**SECTION 26 29 00**

**LOW-VOLTAGE CONTROLLERS**

**BASED ON DFD MASTER ELECTRICAL SPEC DATED 03/01/21**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

**PART 1 - GENERAL**

**SCOPE**

The work under this section includes Low-Voltage Controllers (starters) for motors: Manual motor starters, magnetic motor starters, combination magnetic motor starters, and/or motor control centers. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 References

 Submittals

 Operation and Maintenance Data

 Coordination with Other Trades

 Delivery, Storage, and Handling

 Spare Parts

PART 2 - PRODUCTS

 Manual Motor Starters

 Magnetic Motor Starters

 Controller Overcurrent Protection and Disconnecting Means

 Motor Control Center

 Fuses

PART 3 - EXECUTION

 Installation

 Construction Verification Items

**RELATED WORK**

Applicable provisions of Division 1 shall govern work under this Section.

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 26 05 29 – Hangers and Supports for Electrical Systems

Section 26 08 00 – Commissioning of Electrical

**REFERENCES**

ANSI/NEMA ICS 6 – Industrial Control and Systems: Enclosures.

ANSI/UL 248-8 – Low-Voltage Fuses – Part 8: Class J Fuses.

NEMA AB 1 – Molded-case Circuit Breakers, Molded Case Switches, and Circuit-breaker Enclosures.

NEMA ICS 2 – Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts.

NEMA ICS 18 – Motor Control Centers.

NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches.

NEMA PB 1 – Panelboards.

NEMA PB 1.1 – General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

**SUBMITTALS**

Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time‑current curves of all equipment and components.

Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**COORDINATION WITH OTHER TRADES**

Motors: In general, all electric motors required for this installation will be supplied with equipment, apparatus and/or appliances covered under other sections of the specifications.

For the sake of consistency and conformity of manufacturer, design and construction, all motors shall conform to the following description unless otherwise noted or required.

1. Motors 1/3 HP and smaller shall be wound for operation on single phase, 60 Hz. service unless otherwise noted.
2. Motors 1/2 HP and above shall be wound for operation on 3 phase, 60 Hz service unless otherwise noted.
3. Refer to drawings in each case in order to verify voltage characteristics required.

Equipment:

All building utility motors such as fans, pumps, overhead doors, etc., together with certain "controlling equipment" for same, except motor starters and related apparatus, will be furnished under other sections of the specifications and delivered to the building site unless specifically noted otherwise. The above mentioned "controlling equipment" pertains to electrical thermostats, electro-pneumatic and pneumatic-electric and detection devices, or any other device not purely electrically operating in nature.

The starters for these motors shall be furnished and installed by the Electrical Trade unless noted otherwise (See Motor Schedule on Drawings).

The Electrical Trade shall set and connect all specified starting equipment, install all power conduits and wiring and shall furnish and make all connections from starting equipment to motors as required to leave the apparatus in running condition.

Wiring Connections:

Furnish branch circuits for all motors to the starting equipment and then to the motors, complete with all control wiring for automatic and remote control where required or noted. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible, PVC-coated metal conduit.

Provide all necessary labor and material to completely connect all electrical motors and controls (where required) in connection with the building utility equipment, including fans, pumps, overhead door operators, etc.

All conduits and wiring required for control work from the holding coil circuit of the starter, including the furnishing and installation of control devices such as auxiliary contacts, control relays, time delay relays, pilot lights, selector switches, alternators, etc., shall be provided and installed by other trades unless otherwise indicated.

Power Branch Circuits:

Wire sizes for branch circuits not specifically called for on drawings or in specifications shall be based on 125 percent of the full load current of the motor unless the voltage drop of motor branch circuits exceeds 1-1/2 percent from the distribution panel to the motor; in which case, voltage drop shall govern wire sizes. A power factor of 80 percent shall be used for motors in such calculations.

**DELIVERY, STORAGE, AND HANDLING**

Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

**SPARE PARTS**

Keys: Furnish two (2) each to Owner.

**Provide three (3) spares of each size and type fuse used. Provide enclosure for spare fuses.**

Fuse Pullers: Furnish one fuse puller to Owner.

**PART 2 - PRODUCTS**

**MANUAL MOTOR STARTERS**

**Single-phase Manual Motor Controllers:** Provide controllers for motor loads under 1/2 HP. Controllers shall be 4-inch square box cover units with ON/OFF switch and fuse protection for small motor circuits. Fuses shall be Edison base time-delay plug fuses. Controllers shall be Bussmann SSY or equal.

**Three-phase Manual Motor Starter:** NEMA ICS 2; size as shown on Drawings. AC general‑purpose Class A manually operated full‑voltage controller for induction motors rated in horsepower, with overload protection, red pilot light and toggle operator.

Enclosure: NEMA Type 1, or as indicated on the drawings.

Provide manufacturer’s equipment grounding kit in all starter enclosures.

***A/E note: Coordinate with the division 23 engineer for starter time-delay relays. Delayed starting of motors can usually be handled through the temperature control system and so time-delay relays are not required. If they are required, note this on the motor schedule.***

**MAGNETIC MOTOR STARTERS**

Magnetic Motor Starters: NEMA ICS 2; AC general‑purpose Class A magnetic controller for induction motors rated in horsepower; size 0 minimum.

Full Voltage Starting: Non‑reversing type.

***A/E note: Include Soft-Start controllers only where required. Generally, use across-the-line type starters for 208 volt motors, 20 HP and less, and for 480 volt motors, 40 HP and less. Use Soft-Start controllers for 208 volt motors, 25 HP and more; and for 480 volt motors, 50 HP and more. Indicate which motors require Soft-Start controllers on the motor schedule. Delete if not needed.***

[Reduced Voltage Soft-Starting: Solid-state type. Ramp times and trip current rating shall be adjustable. For pump motors, provide starter with pump control option with sophisticated pump algorithms on both starting and stopping that minimize the pressure surges that cause water hammer. The overload shall be solid-state, self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. The overload shall have a mechanical test function. Provide Soft-Start controllers for motors as indicated on the motor schedule.]

Size: NEMA ICS 2; size as shown on Drawings, size 0 minimum.

Coil Operating Voltage: 120 volts, 60 Hz.

Overload Protection: The overload shall be solid-state, self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. The overload shall have a mechanical test function.

Enclosure: NEMA Type 1, or as indicated on the drawings.

Provide manufacturer’s equipment ground kit in all starter enclosures.

Auxiliary Contacts: NEMA ICS 2, two (2) field convertible contacts in addition to seal‑in contact.

***A/E note: Motors that are used for smoke control shall NOT have a Hand-Off-Auto (H-O-A) selector switch. Indicate which motors are used for smoke control and cannot have an H-O-A switch on the motor schedule.***

Selector Switches: NEMA ICS 2, HAND-OFF-AUTO in front cover.

Indicating Lights: NEMA ICS 2; red “RUN” LED Push-to-test type in front cover.

Control Power Transformers: Each magnetic starter shall have a fused primary and a fused 120Vsecondary control transformer, sized for the load, 50 VA minimum. Additionally, the X2 terminal of the control transformer shall be grounded.

Combination Motor Starters: Combine motor starters with fusible switch disconnect in common enclosure.

**CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS**

**For Three-Phase Motors:** Fusible Switch Assemblies: NEMA KS 1; quick‑make, quick‑break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class J fuses.

**MOTOR CONTROL CENTER**

***In general, specify a motor control center if six (6) or more starters are needed in the same room. If single-phase loads are being fed from the MCC, make sure that a neutral conductor to the MCC is shown on the one-line diagram, and include a neutral bus in the MCC.***

Motor Control Centers: NEMA ICS 2; Class I, Type B-d.

Main Overcurrent Protection: Main Lug Only or as scheduled.

Motor Starters: As specified elsewhere in this Section and as scheduled on Drawings.

Feeder Tap Units: Molded case thermal‑magnetic circuit breakers or as scheduled.

Voltage Rating: [480] [480/277] [120/208] [\_\_\_\_\_] volts, three phase, [three] [four] wire, 60 Hertz.

Horizontal Bussing: Copper, with a continuous current rating of [600] [800] [1200] [1600] [2000] amperes. Include copper ground bus entire length of control center.

Vertical Bussing: Copper, with a continuous current rating of [300] [600] amperes.

[Include copper neutral bus.]

Integrated Equipment Short Circuit Rating: As scheduled on the drawings.

Configuration: Units accessible from the front only.

Enclosure: NEMA Type 1 or as indicated on the drawings.

Finish: Manufacturer's standard gray enamel.

Control Power Transformers: Each magnetic starter shall have a fused primary and a fused 120Vsecondary control transformer, sized for the load, 50 VA minimum. Additionally, the X2 terminal of the control transformer shall be grounded.

**FUSES**

Fuses 600 Amperes and Less: Dual element, time delay, [250] [600] volt, UL Class J. Interrupting Rating: 200,000 rms amperes.

**PART 3 - EXECUTION**

**INSTALLATION**

Install motor control equipment in accordance with manufacturer's instructions.

Set overload protection in motor starters to match installed motor characteristics.

Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

[Provide a 3.5 inch concrete housekeeping pad for motor control centers.]

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION