Basis of Design

This section applies to the design and installation of motor control centers (MCCs) and motor control equipment.

Design Criteria

Provide MCCs in mechanical rooms and other multi-motor locations. They shall be used in lieu of distribution panels and separate starters in these locations.

MCCs shall be of standard manufacturer design and construction to permit ready installation, removal, or replacement of standard components.

Design Evaluation

The following information is required to evaluate the design:

- **Schematic Design Phase**
  - Description of overall design concept
  - Identification of motors to be supplied from the MCCs
  - Preliminary drawings showing location of equipment

- **Design Development Phase**
  - Preliminary drawings showing location and sizes of the MCCs and motors
  - Preliminary drawings showing feeder routing to the MCCs
  - Draft specifications

- **Construction Documents Phase**
  - Final drawings showing location and sizes of the MCCs and motors
  - Final control wiring diagrams, including terminal strip information if required to accomplish control functions
  - Final MCC elevations
  - Final layout drawings of the MCCs, with the motor and capacitor cubicles shown
  - Complete specifications for MCCs and electric motor starters

Submittals

- Equipment catalog cuts
- Dimensioned installation drawings
Products, Materials, and Equipment

Construction shall be National Electrical Manufacturers Association (NEMA) Class I or Class II, Type B, with unit terminal strips only.

Starter units shall be minimum NEMA Size 1 for uniformity and maximum interchangeability and shall be the circuit breaker combination type.

Provide all motors with proper starting and overload protective devices. Provide overload protections in all three phases for three-phase motors and in all “hot” legs for single-phase motors.

Combination circuit breaker-type starters are preferred over separate components.

Full-voltage starters shall normally be used. Provide AC frequency drives in the case of motors over 60 hp, limited supply power, or unusual load characteristics.

Magnetic motor starters shall have rotary selector switch “Hand-Off – Automatic” (HOA) controls for three-phase and single-phase motors. For motors without automatic control, the automatic position shall be left open.

Motor starter circuits shall provide demarcation terminals to allow others to introduce controls both before and after the HOA switch.

The manual position shall have no automatic controls except overload protection.

Use the automatic position for any automatic control, including freezestats, load shed, smoke control, remote manual control, and process control.

Automatic and manual positions shall have status contacts wired to the starter control terminal strip for smoke-control fans and other critical motors.

Only intermittent, task-oriented motor starters shall have locally mounted “start-stop” push-button control (in addition to the starter HOA). If safety is a concern, local emergency stop buttons shall be provided.

Pushbuttons, selector switches, pilot lights, and so forth shall be heavy-duty, “oil-tight” devices.

Control and pilot light circuits shall operate at 120 volts. Starters (480-volt) shall have internal control transformers; MCCs may utilize a common control transformer if a control circuit fuse or breaker separately protects each unit.

Every control or remote pushbutton shall have an “ON” pilot light.

Provide a red “ON” pilot light and “OFF” pushbutton.

Provide a green “OFF” pilot light and an “ON” pushbutton.
Motors over 20 hp should have time delays on "restart after outage" to minimize inrush on startup and to prevent closing in on a back electromagnetic field (EMF). Provide staggered starting where necessary using adjustable relays.

Provide power factor correction capacitors for motors over 15 hp. Power factor shall be corrected to 97 percent.

Following a power failure, electronic starters shall automatically assume the mode the starter was in before the power failure. Specifications must state that electronic control modules shall provide this function.

Installation, Fabrication, and Construction

Vertical wiring shall be accessible from the front without opening individual control units, with hinged cover and captive screws.

Locate units away from high ambient temperatures and radiant heat sources.