MOTOR CONTROLS

Scope

In general, motors larger than 1/3 horsepower shall be 460 volts or 208 volts, 3 phase. Motors 1/3 horsepower and smaller shall be 115 volts, single phase. Motors 200 horsepower and larger may be rated for medium voltage2,400-volts, 4,160-volts, or 4,800-volts.

When both 480/277-volts and 208/120-volts are available in a given building, connect and run all 3-phase motors at 480/277-volts.

Especially when only 208/120-volts is available in a building, carefully evaluate the degree and frequency of motor-starting voltage-drops, on the other systems in the building. Where the 'flicker limits' noted in utility system (DTE's) rate/rule books (or good engineering practice) would be violated, install 'soft starters', variable frequency drives, or other means for reducing the voltage-drop during motor-starts.

Provide a motor control center (MCC) to control motors clustered in a given area or zone of the building. Provide local (individual) combination motor starters to control one, or a small number, of motors in a given area or zone.

Avoid feeding 3 phase motors from lighting or receptacle panels. Use 'power panels', available in the building, whenever possible.

Design motor feeder circuits to limit the motor starting and running voltage drops to values within the requirements of the NEC.

Motors 50 HP and larger shall be provided with power factor correcting capacitors.

- If a VFD is the motor controller, evaluate whether or not a capacitor should be installed given the distorted waveforms often present with VFD's.

- If only 208/120-volts is available in the building, and all 3-phase motors are therefore 208-volt, evaluate and then address the affects of the non-linear loads connected to the system (computers, UPS systems, etc.)

A duplex work receptacle shall be in close proximity to all motors and motor controllers.

Distribution systems and motor feeders to 'duplex' systems shall be sized to operate both motors simultaneously - even if current plan is only operate one at a time.

Motor Controllers

Provide electrically operated, motor controllers to provide short circuit and motor overload protection, and motor disconnecting means, for all three-phase motors.

Single phase motors may be controlled by manual motor starters.

Starters shall be lockable in the open (preferably in open and closed) positions.

Combination motor starters, with fused switches, are preferred whenever possible (for their visible break).

Variable Frequency Drives, and Reduced Voltage Starters

When variable frequency drives (VFD) are specified (these are normally specified by mechanical engineer), the drive should be supplied with a disconnecting means. If none is supplied (specified), a separate disconnection means shall be provided - at the VFD. If VFD is not in line of sight of motor, or is not lockable in the open position, install a non-fused disconnect switch at the motor. That disconnect shall have 'pre-break' contacts. If the VFD controller needs this pre-break contact, wire this contact to the VFD. These control wires for the pre-break, may be run in the same conduit as the motor feeder.

Provide reduced voltage or soft motor starters when full voltage motor starting may affect voltage sensitive equipment on the same bus.

Disconnecting Means Needed in Line of Sight of Motor

If motor control (starter) disconnecting means is not in line of sight of motor, or is not lockable, provide a lockable, non-fused safety switch at the motor. (This requirement applies to all types of motor control equipment.)

For critical motor loads such as many fume hoods, provide motor single-phasing-protection. Single phasing protection shall be accomplished by the use of a 'single phase detector' on a fused disconnect, or by the use of a molded case circuit breaker.

Control Circuit Requirements

In general, provide 'Hand-Off-Auto' (HOA) control switches for motors 1/2 horsepower and larger (including those controlled by variable speed drives). In the "hand" position, the motor shall run independently of most automatic start/stop controls. Only the safety and modulating controls shall remain active. In the "auto" position, all start/stop controls shall be active. Wherever possible, control circuits shall be wired so that motors automatically restart after a power disruption. Provide time delays to allow large fans and pumps to coast down before restarting after a momentary power disruption, and to prevent all of the large motors from restarting simultaneously.

High temperature detectors (firestats), smoke detectors, low temperature detectors (freezestats), flow switches and all other safety controls shall be energized and operational whenever the equipment they protect is operating.

When required, provide limit switches on dampers to prevent the associated fans from starting until the dampers are fully open.

Duct smoke Detectors

Duct smoke detectors required by code.

- Duct Smoke detector shall be supplied by, installed, and wired by the fire alarm system supplier. This detector shall be compatible with that fire alarm system.

- When fire alarm system is 'intelligent', do not directly control motor from smoke detector. See detail 16720006 noted below.

- Wire those duct smoke detector to the 'Duct Smoke Detector Interface Box' as shown on details 16720008 (for buildings without fire alarm systems, 1672007 (for buildings with 'hard-wired' fire alarm systems), or 16720006 (for buildings with addressable fire alarm systems). These interface boxes allow quicker isolation of equipment failures to either the temperature control system or the fire alarm system. Interface boxes are available from Owner.

- Fire alarm contractor and temperature control contractor will wire to these interface boxes, and test them for proper operation.

- The interface box(es) should be close to the temperature control panels.

Equipment Requirements

Medium voltage motor starters shall be of the vacuum breaker type. Coordinate the selection of medium voltage motor starters with the University Utilities Department through the University Project Coordinator.

Each MCC motor starter or combination motor starter shall consist of a fused disconnect switch or molded case circuit breaker, a magnetic motor starter with 1 overload relay per phase, and a control power transformer. Fuses shall be of the dual element, time delay, rejection type. Fused disconnects are preferred since they provide a 'visible break'.

Provide drip shields for motor control equipment installed in areas with fire protection sprinkler systems.

Installation Requirements

Instruct the Contractor to perform testing in accordance with Section 16950, and to provide the University Project Coordinator with test reports.