. Shop Drawing: All motor starters and enclosures.
- B. Product Data: All components.

1.3 Warranty: Provide 3-year coverage on parts.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers:

- A. Magnetek
- B. ABB
- C. Toshiba
- D. DanFoss
- E. Siemens
- F. Cutler Hammer
- G. Square-D
- H. Trane (DanFoss)
- I. Engineer and Owner approved equal: refer to Section 01600.

2.2 MATERIALS

- A. Adjustable frequency drive unit shall be complete UL listed assembly as specified herein and shall be rated for continuous duty at maximum service factor and full load horsepower as indicated on the drawings. All adjustable frequency drives supplied shall be of the same manufacturer and model.
- B. Unit shall operate in condition of 0% to 95% non-condensing humidity and 0° to 40°C ambient temperatures.
- C. The adjustable frequency drive shall be housed in a NEMA 1 enclosure finished with the manufacturer's standard paint system. All power and control electronics shall be of modular construction for ease of maintenance and replacement.
- D. Power input to the unit shall be as 480 VAC ($\pm 10\%$), 3-phase. Unit shall be provided with integral high-interrupting (65,000 ACC) minimum circuit breaker disconnects sized in accordance with line current input to the drive. Door interlock shall disconnect the unit from line

power upon opening. Line reactors shall be provided to minimize line interference, voltage transients, and short circuit currents. Efficiency of the unit shall be 95% minimum at rated load and speed. Unit power factor shall not be less than 95% lagging throughout the speed range.

- E. The inverter unit shall be provided with manual by-pass control, allowing the motor to continue to operate at nominal speed when VF drive components are removed for service. The inverter shall utilize the two-step (AC to DC, DC to AC) pulse width modulated type with capacitor bank filtered output or voltage vector control (VVC) technology. The RFI/EMI filters shall be factory installed Class A devices per FCC Regulations, Part 15, Subpart J. Surge arrestors with capabilities to reduce RFI are not acceptable. Power electronics components shall not be paralleled and shall be rated to withstand maximum short circuit conditions without damage. Unit shall be capable of catching a motor spinning in the forward or reverse direction upon starting. A separate grounding connection for the inverter output shall be provided. Unit output shall include full voltage, non-reversing NEMA rated output motor starter to provide a positive disconnection means, inverter power disconnect and NEMA rated full voltage non-reversing bypass starter mechanically and electrically interlocked to allow connection to the line voltage source and its safety ground in event of inverter failure. Bypass contactor shall be isolated from inverter output by mechanical and electrical interlocking. Inverter output shall be constant volts per Hertz as follows:

Volts	0 to 460 VAC, 3-phase, 3 wire plus ground
Frequency	4 to 120 Hertz + or - 2 Hertz
Service Factor	1.15
Overload	110% for 1-minute

Unit fault conditions shall de-energize output and require manual reset by an operator. Output shall be protected against faults with front panel indication provided for each of the following conditions:

- DC bus under/over voltage
- Short circuit
- Overload
- Phase Loss
- Over/Under frequency
- Over temperature

- F. Unit shall include a microprocessor based control system with non-volatile memory. Control power shall be electrically isolated from the power electronics using a dedicated step-down control power transformer, power supplies, and filters. All electrical interfaces between the unit and other control equipment shall be made on dedicated and labeled terminal blocks. All manual operation interfaces and indications shall be front panel mounted. Provide the following readily accessible interface inputs and outputs:

- INVERTOR ON-OFF-INVERTOR BYPASS selector switch
- MANUAL/AUTO selector switch
- RUN/STOP Pushbuttons (Manual Mode)
- RESET Pushbuttons
- Local speed adjustment potentiometer (Manual Mode)
- Remote RUN-STOP input (dry contact closure)
- 0 to 10 VDC remote speed reference
- External Trip (dry contactor closure)
- RUN/STOP/BYPASS pilot lights
- Output speed (0 to 10 VDC)
- Output current (0 to 10 VDC)
- Run Output Contact (Dry Form C)

Fault Output Contact (Dry Form C)

Provide the following readily accessible user adjustments:

- Minimum frequency
- Maximum frequency
- Speed default upon loss of speed reference signal
- Acceleration time
- Deceleration time
- Overload current
- Speed input reference signal bias
- Speed input reference signal gain
- Minimum speed dwell time (0 to 18 seconds)
- Motor noise reduction via carrier frequency or
- Volts per Hertz linear/reduced

- G. The following communication features shall be provided to interface with the existing Energy Management System:
 - 1. Serial communications interface hardware. A serial communications interface board that provides RS 232C or RS 422 communications capability to computers or programmable controllers shall be provided. It shall be able to access all drive set up parameters and all diagnostic information with the proper software program.
 - 2. Serial communications interface software. A software program for setting up all drive operating parameters and accessing all diagnostic information shall be provided for interface to IBM or compatible computers.
- H. Units shall be factory pre-tested prior to shipment including operation at full load and speed for 24 hours.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Unit shall be mounted in accordance with manufacturers recommendation in locations shown on the drawings, plumb and level.
- B. Adjustable frequency drive shall be energized and tested by original equipment manufacturer's certified and qualified technician. This service shall be included in the base bid cost. Testing shall be documented on test forms and witnessed by the Owner's Representative. Test adjustable frequency drive in accordance with manufacturer's requirements and include the following operational tests:
 - Verify proper operation and indications for manual operation including run/stop and full range manual speed control.
 - Verify bypass across the line operation and indications including manual and automatic run/stop operation.
 - Verify automatic operations and indications including run/stop and full range speed control.
 - De-energize unit and verify non-volatile memory and reset.Final acceptance shall depend upon the satisfactory performance of the motor-control centers and adjustable frequency drive under test. No motor-control center shall be energized until the Owner's Representative has approved recorded test data.

END OF SECTION