

Specification for Purchase of VFDs

GENERAL

1.1. SCOPE:

- 1.1.1. This specification gives the technical requirements for the purchase of quantity (3) 15 Horsepower Variable Frequency Drive (VFD) packages.

1.2. REFERENCES

- 1.2.1. NEMA 250
- 1.2.2. EN 50178 (LVD)
- 1.2.3. EN 61800-3, EN 61000-4-2(-3,-4,-5-6)/A2, EN 61000-2-1, EN 60146-1-1/A1
- 1.2.4. IEEE 519
- 1.2.5. UL 508C (Power Conversion)

1.3. SUBMITTALS

- 1.3.1. Shop drawings shall include: Wiring diagrams, electrical schematics, front and side views of enclosures, overall dimensions, conduit entrance locations and requirements, nameplate legends, physical layout and enclosure details. Shop drawings shall be provided to the government for review and approval prior to final assembly. The government shall have 10 working days to review and provide comment or approval.
- 1.3.2. Product Data: Provide data sheets showing; voltage, short circuit rating, and weights.
- 1.3.3. Manufacturer's Installation Instructions and Technical Manuals: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Adjustable Frequency Drive. Document the sequence of operation, cautions and warnings, troubleshooting procedures, spare parts lists and guidance.

1.4. QUALIFICATIONS

- 1.4.1. The packaged VFD must be listed with one the following organizations:
 - 1.4.1.1. UL
 - 1.4.1.2. cUL
 - 1.4.1.3. CSA
- 1.4.2. CE certification is not acceptable unless also listed with one of the above organizations.

Specification for Purchase of VFDs

2. **APPLICATION DESCRIPTION**

- 2.1. The VFD packages will be installed on existing 15 horsepower blowers.
- 2.2. The VFD package will be manually operated using either the local start and stop pushbuttons on the front of the enclosure, or the remote start and stop pushbuttons mounted in a pushbutton enclosure near the point of localized ventilation. The remote control enclosure will also provide indication that the blower is running. See figure 1 for a representation of the VFD package setup.
- 2.3. The VFD package incoming power will be run in close proximity to cables for various power circuits and will need incoming power line filters to mitigate Electro Magnetic Interference (EMI).

3. **PRODUCTS**

3.1. **RATINGS:**

- 3.1.1. Input 460 VAC +/- 10%, 3 phase, 48-63 Hz
- 3.1.2. Output Frequency 0 to 60 Hz
- 3.1.3. Environmental operating conditions: 0 to 40C, less than 95% humidity, non-condensing.
- 3.1.4. Enclosure shall be UL Type 3R.
- 3.1.5. Must meet Radio Frequency Interference (RFI) requirements as specified by IEC STD EN 61000-2(-4)(2001) for variable frequency drives.

3.2. **DESIGN**

- 3.2.1. The VFDs must be solid state, utilizing Space Vector Pulse Width Modulated (PWM) control. The VFD package as specified herein shall be enclosed in a UL Type 3R enclosure, completely assembled and tested by the manufacturer.
- 3.2.2. The VFD's must have adjustable carrier frequency and up to 4 programmable Volts/Hertz (V/Hz) points.
- 3.2.3. The VFDs shall be capable of operating in a V/Hz mode.
- 3.2.4. The VFDs shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
- 3.2.5. The VFD shall be capable of both Automatic and Manual Torque Boost function to overcome sudden fluctuation of the load.
- 3.2.6. The VFD shall be capable of starting into a rotating load and accelerate or decelerate to set-point without safety tripping or component damage (flying start). The VFD shall also be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.

Specification for Purchase of VFDs

- 3.2.7. The VFD shall be equipped with an automatic extended power loss ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Minimum power loss ride-through shall be one-cycle, based on full load and no inertia. Typical control power loss ride-through for a fan load shall be 2 seconds minimum.
- 3.2.8. The drive shall employ current limit circuits to provide "trip-less" operation
- 3.2.9. The Maximum current limit shall be fixed at 150% (minimum, instantaneous) of the VFD normal duty current rating.
- 3.2.10. The overload rating of the drive shall be 120% of Rated Current for 1 Min., 150% of Rated Current for 0.5 sec.
- 3.2.11. The VFD shall provide an adjustable Acceleration and Deceleration time setting.
- 3.2.12. The VFD shall be optimized for various levels of carrier frequency programmable from 1 to 15 kHz to reduce motor noise and to provide high system efficiency.
- 3.2.13. All VFD include the following programming adjustment capabilities:
 - 3.2.1.1. Directional Lock selection to prevent the unexpected motor direction.
 - 3.2.1.2. Three programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
 - 3.2.1.3. Fault Histories with detailed description of frequency, current, and other operational status at the time of each fault.
- 3.2.14. The VFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop and announce the fault condition.
 - 3.2.1.1. IGBT overcurrent protection
 - 3.2.1.2. Overcurrent trip on load output
 - 3.2.1.3. DC overvoltage
 - 3.2.1.4. Internal over temperature
 - 3.2.1.5. Ground Fault
 - 3.2.1.6. Low Voltage
 - 3.2.1.7. Open output phase
 - 3.2.1.8. Electronic Thermal Protection. The Electronic Thermal Overload protection shall protect the motor based on speed, load curve, and motor parameters.

Specification for Purchase of VFDs

3.3. PRODUCT OPTIONS

- 3.3.1. The VFD package shall be provided with the following options pre-installed by the contractor.
 - 3.3.1.1. Three switch Manual Bypass. VFD and bypass components shall be mounted inside a common NEMA 3R enclosure, fully pre-wired, and ready for installation as a single UL listed device.
 - 3.3.1.2. Output, and bypass contactors, to switch power from the VFD to bypass.
 - 3.3.1.3. Control and safety circuit terminal strip.
 - 3.3.1.4. Drive/Off/Bypass selector switch and Hand/Off/Auto selector switch.
 - 3.3.1.5. Pilot lights (LED) for, "Drive Run" and "Bypass".
 - 3.3.1.6. Hand/Off/Auto selector switch shall provide the following operation:
 - 3.3.1.6.1. Hand Position - The drive is given a start command, and the drive will run at preset speed- user adjustable.
 - 3.3.1.6.2. Off Position - The start command is removed, all speed inputs are ignored, and power is still applied to the drive. If in bypass mode, the motor is stopped.
 - 3.3.1.6.3. Auto Position - The drive is enabled to receive a start command and speed input from a building automation system. If in bypass mode, the motor start/stop is controlled by the building automation system
 - 3.3.1.7. Annunciation contacts for drive run, drive fault, bypass run, and motor OL/safety fault.
 - 3.3.1.8. VFD operator/keypad selection, LCD multi-line display.
 - 3.3.1.8.1. The VFD operator/Keypad and LCD display shall be mounted on the front face of the VFD package enclosure to allow viewing of parameters/fault history without the need to open the enclosure.
 - 3.3.1.9. Start and Stop pushbutton switches.
 - 3.3.1.9.1. Terminal screws shall be provided for connection of Government provided remote start and stop pushbuttons and a blower running indicator light, such that pushing the remote start will start the blower in VFD or bypass mode, pushing the remote stop will stop the blower in the VFD or bypass mode, and the indicator light will illuminate if the VFD or the bypass is running.
 - 3.3.1.10. RFI filters to further attenuate possible VFD generated noise shall be provided.
 - 3.3.1.11. Line reactors shall be provided on the input side of the drive for harmonic suppression and input rectifier protection.
 - 3.3.1.12. Surge suppression shall be provided to protect the drive from input power disturbances.

4. PRODUCT SUPPORT

- 4.1. Factory trained application engineering and service personnel that are thoroughly familiar with the drive products shall be available for installation and maintenance/troubleshooting support.

Specification for Purchase of VFDs

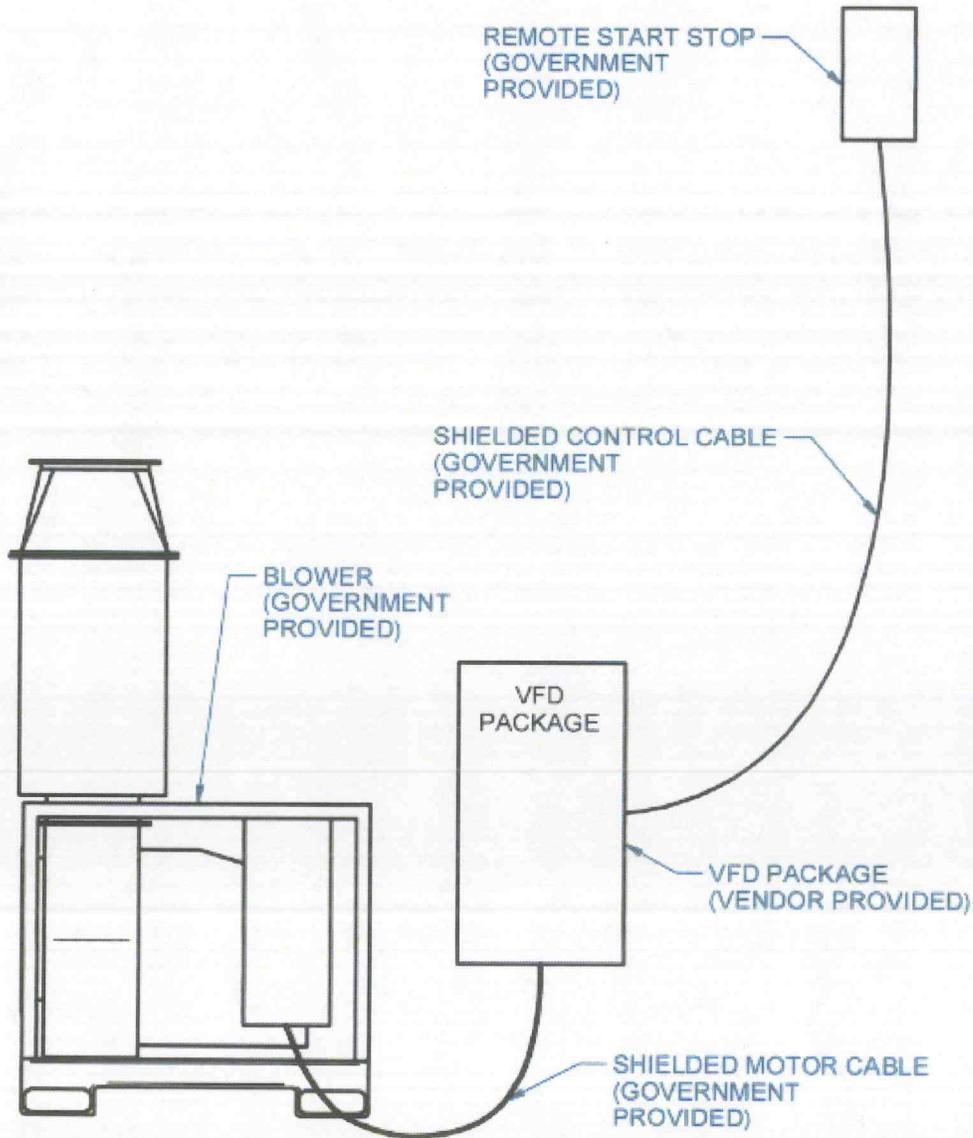


FIGURE 1
REPRESENTATIVE BLOWER AND VFD PACKAGE ARRANGEMENT