

## SECTION 26 29 23: VARIABLE SPEED DRIVES

### 1. GENERAL

- A. Harmonic analysis studies will be performed for all large motor loads (over 50 HP) or large quantities of smaller motor loads to verify compliance WITH IEEE Standard 519 or where VFDs are added to existing services with high harmonic content
- B. VFDs using six-pulse conversion technology are typically acceptable for installation in most facilities; use 12 or 18-pulse conversion technology for motor loads over 50 hp where:
  - Sensitive research equipment may be affected by harmonic distortion
  - VFDs will be operated from standby generators
  - Building service size is small in relation to overall VFD loads
- C. Electric service: Isolation transformers or line reactors may be considered on installations where Total Harmonic Distortion (THD) limits cannot be achieved as described above
- D. All control wiring should be shielded wire and installed in separate conduit from power wiring
- E. In applications where the drive will be more than 100 cable feet from the motor, coordinate with the motor manufacturer to ensure that the motor is suitable for the application, or to provide a motor protecting dV/dT filter on the drive output to protect the motor.
- F. Provide one full set of spare fuses in each drive
- G. Design to include defined connection points and to address termination, programming, integration, and start-up responsibilities
- H. Variable torque, variable voltage/frequency type for centrifugal fan and pump applications, suitable for use with both standard and high efficiency 3-phase, squirrel cage, induction motors
- I. Must have the following features and operational requirements:
  - Auto restart after a power line transient (over or under voltage, or power loss) when the power line returns to normal
  - Auto restart after selected drive faults. The number of restart attempts to be adjustable at the drive for zero, one or two
  - "On-the-fly" restart into a coasting load; resynchronization will not require more than 150% current
  - Auto/off/manual switch; manual local speed control; adjustable current limit, adjustable acceleration and deceleration rates; remote start/stop for automatic control. It is not necessary to stop the drive when toggling from remote to local speed control
  - Capable of accepting external, permissive contacts such as a freezestat, static pressure safety, damper end switch and fire alarm shutdown contacts to de-energize the motor whether the drive is in automatic, manual drive, or bypass mode
  - Dedicated "Fireman's override" external contacts for programmable VFD operation to a preset speed setting for smoke purge or emergency reduced power operation
  - Programmable auxiliary output dry contacts (2 N/O, 2 N/C each) to indicate: drive run, bypass run or to control devices such as damper open/close
  - Isolated 4-20mA speed input follower and speed feedback circuits

- EIA-485 and EIA-232 communications ports, for BACNET communications card interface with Building Automation Systems (BAS)
  - 5% Input line reactors for harmonic suppression
- B. VFDs to be provided with 3-contactor type bypass or 2-contactor type bypass with internal VFD isolation switch configured as follows:
- Controls to be configured to allow system operation in bypass mode without damage to equipment, pipes, ductwork, etc.
  - Indicating lights to be provided for all functions
  - Allow for servicing and operational testing of the drive while operating on bypass.
  - Bypasses to include short circuit protection and separate electronic-type motor overload devices
- C. VFDs to include the following protective requirements:
- Input circuit-breaker type disconnect, pad-lockable type
  - Minimum VFD short circuit protection rating of 65KAIC at both 480 VAC and 208VAC
  - Motor thermal protection with RTD capability over 100 hp
  - Stall protection
  - Drive over temperature
  - Under voltage trip
- D. Provide VFD and bypass within common enclosures, with ratings based on environment:
- Indoor dry environments; NEMA1, ventilated type
  - Indoor dirty or dusty environment: NEMA 12 gasketed, with filters or external heat exchanger
  - Outdoor or wet environments: NEMA 4x
- E. Provide hardcopy of all VFD program settings, wiring diagrams and operating manual within the VFD cabinets
- F. Include copy of all VFD program settings, wiring diagrams and operating manual with project O & M Manual
- G. Manufacturers:
- ABB
  - Toshiba
- H. Warranty:
- Five (5) years from the date of certified start up. Include all parts, labor, travel time and expenses