

SECTION 26 29 11
MOTOR STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All motor starters, including installation and connection (whether furnished with the equipment specified in other Divisions or otherwise), shall meet these specifications.

1.2 RELATED WORK

- A. Other sections which specify motor driven equipment, except elevator motor controllers.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.
- 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.

1.3 QUALITY ASSURANCE

- A. 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. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, weights, mounting details, materials, running over current protection, size of enclosure, over current protection, wiring diagrams, starting characteristics, interlocking and accessories.
- C. Manuals:
 - 1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams and information for ordering replacement parts.
 - a. Wiring diagrams shall have their terminals identified to facilitate installation, maintenance and operation.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
 - c. Elementary schematic diagrams shall be provided for clarity of operation.

2. Two weeks prior to the project final inspection, submit four copies of the final updated maintenance and operating manual to the Contracting Officer's Representative.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the Resident Engineer:
 1. Certification that the equipment has been properly installed, adjusted, and tested.
 2. Certification by the manufacturer that medium voltage motor controller(s) conforms to the requirements of the drawings and specifications. This certification must be furnished to the Resident Engineer prior to shipping the controller(s) to the job site.

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 basic designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
 - 519.....Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
 - C37.90.1.....Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
- C. National Electrical Manufacturers Association (NEMA):
 - ICS 1.....Industrial Control and Systems General Requirements
 - ICS 1.1.....Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
 - ICS 2.....Industrial Control and Systems, Controllers, Contactors and Overload Relays Rated 600 Volts DC
 - ICS 6.....Industrial Control and Systems Enclosures
 - ICS 7.....Industrial Control and Systems Adjustable-Speed Drives
 - ICS 7.1.....Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems
- D. National Fire Protection Association (NFPA):
 - 70.....National Electrical Code (NEC)
- E. Underwriters Laboratories Inc. (UL):

508.....Industrial Control Equipment

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

- A. Shall be in accordance with the requirements of the IEEE, NEC, NEMA (ICS 1, ICS 1.1, ICS 2, ICS 6, ICS 7 and ICS 7.1) and UL.
- B. Shall have the following features:
 - 1. Separately enclosed unless part of another assembly.
 - 2. Circuit breakers and safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
 - 3. Motor control circuits:
 - a. Shall operate at not more than 120 volts.
 - b. Shall be grounded except as follows:
 - 1) Where isolated control circuits are shown.
 - 2) Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
 - c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 volts.
 - d. Incorporate over current protection for both primary and secondary windings of the control power transformers in accordance with the NEC.
 - 4. Overload current protective devices:
 - a. Overload relay (solid state type)
 - b. One for each pole.
 - c. Manual reset on the door of each motor controller enclosure.
 - d. Correctly sized for the associated motor's rated full load current.
 - e. Check every motor controller after installation and verify that correct sizes of protective devices have been installed.
 - f. Deliver four copies of a summarized list to the Resident Engineer, which indicates and adequately identifies every motor controller installed. Include the catalog numbers for the correct sizes of protective devices for the motor controllers.
 - 5. Hand-Off-Automatic (H-O-A) and/or On/Off control switch is required unless specifically stated on the drawings as not required for a particular starter. H-O-A switch is not required for manual motor starters.

6. Incorporate into each control circuit a solid state time delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection.
7. Unless noted otherwise, equip with not less than two normally open and two normally closed auxiliary contacts. Provide green run pilot lights and H-O-A control devices as indicated, operable at front of enclosure without opening enclosure. Push buttons, selector switches, pilot lights, etc., shall be interchangeable.
8. Enclosures:
 - a. Shall be the NEMA types shown on the drawings for the motor controllers and shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
 - b. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open. Provision for padlock must be provided.
 - c. Enclosures shall be primed and finish coated at the factory with the manufacturer's prime coat and standard finish.
- C. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.
- D. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.
- E. Provide a disconnecting means or safety switch near and within sight of each motor as shown on the drawings. Provide all wiring and conduit required to facilitate a complete installation.

2.3 MAGNETIC MOTOR STARTERS

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Starters shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum size 0.
- C. Where combination motor starters are used, combine starter with protective or disconnect device in a common enclosure.
- D. Provide phase loss protection for each starter, with contacts to de-energize the starter upon loss of any phase.
- E. Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and opened by gravity. For motors 75 HP and larger, provide reduced voltage starters. Equip starters with 120V AC coils and individual control transformer unless otherwise noted. Locate "reset" button to be accessible without opening the enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's recommendations, the NEC, NEMA and as shown on the drawings.
- B. Furnish and install heater elements in motor starters and to match the installed motor characteristics. Submit a list of all motors listing motor nameplate rating and heater element installed.
- C. Motor Data: Provide neatly-typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage/phase rating and heater element installed.
- D. Connect hand-off auto selector switches so that automatic control only is by-passed in "manual" position and any safety controls are not by-passed.
- E. Examine control diagrams indicated before ordering motor controllers. Should conflicting data exist in specifications, drawings and diagrams, request corrected data prior to placing orders.

3.2 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. Perform **the following tests in the order indicated:**

1. Visual and Mechanical Inspection

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Inspect contactors.
- d. Clean motor starters and variable speed motor controllers.
- e. Verify overload element ratings are correct for their applications.
- f. If motor-running protection is provided by fuses, verify correct fuse rating.
- g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

3.4 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor starters and variable speed motor controllers are in good operating condition and properly performing the intended functions.

3.5 SPARE PARTS

- A. Two weeks prior to the final inspection, provide one complete set of spare fuses (including heater elements) for each starter/controller installed on this project.

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