SECTION 26 28 39
MOTOR CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED
- A. Manual motor starters
- B. Magnetic motor starters
- C. Combination magnetic motor starters
- D. Motor control centers

1.2 REFERENCES
- A. NEMA ICS 6 - Enclosures
- B. FS W-C -375 - Circuit Breakers, Molded Case; Branch Circuit and Service
- C. UL 489 - Molded Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts
- E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches
- F. NEMA PB 1 - Panelboards
- G. NEMA PB 1.1 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less

1.3 SUBMITTALS
- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions.
  1. 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.
- C. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and over current protection devices.
- D. Submit manufacturers' instructions under provisions of Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA
- A. Submit operation and maintenance data under provisions of Section 01 77 00.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to site under provisions of Section 01 60 00.
- B. Deliver in 30" maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.
- C. Store and protect products under provisions of Section 01 60 00.
- D. Store in a clean, dry space
  1. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with manufacturer's written instructions.
  1. Lift only with lugs provided for the purpose.
  2. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.6 SPARE PARTS
- A. Keys: Furnish two each to Owner.

1.7 COMMISSIONING

A. Commissioning of a system or systems specified in this section is part of the construction process.
B. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Authority.
C. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure.
D. Refer to Section 01 77 00 - Contract Closeout, for substantial completion details.
E. Refer to Section 01 91 00, Commissioning, for detailed commissioning requirements.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS
A. Square D
B. General Electric
C. Cutler Hammer
D. Siemens/ITE
E. Allen Bradley

2.2 MANUAL MOTOR STARTERS
A. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated full-voltage controller for induction motors rated in horsepower, with overload relay, red pilot light, auxiliary contact, and push button operator.
B. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, pole, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and key operator.
C. Motor Starting Switch: NEMA ICS 2 AC general-purpose Class A manually operated pole with full-voltage controller for fractional horsepower induction motors, without thermal overload unit, red pilot light, auxiliary contact, and push button operator.
D. Enclosure: NEMA ICS 6

2.3 MAGNETIC MOTOR STARTERS
A. Magnetic Motor Starters: NEMA ICS 2 AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
B. Full Voltage Starting
C. Reduced Voltage Starting
D. Two-Speed starting with integral time delay transition between FAST and SLOW speeds.
E. Coil Operating Voltage: 120 volts, 60 Hertz
F. Size: NEMA ICS 2; size as shown on Drawings
G. Overload Relay: NEMA ICS 2; melting alloy
H. Enclosure: NEMA ICS 6
I. Combination Motor Starters: Combine motor starters with disconnecting means, type as scheduled.
J. Auxiliary Contacts: NEMA ICS 2 two normally opened and two normally closed contacts in addition to seal-in contact.
K. Indicating Lights: NEMA ICS 2 RUN: red in front cover.
L. Selector Switches: NEMA ICS 2 HAND/OFF/AUTO, in front cover.
M. Relays: NEMA ICS 2
N. Control Power Transformers: 120-volt secondary, capacity as scheduled.

O. Provide motor starters with overload heaters sized from nameplate full load amperage for each phase, manually reset.
P. Motor starters provided with phase failure-relay protection.
1. Provide phase failure, under voltage and phase reversal.
2. Automatic reset between 10 to 20 seconds after fault condition correction.

2.4 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS
A. Molded Case Thermal-Magnetic Circuit Breakers: Provide UL 489 circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
B. Motor Circuit Protector: Provide UL 489 circuit breakers with integral instantaneous magnetic trip in each pole.
C. Non-fusible Switch Assemblies:
1. NEMA KS 1 quick-make quick-break, load interrupter enclosed knife switch with externally operable handle.
2. Provide interlock to prevent opening front cover with switch in ON position. (Handle lockable in OFF position.)
D. Fusible Switch Assemblies:
1. NEMA KS 1 quick-make quick-break load interrupter enclosed knife switch with externally operable handle.
2. Provide interlock to prevent opening front cover with switch in ON position.
3. Handle lockable in OFF position.

2.5 ACCEPTABLE MANUFACTURERS - MOTOR CONTROL CENTER
A. Square D
B. General Electric
C. Cutler Hammer
D. Siemens/ITE
E. Allen Bradely

2.6 MOTOR CONTROL CENTER
A. Motor Control Centers: NEMA ICS 2
B. Main Overcurrent Protection: As scheduled.
C. Motor Starters: As scheduled.
D. Feeder Tap Units: As scheduled.
E. Horizontal Bussing: Include copper ground bus entire length of control center.
F. Vertical Bussing: NEMA ICS 2 copper.
G. Configuration: Units front accessible from the front only.
H. Enclosure: ANSI/NEMA ICS 6; Type as required to meet conditions of installation unless indicated on the Drawings.
I. Finish: Provide the Manufacturer's standard enamel color.
J. Provide phase loss protection relay with contacts to de-energize each motor starter in control center.
K. Control Transformer: Provide control transformer in motor control center to provide 120-volt control source for all motor starters in control center.

PART 3 EXECUTION

3.1 INSTALLATION
A. Install motor control equipment in accordance with manufacturer's instructions.
B. Install fuses in fusible switches.

C. Select and install heater elements in motor starters to match installed motor characteristics.
D. 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.

3.2 FUNCTIONAL PERFORMANCE TESTING

A. System Functional Performance Testing is part of the Commissioning Process.
   1. The Contractor shall perform the Functional Performance Testing and the Commissioning Authority shall witness and document the test.
   2. Refer to Section 01 91 00, Commissioning, for functional performance tests and commissioning requirements.
B. Systems Readiness Checklists shall be completed and submitted for each piece of equipment included in this section.
C. Perform the functional performance testing of Motor Controls as part of the Electrical System Functional Performance testing.

3.3 DEMONSTRATION AND TRAINING

A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative.
   1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.
   2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.
   3. Refer to Section 01 91 00, Commissioning, for further contractor training requirements.
B. Provide demonstration and training for all types of motor controls installed in this project.

END OF SECTION