Honeywell

Variable Frequency Drives

GUIDE SPECIFICATION

GENERAL

Work Included

Furnish and install all components, devices and wiring for variable frequency drive (VFD) control of fans and/or pumps as indicated on the drawings, and as described in this document.

- The VFD shall generate the required variable frequency through three main input voltage lines connected to a coil capacitor LC filter and diode bridge. This shall produce a DC voltage for an insulated gate bi-polar transistor (IGBT) bridge. The IGBT bridge shall produce a pulse-width modulated (PWM) AC voltage for the motor. A microprocessor shall control the motor according to measured signals and control commands set from the VFD control panel. Control commands may be provided by stand-alone sensor input or by output from a DDC building management system.
- The VFD shall have seven programmable applications that can be modified using a personal computer-based commissioning tool with an optional software package, or a field removable control panel with either an alphanumeric or graphic LCD interface. The graphic LCD must transfer custom program configurations via upload/download to several VFD units. The operating keypad shall be removable from the VFD for separate mounting, minimum 45 feet away from the drive. The VFD shall log and display as a minimum, without adding separate instruments or other equipment:
  - temperature of the heatsink
  - temperature of the motor
  - output frequency
  - status of the analog/digital I/Os
  - motor speed in rpm
  - total kWh consumed
  - total kWh trip counter
  - total hours run counter
  - total hours run trip counter
- The VFD shall be UL, cUL, and CE approved.
- The VFD shall be provided with built-in RFI filters and all models with 3 HP or more shall include an AC choke.
- The VFD shall have the capability of communicating with DDC building management systems by way of a two-wire Echelon (free topology transceiver) communication network to allow data exchange between each VFD and the system interface (PC workstation) at a minimum rate per second of 76.8K baud.

Associated Work

The mechanical contractor shall coordinate the installation of devices detailed in this section with the installing contractor by trade jurisdiction:

- Plumbing/Heating Contractor: Install pump-related union fittings, pressure taps, shutoff cocks, flow switches, flow meters, and immersion wells.
- Controls (DDC) Contractor: Provide all sensors and/or other input signals as required for control of the VFD (unless single, stand-alone sensor input is utilized).
- Electrical Contractor: Install electrical power to all VFD locations as indicated in the plans.

Quality Assurance

- Manufacturer: Subject to compliance with these specifications, provide VFD from only one of the following approved source:
  - Honeywell International Inc.
- The system components shall be listed by UL, cUL, and CE.
- All VFD and components in the system shall be installed according to manufacturer recommendations and according to general installation standards for VFD units.
- The VFD shall be fully tested at the factory including burn-in and motor loading. Certificates of these tests shall accompany every VFD when delivered.

PRODUCTS

Technical Data

Integral power supply shall be one of the following as required by each motor:

- 200-240 Vac, 3 phase, 45-66 Hz, ±10%.
- 380-500 Vac, 3 phase, 45-66 Hz, ±10%.
- 525-690 Vac, 3 phase, 45-66 Hz, ±10%.

The ambient ratings and temperature ranges shall be:

- Operating: 14°F to 104°F (-10°C to 40°C).
- Storage: -40°F to 140°F (-40°C to 60°C).
- Humidity range: 5 to 95% RH (non-condensing).

The VFD shall accept 0-10 Vdc, 4-20 mA, or potentiometer inputs as a control signal. Along with six programmable digital inputs.

The VFD shall include a minimum of two programmable output relays, to provide signals such as run, ready, trip or any other selected information, and one programmable analog output, 4-20 mA or 0-20 mA and one programmable digital output, to provide signals such as motor speed, output frequency or any other selected information.

The VFD shall have sufficient capacity and provide a quality waveform so as to achieve full output power of the motor without causing additional heat rise. The operating conditions shall include:
- Minimum efficiency
  - — at 100% load: > 96%
  - — at 20% load: > 92%
- The VFD enclosure rating shall be at least NEMA 1
- The drive shall comply with following EMC standards:
  - — Immunity: EN50082-1,-2, EN61800-3
  - — Emission: EN50081-1,-2, EN61800-3
- Output frequency range 0 - 320 Hz with 0.01 Hz resolution.
- It shall be possible to set the switching frequency within the range from 3 kHz to 16 kHz to minimize audible motor noise.
- Connection of oversized motors within the current rating of the VFD shall be allowed.
- A minimum of 8 preset speeds shall be available.
- The VFD shall provide 3 skip frequencies with lower and upper frequency separately selectable to avoid mechanical resonance.

The VFD shall be suitable for any NEMA or IEC standard design motor and shall not require derating the motor.

The VFD shall not require any test runs and all parameters shall be possible to set with no motor connected.

The maximum motor cable length shall be at least 600 feet without any output chokes, filters or similar equipment.

All I/O expansion and communication cards to be installed inside the drive housing.

The VFD shall offer the following accessories and options:
- Inverter bypass with overload protection.
- Modbus Connection Board.
- LONWORKS® Connection Board.
- I/O Option Cards.

VFD Design Requirements

The VFD shall include a built-in AC-choke to protect the drive from voltage spikes or other similar disturbances in the supply network. The inductance of this choke shall be enough to reduce the harmonic current disturbances, caused by the drive, to less than 45% THD. The offer must include a list of the current THD for all quoted drives. External or separately supplied chokes will not be accepted.

The VFD shall be capable of controlling a set of parallel connection of motors, of mixed ratings, and allow disconnection of any number of running motors without causing tripping or decreased performance in any way.

The VFD shall be capable of automatic reconnection to a spinning fan, forward or reverse running, without tripping, following a mains interrupt or a transfer from bypass running. Automatic restart functions are required after a tripping situation.

The VFD shall protect itself against:
- input transients to VDE0160 class W2
- loss of input phase
- loss of motor phase
- grounding of any output phase
- loss of speed reference.

The VFD shall model the motor temperature in its software to predict motor temperature and prevent motor overheating without the use of thermistor in the motor. When overheating of the motor is predicted an alarm or automatic shutdown shall be initiated.

The VFD shall provide full electrical isolation between power and control components, including input/output signals.

The VFD shall include a Proportional+Integral+Derivitive (PID) controller as standard to provide closed loop control directly from a signal transmitter without the need for external signal conditioning.

The VFD shall have, as standard, selectable applications ranging from the simplest with a minimum of parameters, to a pump and fan control application for automatic operation of several pumps and fans without extra equipment. This application shall also include an automatic change of the lead pump.

NOTE: All applications shall have a minimum of parameters to be set and only those necessary for the specific application must be accessible.

The operating panel of the VFD shall show, as a minimum, motor speed, motor temperature, heatsink temperature and motor current in curve form. Display must be LCD type.

The VFD shall not be damaged if it is energized with a start signal without a connected motor. The drive shall be ready to start the motor within one second after power on to the drive.

The VFD shall, as standard, have the following protection functions:
- Heat sink overtemperature
- Undervoltage protection
- Overvoltage protection
- Overcurrent protection
- Earth fault protection
- VFD fault protection
- Loss of input/output phase protection
- Motor stalled protection
- Motor underload protection
- Motor overtemperature protection
- Short circuit protection
- External fault injection

The design technology and operation technique shall be common throughout the drives installed in the project. The drive shall be factory pre-commissioned and require minimum site settings.

The VFD shall be of a modular type. Separate modules for the control section, power section, and the fan. Each section shall be easily removed and replaced, if necessary.

The entire power section must be in a steel enclosure. No other enclosures are acceptable.

The control unit section shall be powered by the power section or an external 24 Vdc supply. The use of the 24 Vdc power supply allows access to the stored data and other parameters to allow for: commissioning, field bus applications, and checkout prior to connecting the main supply.

Control Panel Display

The integral LCD control panel shall display at least five run status indicators, including:

- Run
- Ready
- Fault
- Motor Direction
- Stop

The control panel shall contain at least nine push buttons for VFD programming and monitoring.

The control panel shall have EEPROM to retain all parameters and settings even when powered down.

The control panel shall allow up to three monitoring values to be viewed simultaneously.

The display shall allow the user to lock out parameters by the choice of a password or parameter selection.

The display shall allow the user to view monitoring values, parameters, faults in: English, Spanish, French, or Portuguese.

The control panel shall show, on a fault condition, the type of fault (in English text) and the following information at the time of fault:

- Operation days
- Operation hours
- Output frequency
- Motor current
- Motor voltage
- Motor power
- Motor torque
- DC voltage
- Unit temperature
- Run status

The control panel shall be detachable and isolated from the input line potential. Use of an optional 9-pin-to-9-pin (male-female) RS232 cable shall allow remote mounting, laptop PC connection, or use of the LCD control panel.

The control panel shall have menu navigation to facilitate the display of measurement and control signals, parameter settings, reference values, fault displays (including history), contrast, and programmable buttons.

The VFD shall be configurable to be commanded from the panel, from another network device, or the I/O terminals. The mode selection shall be performed on the panel or from PC software interface.

EXECUTION

Installation

Install in accordance with manufacturer's printed instructions. Coordinate with motors furnished with equipment and with applicable controls.

Locate controllers within sight of motors controlled, unless otherwise indicated.

Validation

A representative shall demonstrate to the Owner's representative and mechanical contractor the proper functioning of the VFD, and provide fundamental operating instruction.

Sequence of Operation and Data Point Requirements

[to be filled in by consulting engineer]

Submittals

Provide 10 copies of submittal data within 10 days of contract award.

The submittal shall consist of:
— Specification sheet.
— Equipment lists of all proposed ancillary devices and equipment.
— Pocket guide.

Manuals

The following manuals shall be provided for *each* type of VFD:
— An Operators Manual shall be provided with explanations of use for all operator functions specified under Operator Training. An Application Manual shall be provided with description and definition of all program parameters.

Warranty

All VFD components, parts and assemblies shall be guaranteed against defects in materials and workmanship for 24 months from recorded date of installation or 36 months from date of purchase, whichever comes first.