

## SECTION 26 24 22

### MOTOR STARTERS AND CONTACTORS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Motor starters.
- B. Manual starters.
- C. Magnetic contactors.
- D. Combination starter.
- E. Nameplates.

##### 1.02 RELATED SECTIONS

- A. Electric motors are specified in Section 20 60 13 - Motors for Facility Services.
- B. Motor control centers are specified in Section 26 24 19 - Motor-Control Centers.

##### 1.03 MEASUREMENT AND PAYMENT

- A. General: Motor starters and contactors, as specified herein, will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Electrical Work as indicated in the Bid Schedule of the Bid Form.

##### 1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 2. ASTM D6386 Standard Practice for Preparation of Zinc (Hot Dip Galvanized) coated Iron and Steel Product and Hardware Surfaces for Painting
- B. Federal Specifications (FS):
  - 1. FS TT-C-490 Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings
- C. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA ICS 2 Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC

**1.05 REGULATORY REQUIREMENTS**

- A. Refer to Section 20 70 26 - Common Materials and Methods for Electrical Systems, for requirements

**1.06 SUBMITTALS**

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit Shop Drawings and electrical diagrams.
- C. Product Data: Submit manufacturer's product data of manufactured materials and equipment.
- D. Operational and Maintenance Data: Submit maintenance data and operating instructions in accordance with Section 01 78 23 - Operation and Maintenance Data, including the following requirements:
  - 1. Description of the equipment and its components;
  - 2. Manufacturer's operating and maintenance instructions, parts list, illustrations, and diagram of components;
  - 3. Recommended list of spare parts; and
  - 4. Wiring diagrams.
- E. Test Reports: Submit certified test reports of factory and field tests performed, verifying that performance of equipment meets Specification requirements.

**1.07 DELIVERY, STORAGE AND HANDLING**

- A. Ship each unit securely wrapped, packaged, and labeled for safe handling of shipment and to avoid damage or distortion.
- B. Store motor starters and contactors in secure and dry storage facility.

**PART 2 - PRODUCTS**

**2.01 MOTOR STARTERS**

- A. Provide motor starters meeting requirements of NEMA ICS 2, general purpose Class A, and the following additional requirements:
  - 1. Rating: Continuous current rating suitable for associated motor as indicated. Provide heater sized for motor running protection in accordance with applicable requirements of the California Electrical Code.

2. Type:
    - a. Less than 3/4 hp Motor: Starter operable on 120 V, single phase, 60 Hz supply unless otherwise indicated.
    - b. 3/4 hp and up to 50 hp Motor: Across-the-line magnetic starter operable on 480 V, three-phase, 60 Hz supply.
    - c. Larger than 50 hp motor: Reduced voltage autotransformer or solid-state type starter.
  3. Enclosure:
    - a. Type:
      - 1) For indoor location: NEMA 12.
      - 2) For outdoor location: NEMA 3R.
    - b. Materials: Provide enclosure fabricated from zinc-coated steel sheet conforming to ASTM D6386, zinc coating designation G90, minimum thickness of 14 gage.
    - c. Finish: Provide painted finish for all ferrous and galvanized metal surfaces as follows: ferrous metal surfaces shall be prepared for painting in accordance with FS TT-C-490. Galvanized metal surfaces shall be prepared for painting in accordance with ASTM D2092. After pretreatment, surfaces shall be prime-painted with an approved corrosion-inhibitive metal primer for ferrous or galvanized surfaces, as applicable. Finish coat shall be a heavy-duty, industrial-grade polyurethane enamel in color as selected by the Engineer.
- B. Provide nameplate on each motor starter in accordance with NEMA ICS 2, showing manufacturer's name and brand designation, the referenced standard, type, class, and rating, as applicable.

## **2.02 MANUAL STARTERS**

- A. Provide manual starters for fractional horsepower (hp) loads rated at 120 V ac, single phase. Manual starters shall have quick-make quick-break toggle mechanism, trip-free manual reset thermal overload relay, position indicator showing ON, OFF, and TRIPPED positions, and red indicating light showing the CLOSED position.

## **2.03 MAGNETIC CONTACTORS**

- A. Provide across-the-line magnetic contactors of reversing or non-reversing type as indicated, with the following additional requirements:
  1. Provide NEMA size as indicated, not smaller than size NEMA 1 for 480 V and size NEMA 0 for 120 V ac.
  2. Provide 480 V primary to 120 V secondary control transformer with one fuse in the secondary circuit.

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3. Provide two NO and two NC auxiliary contacts with provision for the future addition of two NO or NC contacts as indicated.
  4. Provide indicating lights on each unit enclosure as indicated.
- B. Provide auxiliary devices meeting the following requirements:
1. Auxiliary devices to be installed at each contactor enclosure shall be standard products of manufacturers. Provide heavy-duty type relay with contact rating of 20 A at 120 V ac and able to operate satisfactorily at a temperature of 120 degrees F. Identify relay characteristics, including inrush current rating, on Shop Drawings.
  2. Terminal blocks used at the contactor shall be mounted in the enclosure. Each terminal block shall be able to accommodate two 14 AWG wires.
  3. Control wiring inside the contactor enclosure shall be a minimum of 16 AWG, stranded, thermoplastic-insulated wire, rated 105 degrees C, with red color for ac. Power cable shall be of the same type and rating, black color, and with capacity compatible with the contactor or breaker rating.
- C. Provide nameplate on each magnetic contactor in accordance with NEMA ICS 2, showing manufacturer's name and brand designation, the referenced standard, type, class, and rating.

### **2.04 COMBINATION STARTER**

- A. Provide combination starter meeting requirements of NEMA ICS 2, rated 480 V, three phase or single phase, 60 Hz, and the following additional requirements:
1. Provide one 480 V, three-pole, motor circuit protector type circuit breaker with current limiter, as indicated, with adjustable trip-point.
  2. Provide externally mounted operating handle with position indicator showing ON, OFF, or TRIPPED condition of the circuit breaker or disconnect switch as applicable. Operating handle shall be interlocked for preventing opening and closing of the door when the circuit breaker or disconnect switch is in the ON position. Provide defeater to bypass the interlock.
  3. Provide indicating lights on each unit enclosure as indicated on approved wiring diagrams.

### **2.05 NAMEPLATES**

- A. Provide motor starters and contactors with nameplates showing function and number of the motor being controlled. Nameplates shall conform to the requirements of Section 20 70 26 - Common Materials and Methods for Electrical Systems

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Install motor starters and contactors as indicated and as recommended by the manufacturer. Motor starters shall be properly anchored and the installation shall provide for anchors and restraints for seismic loading in accordance with applicable requirements of the California Building Code and California Electrical Code.
- B. Install conduit in accordance with Section 20 50 13 - Raceways for Facility Services.
- C. Connect power cables and control wires as indicated, in accordance with Section 26 05 24 - Low Voltage Wires and Cables, and Section 20 70 26 -Common Materials and Methods for Electrical Systems.
- D. Ground motor starters and contactors in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

**3.02 FIELD QUALITY CONTROL**

- A. Perform the following tests and submit certified test reports of all tests. Provide all equipment and instruments required to perform the tests.
  - 1. Test circuits for connections in accordance with accepted wiring diagrams.
  - 2. Test that insulation resistance to ground of non-grounded conductor is a minimum of 10 MΩ.
  - 3. Test equipment enclosures for continuity to the grounding system.
  - 4. Test operation of circuits and controls. When testing, operate each control a minimum of ten times and each circuit continuously for a minimum of 1/2 hour.

**END OF SECTION 26 24 22**