

**SECTION 26 24 19**  
**MOTOR CONTROL CENTERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, complete installation, and connection of motor control centers.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.
- E. Section 26 29 11, MOTOR STARTERS: Control and protection of motors.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Catalog Data: Submit catalog data and information as required to demonstrate that materials conform to the specification requirements. Data shall include features, characteristics, ratings, and settings of all adjustable components.
- C. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, enclosure type, dimensions, weights, mounting details, front view, side view, equipment and device arrangement, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams, materials, connection diagrams for each motor control center, and nameplate schedule.
  - 3. For starters: a list of overload sizes for each motor and circuit breakers sizes.

- D. Manuals: Two weeks prior to the final inspection, submit four copies of the following to the COTR:
  - 1. Complete maintenance, operating and testing manuals, including wiring diagrams, technical data sheets, including load current, overload relay and settings of adjustable relays, and information for ordering replacement parts:
    - a. Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
    - b. Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
    - c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
    - d. Instructions for testing and adjusting overcurrent protective devices.
- E. Certification: Two weeks prior to final inspection, submit four copies of the following to the COTR:
  - 1. Certification from the manufacturer that the motor control center(s) will withstand the design seismic event forces, and that the unit will be fully operational after the design seismic event at the project site.
  - 2. Certification by the manufacturer that the motor control centers conform to the requirements of the drawings and specifications.
  - 3. Certification by the contractor that the motor control centers have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
  - ICS 1-05.....Industrial Control and Systems: General Requirements
  - ICS 2-05.....Industrial Control and Systems: Controllers, Contactors, and Overhead Relays, Rated 600 volts
  - ICS 6-06.....Industrial Control and Systems: Enclosures
  - FU 1-02.....Low-Voltage Cartridge Fuses
  - 250-03.....Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. National Fire Protection Association (NFPA):
  - 70-05.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 845-05.....Motor Control Centers

## **PART 2 - PRODUCTS**

### **2.1 MOTOR CONTROL CENTERS**

- A. Factory-assembled motor control centers shall comply with NEC, NEMA, and UL, and as shown on the drawings.
- B. Motor control centers shall be complete, floor-mounted, dead-front metal-enclosed, free-standing, grounded, indoor type.
- C. Wiring: The motor control centers shall be NEMA Standard, Class 1, Type B.
- D. Ratings: Ratings shall be not less than shown on the drawings. Interrupting ratings shall be not less than the maximum short circuit currents available at the motor control center location, as shown on the drawings.
- E. Motor control centers shall conform to the arrangements and details of the drawings and to the spaces designated for installation.
- F. The components and the control wiring shall conform to the approved shop drawings as furnished for the various applicable electrical and mechanical sections of the specifications.
- G. All steel parts shall be factory-phosphatized, painted with primer, and baked enamel or lacquer finishes, except for ground connections. The paint and finish shall withstand a minimum of 1000 hours salt spray test.
- H. Vertical Sections:
  - 1. Approximately 90 in [2.25 M] high, front, and rear line-up, dead-front assembly. Unit shall be designed to permit future additions or rearrangement of units.
  - 2. The structure shall be NEMA-Type rated (Type 1, Type 3R, or Type 12) as indicated on the drawings or as required per the environment.
  - 3. Spaces within the sections shall be suitable and adequately sized for starters and accessories as indicated on the drawings.
  - 4. Mount the sections on adequate structural steel supports at the factory, front, and rear, for the full length of each center.
  - 5. Each space shall have an individual door with hinges and latches for present and future starters.
  - 6. End panels shall be removable to facilitate future additions.
  - 7. All section parts shall be accessible from the front for maintenance rearrangement.
  - 8. Screws in the removable panels shall remain in the panels when the panels are removed. Self-aligning, self-retaining nuts, which are parts of the screw assembly, shall remain intact.

9. The structure shall have a minimum 12 in [300 mm] high wireway at the top of each section and a minimum 6 in [150 mm] high wireway at the bottom of each section. The wireway shall run the full length of the structure.
10. Each section in the motor control center shall have isolated vertical full height wireways. Vertical wireways shall connect with both the top and bottom horizontal wireways.
11. Each vertical section for starters shall be equipped with all necessary hardware and busing for modular plug-in units to be added or relocated. All unused space shall be covered by hinged doors and equipped to accept future units.

## **2.2 BUS BARS AND INTERCONNECTIONS**

- A. Horizontal and vertical bus ratings as shown on drawings; bus bars shall be fully rated.
- B. Bus shall be tin-plated copper.
- C. Bus bar joints and interconnection joints shall be plated, constant high-pressure type, with high strength copper-silicon bolts and nuts.
- D. Vertical bus shall have insulation as follows:
  1. High strength polyester glass or the equivalent.
  2. High track-resistance.
  3. High impulse and dielectric strength, suitable for withstanding the maximum short-circuit currents.
  4. High flame-retardant, self-extinguishing.
  5. Comply with NEMA Standard for 122° F [50° C] temperature rise above the ambient temperature.
- E. A ground bus shall extend across the entire length of the motor control center.
- F. Bus bars and interconnections shall include provisions to extend the motor control center horizontal bus into additional future vertical sections.
- G. Provide shutter mechanism to isolate vertical bus when plug-in device is withdrawn.
- H. Equip future spaces for motor controllers, circuit breakers, and switches with all hardware necessary for the future equipment.

## **2.3 STARTERS**

- A. Product of the same manufacturer as the motor control centers.
- B. Factory tested, stab-on, draw-out type up through size 4. Size 5 and above require bolted connections.
- C. Shall conform to the requirements in Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

- D. Interchangeable with starter of the same ratings in all of the motor control centers being installed for this contract. Each motor starter shall be provided with a label indicating all of its ratings.
- E. Disconnecting devices shall be circuit breaker motor circuit protector type with external operating handle with lock-open padlocking positions and on-off position indicator.
  - 1. Circuit Breakers:
    - a. UL listed and labeled, in accordance with the NEC, as shown on the drawings and as specified.
    - b. Bolt-on thermal-magnetic type with a minimum interrupting rating as indicated on the drawings.
    - c. Equipped with automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100A or less. The magnetic trips shall be adjustable from 3x to 10x for breakers greater than 100A frames. Factory setting shall be HI, unless otherwise noted.
    - d. Additional features shall be as follows:
      - 1) A rugged, integral housing of molded insulating material.
      - 2) Silver alloy contacts.
      - 3) Arc quenchers and phase barriers for each pole.
      - 4) Quick-make, quick-break, operating mechanisms.
      - 5) A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
      - 6) Electrically and mechanically trip-free.
      - 7) An overload on one pole of a multi-pole breaker shall automatically cause all breaker poles to open.
- F. Doors for each space shall be interlocked to prevent their opening unless disconnect is open. A "defeater" mechanism shall be incorporated for inspection by qualified personnel.
- G. Identify each motor controller, circuit breaker, and switch with a separate nameplate of laminated black phenolic resin with white core and engraved lettering not less than 0.25 in [6 mm] high. Identify each motor by its number or other designation, which indicates function fulfilled by the motor. Identify pilot light with ON and OFF designation.

#### **2.4 FEEDER UNITS**

- A. Circuit breaker: shall conform to the applicable portions of Section 26 24 16, PANELBOARDS.
- B. Fusible Switches: shall conform to the applicable portions of Section 26 29 21, DISCONNECT SWITCHES.

## **2.5 METERS**

Meters shall be provided as shown on the plans.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be in accordance with NEC, written instructions of the manufacturer, and as shown on the drawings.
- B. Install motor control center on concrete pad as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Bolt the motor control center to the concrete pad.
- C. Comply with mounting and anchoring requirements specified in Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
  - 1. Visual and Mechanical Inspection
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify appropriate anchorage and required area clearances.
    - d. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.
    - e. Use calibrated torque-wrench method to verify the tightness of accessible bolted electrical connections, or perform a thermographic survey after energization.
    - f. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
    - g. Clean motor control center.
    - h. Inspect insulators for evidence of physical damage or contaminated surfaces.
    - i. Exercise all active components.
    - j. Verify the correct operation of all sensing devices, alarms, and indicating devices.
    - k. If applicable, inspect control power transformers.
  - 2. Electrical Tests
    - a. Perform insulation-resistance tests on each bus section.
    - b. Perform overpotential tests.
    - c. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.

**3.3 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the motor control center is in good operating condition and properly performing the intended function.

**3.4 TRAINING**

Furnish the services of a competent, factory-trained engineer or technician for a 2-hour period to instruct VA personnel in operation and maintenance of the equipment, including review of the operation and maintenance manual, on a date requested by the COTR.

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