

## SECTION 26 29 13

### ENCLOSED CONTROLLERS

#### PART 1 GENERAL

##### 1.01 SUBMITTALS

- A. Quality Assurance Data: Certified production test reports or mill test reports.
- B. Project Record Documents:
  - 1. Product Data.
  - 2. Shop Drawings:
    - a) Front and side views of motor control center enclosures with overall dimensions.
    - b) Conduit entrance locations and requirements.
    - c) Nameplate legends.
    - d) Size and number of bus bars per phase, neutral, and ground.
    - e) Electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Operation and Maintenance Data:
  - 1. Operating and maintenance procedures.
  - 2. Complete set of manufacturers drawings.
  - 3. Complete documentation of inspections and tests performed, including any logs, curves, and certificates. Documentation shall note any replacement of equipment or components that failed during testing.
  - 4. Spare parts lists.
  - 5. Data sheets updated to reflect field installation conditions.

#### PART 2 PRODUCTS

##### 2.01 ACCEPTABLE MANUFACTURERS

- A. Motor Starters and Motor Control Centers:
  - 1. General Electric.
  - 2. Eaton.
  - 3. Siemens.
  - 4. Allen-Bradley.
  - 5. Square-D.

##### 2.02 MATERIALS

- A. Manual Motor Starters (NEMA 1CS 2):
  - 1. AC general-purpose Class A manually-operated full-voltage controller for induction motors rated in horsepower, with Class 20 overload relay, red pilot light and toggle or push-button operator.
    - a) Number of poles as required.
    - b) Enclosure rating as required, NEMA 3R enclosures shall be used in exterior or wet locations.
    - c) Housing finished in manufacturer's standard enamel.
- B. Magnetic Motor Starters (NEMA 1CS 2):

1. AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
    - a) Coil operating voltage 120V or as required by Controls Contractor.
    - b) Provide factory installed control transformers with UL Class CC primary fuse protection and secondary fuses, in accordance with the latest edition of the National Electrical Code, within the starter enclosure for all voltage systems that do not allow for direct access to 120 volts, including 208 volt, 3 phase, 3 wire systems.
    - c) Electronic overload relay, Square D Motor Logic or similar, Class 20.
    - d) Push-button operators in front cover with operation pilot lights.
    - e) Number of poles as required.
    - f) Housing finished in manufacturer's standard enamel.
    - g) Provide an HOA switch for all motors with automatic operation.
  2. Combination Motor Starter:
    - a) AC general-purpose Class A magnetic controller in the same enclosure with motor circuit protector.
    - b) Motor circuit disconnecting device shall be molded case thermal-magnetic circuit breaker, inverse-time limit characteristics, quick-make, quick-break, trip-free, trip-indicating. Provide external operating handle arranged for locking in "Off" position and mechanical interlock to prevent opening door in "On" position. Provide emergency release for access to live unit.
  3. Auxiliary Contacts:
    - a) Two normally-open and two normally-closed contacts in addition to seal-in contact.
    - b) Provide an alarm contact, electrically separate from the trip contact, for remote annunciation of thermal overload trip condition.
  4. All starters shall be UL-listed and rated in accordance with the requirements of NEMA Standards Publication ICS-2.
- C. Motor Control Center:
1. Class II Type B.
  2. Main overcurrent protection, molded-case circuit breaker, or main lugs as required.
  3. Voltage rating 120/208V or 480V, 1Ø or 3Ø, 60 Hz as required.
  4. Horizontal bussing, silver-plated copper with continuous current rating as required.
  5. Provide with continuous silver-plated copper ground bus for the entire horizontal length of control center. Vertical bussing of silver-plated copper.
  6. Integrated short-circuit rating as required by available fault current.
  7. Enclosure rating as required with manufacturer's standard enamel finish.
  8. Individual compartments shall be plug-in type units with pressure type disconnecting stabs, high-strength copper alloy, silver-plated.
- D. Accessories: Provide the following for all motors (use Square D Motor Logic or similar):
1. Undervoltage protection relay.
  2. Overvoltage protection relay.
  3. Phase monitoring relay (rotation and single phasing).
- E. Power Factor Correction:
1. For all motor installations 5 HP or larger, provide power factor correction to minimum 0.95 power factor at  $\frac{3}{4}$  load and full load.
- F. IEC-style starters are prohibited.

G. Pilot Lights:

1. Pilot lights shall be LED type.
2. Pilot light colors shall be as follows.

<u>MODE</u>	<u>COLOR</u>
Running Red	
On	Red
Auto	Amber
Off	Green
High Speed	White
Low Speed	White

**2.03 REDUCED VOLTAGE MOTOR STARTERS**

A. SCR-Type Starters:

1. Provide reduced voltage starters for all 200 volt, three-phase motors, 25 horsepower and larger and may be SCR-type, solid state starters, with fully adjustable time relays, for all 460 volt, three phase motors 40 horsepower and larger. Derate reduced voltage starters for 5400 feet elevation. Reduced voltage SCR-type starters shall have the following features:
  - a) Current Limit: the current limit feature shall limit the motor current to a preset level at all times during start and run conditions. Current limit shall be adjustable between 150% and 425% of motor full load current (MFLC) via a potentiometer located behind the cover.
  - b) Acceleration Ramp Time: provide a linear voltage ramp during acceleration to provide a smooth, soft start. Acceleration ramp time shall be adjustable between 0.5 and 30 seconds.
  - c) Solid State overload Protection: solid state overload protection with external manual reset shall be included as an integral part of the starter. Trip settings shall be made via DIP switches located behind the cover, eliminating the need for separate thermal unit selectivity. Approximate trip times shall be 75 seconds at 2 times maximum full load current and 15 seconds at 4.25 times maximum full load current per NEMA Class 20 trip characteristics.
  - d) Phase Loss: If one or more phases fail, shutdown shall occur, starting shall be inhibited, and the phase loss LED shall illuminate. Correcting the phase loss condition shall automatically reset the starter.
  - e) Shorted SCR Detection: The shorted SCR circuitry shall be activated when control power and line power are available and the starter is turned off. If one or more shorted SCRs are detected, starting shall be inhibited and the shorted SCR LED shall illuminate. Shorted SCR detection shall be inhibited via a DIP switch setting behind the cover. In this mode, the starter shall be able to be operated, but the shorted SCR LED shall continuously flash on and off.
  - f) Diagnosis: Flush-mounted, red light-emitting diodes (LEDs) shall be provided for monitoring of motor and starter status. The LEDs shall indicate: control power (available), starter on, overload trip, phase loss, and shorted SCR.

B. Autotransformer, Part Winding & Wye-Delta Type Starters:

1. Reduced voltage starters shall be provided for all 200 volt, three phase motors 25 horsepower and larger, and for all 460 volt, three phase motors 40 horsepower and larger with fully adjustable time relays and over-temperature sensing device.

C. Accessories:

1. For all 10 HP motors and larger, provide the following accessories:
  - a) Under voltage protection relay.
  - b) Overvoltage protection relay.
  - c) Ammeter.

- D. Provide engraved lamacoid nameplates, screwed on the door of each control unit for identification of equipment controlled. Do not use abbreviations for equipment.

**2.04 ENCLOSURES**

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
  - 1. Dry and Clean Indoor Locations: Type 1.
  - 2. Outdoor Locations: Type 3R.
  - 3. Kitchen or Wash-Down Areas: Type 4X.
  - 4. Other Wet or Damp Indoor Locations: Type 4.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Provide a neatly-typed label inside each motor starter enclosure identifying motor served, nameplate horsepower, full load amperes, code letter and service factor.
- B. Provide nameplates and identify control wiring as required by Section 26 05 53 Identification for Electrical Systems.
- C. Provide 4"-high full-sized housekeeping pad under motor control centers.
- D. Require tightening of shipping split and termination bolts on busses using calibrated torque wrench to manufacturer's requirements.

**3.02 FIELD QUALITY CONTROL**

- A. Inspection: touch up scratched or marred surfaces to match original finish.
- B. Site Tests: verification that control sequences, time delay and adjustments are as indicated on documents.

**3.03 DEMONSTRATION**

- A. Provide training of DPS personnel in the use, care, and maintenance of the equipment or system covered by this section.

**3.04 SPARE PARTS AND TOOLS**

- A. Provide necessary tools for mainenance, spare control fuses, and fuse puller.

**END OF SECTION 26 29 13**