VARIABLE FREQUENCY DRIVES

Scope

For the purposes of these guidelines, the terms variable speed drive and VSD, can, and may be used interchangeably with the terms variable frequency drives and VFD

This electrical guideline, in large part, deals with the installation of VSD. For information dealing with the drives themselves refer to the mechanical guidelines, Section 15960.

Safety disconnect switches are not required at the motor, when the line disconnect of the VSD is lockable, and within sight of the motor. When the VSD line disconnect is not lockable, or is not in line-of-sight, a separate safety disconnect shall be installed at the motor location. All safety disconnect switches shall have pre-break (auxiliary) control contacts, (even if they are not specifically required by the VSD supplier). The wires for this control contact shall be run in the same raceway as the power conductors.

All wiring and grounding shall be in accordance with the associated electrical sections dealing with these requirements.

Harmonic Distortion Considerations

Before adding a VFD, determine the total harmonics generating load on the unit substation transformer. The new harmonic generating load shall not exceed 10 percent of the transformer base rating without approval from the University Utilities Department through the University Project Coordinator. Harmonic generating loads, as defined here, include electronic ballasts, computers and their peripherals, solid state power supplies, UPS systems, VSD drives, etc.

If the total load on the transformer, after the additions of the current project, exceed 75% of its rating; and/or if the total harmonic generating load on a substation will exceeds 50%; the A/E shall prepare a study for review by the University showing that the transformer can safely carry those loads. If the study shows the transformer inadequate, the project shall either increase the transformer size, or add additional transformers. Before adding a VSD, evaluate the possible effects of the VSD on power factor correcting capacitors or harmonic sensitive equipment on the same bus. Avoid installing a VSD on the same bus with capacitors or 'sensitive' equipment. Sensitive equipment, as defined here, are loads adversely affected by harmonic voltage distortions. These include, high sensitivity laboratory equipment, patient monitoring or treatment equipment, computers, etc.

Provide calculations per IEEE Standard 519 showing the current and voltage total harmonic distortion (THD) that will be reflected into the existing University power system, for any load exceeding 10% of the rating of the transformer serving it. Contact the University Utilities Department through the University Project Coordinator for the required power system data. The VSD shall limit the THD to the values noted below when operating at any load from zero to 100 percent.

- VSD input voltage waveform: less than 3 percent THD
- VSD input current waveform: less than 100 percent THD

After startup of the VSD, the mechanical contractor shall provide, and the electrical contractor shall install, at no additional cost to the University any additional reactors or filters required to reduce the actual THD to the calculated THD.

Maintenance Bypasses

All VSD's for motors larger than 5 HP, and/or on systems serving critical loads (as defined in program statement, shall include full maintenance bypass systems. These bypasses shall be configured to allow operation of the motor; 'across the line' mode while the drive is being repaired. Also, the bypass equipment shall be electrically isolated from the VSD drive equipment so that maintenance may be safely done with the motor running 'across the line' in through the bypass.

The electrical system serving a VSD, and the mechanical system being served by the VSD, shall be sized and braced to allow that motor (and associated mechanical system) to start and operate properly and safely when in the bypass mode - across the line. Special attention needs to be given to the affects of the voltage drops during start and the ability of the upstream overcurrent devices to carry the locked rotor current during the startup.