

SECTION 16483 – “ADJUSTABLE SPEED DRIVES”

- 1.0 Variable Frequency Drives (VFDs) may be employed to vary the flow of water and air. The A/E shall evaluate the specific application of each variable frequency drive and provide life cycle costing to prove its economic viability. VFDs shall be locally mounted near to the motor to limit distance between VFD and motor to less than 75 feet. Distances over 75 feet shall be analyzed for adverse effects on the cable insulation, disconnect switch and the motor insulation. VFDs shall be furnished under Division 15 and installed by Division 16.
- 2.0 The A/E shall consider the following issues when employing VFDs:
- A. When main and standby equipment is to be controlled by variable frequency drives, separate drives shall be provided for redundant equipment. Manual bypass starters for VFDs are generally not required but should be considered on a case by case basis where life safety or risk of extensive losses are an issue.
 - B. Equipment motors shall be matched to the drive so that low speeds can be realized.
 - C. The operational overloads and starting conditions required by the application shall be defined. Typical requirements may be: variable torque = 115 percent for 1 min, constant torque = 150 percent for 1 min. VFD shall employ torque regulation which shall override speed command and lower frequency while maintaining Volts per Hertz control whenever load level surpasses preset limit.
 - D. The method in which control commands for the VFDs will be generated by the process shall be determined, i.e.:
 - 1. Manual Speed Control
 - 2. Analog current loop, 4-20 mA feedback signal to DDC
 - 3. Isolated or nonisolated analog current automatic speed control signal from DDC
 - 4. Process feedback input (pressure, temperature, flow, etc.)
 - E. A dry common trouble alarm shall be provided for input to the BAS.
 - F. VFD unit shall automatically restart and catch a spinning load when return-to-normal conditions occur.
 - G. Provide minimum 3 percent input line reactor for each VFD (up to 200 HP) to limit harmonic feedback into the electrical system. VFDs for motors larger than 200 HP shall be provided with split-phase harmonic cancellation transformers.

- H. What speed range is required and whether the load will be operated beyond base speed range shall be defined. Provide “critical/resonant” frequency avoidance protection and adjustable carrier frequency.
 - I. It shall be determined if all parts of the rotating load are suitable for the range of vibration excitation frequencies.
 - J. It shall be verified that the motor is sized to provide the necessary load torque while operating at reduced speed. The power capability of the motor may be restricted at low speeds. The motor output capability shall be compared with the load requirement. An additional cooling fan may be required for constant torque loads.
 - K. How the VFD operates under fault conditions shall be defined; for example, a mechanical overload, an electrical short circuit in the motor circuit, or a ground fault in the load system.
 - L. The motor protection provided by the VFD equipment and any additional protection required for comprehensive system protection, e.g., overload, overspeed, reverse rotation, short circuit, transient voltage surge protection, etc. shall be defined.
 - M. The manufacturer shall be required to submit information for system operations and maintenance and provide, warranty, training, and operation and maintenance manuals.
 - N. The following manufacturers are approved for use.
 - Cutler-Hammer (Eaton Corporation) (SV 9000).
 - ABB Industrial Systems (ACH 550).
 - Yaskawa (formerly Magnetek) (GPD 506).
- 3.0 The heat rejection from the VFD controller and how the losses are removed from the equipment shall be defined. Ventilation fans should be considered in units over 50 HP.
- 4.0 The total input power factor (PF) (i.e., real PF and apparent PF) shall be defined.
- 5.0 Enclosure shall be suitable for the application and **shall be minimum NEMA 2 (drip-proof)**.

END OF SECTION