

SECTION 23 05 14

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
  - 1. Across-the-line, manual and magnetic controllers.
  - 2. Reduced-voltage controllers.
  - 3. Multispeed controllers.
  - 4. All with fused disconnect switches.

1.3 WORK INCLUDED

- A. The mechanical contractor is to provide motor, motor controllers and VFD's. The mechanical contractor to install motor, motor controllers and VFD's. The Electrical contractor is to wire all motors and motor controllers.
- B. The mechanical contractor shall be responsible for coordinating all requirements of the motor and controller manufacturer.
- C. If this contractor elects to substitute or increase motor horsepower over that specified, the cost of motor, motor controllers and electrical changes shall be borne by this contractor
- D. Each motor except as noted, shall be provided with a combination fused disconnection means and across-the-line magnetic starter with push button stations mounted on cover or variable frequency drive. Coordinate requirements between trades (electrical and mechanical contractors).
- E. For automatically or remotely controlled motors, furnish hand off auto (HOA ) selector switches in place of the push buttons.
- F. Provide manually operated motor starters of the proper size for all motors less than 1/2 hp which are not automatically controlled. Starters for motors 175 watts or less shall consist of a snap switch with thermal overload protection where such protection is not an integral part of the motor.

- G. Combination magnetic starters for all motors shall have thermal overload, pilot light, low voltage protection in all three phases. Include a control transformer for each magnetic starter to provide 120 volt control power with 3 sets of spare normally closed or normally open contacts
  - H. Starters for motors 75 hp and above shall be solid state electronic soft start type starters.
  - I. All disconnect switches shall be provided by this contractor and shall be fused suitable for the motor or equipment served.
  - J. Provide enclosures for motor controllers suitable for operating environment.
  - K. Where a motor control center is indicated on plans, individually mounted motor controllers shall not be utilized. Please review electrical drawings for all motor control center starters, which will be provided by others.
- 1.4 Related Sections include the following:
- 1. Division 26 Section "Electrical Power Monitoring and Control" for interfacing communication and metering requirements.
  - 2. Division 23 Section 230515 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on constant torque loads in ranges up to 200 hp.
  - 3. All division 230000 sections.
  - 4. Division 26 Section "Enclosed Controllers".
- 1.5 SUBMITTALS
- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
  - B. Shop Drawings: For each enclosed controller.
    - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      - a. Each installed unit's type and details.
      - b. Nameplate legends.
      - c. Short-circuit current rating of integrated unit.
      - d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
      - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
    - 2. Wiring Diagrams: Power, signal, and control wiring.

- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around enclosed controllers where pipe and ducts are prohibited. Show enclosed controller layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer. Coordinate with the project electrical contractor so all equipment is compatible.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### 1.8 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

## 1.9 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spare Fuses: Furnish one spare for every five installed, but no fewer than one set of three of each type and rating.
  - 2. Indicating Lights: Two of each type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, and compatibility with the electrical system equipment being provided, provide products by one of the following:
  - 1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
  - 2. Danfoss Inc.; Danfoss Electronic Drives Div.
  - 3. Eaton Corporation; Cutler-Hammer Products.
  - 4. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
  - 5. Square D.

## 2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."
  - 1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
  - 1. Control Circuit: 120 V; obtained from integral control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
  - 2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
  - 3. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
- C. Combination Magnetic Controller: Factory-assembled combination controller and fused disconnect switch.
  - 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
  - 2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
  - 3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

## 2.3 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

- A. Star-Delta Controller: NEMA ICS 2, closed transition with adjustable time delay.
- B. Part-Winding Controller: NEMA ICS 2, closed transition with separate overload relays for starting and running sequences.
- C. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition.
- D. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

1. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.
2. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
3. LED indicators showing motor and control status, including the following conditions:
  - a. Control power available.
  - b. Controller on.
  - c. Overload trip.
  - d. Loss of phase.
  - e. Shorted silicon-controlled rectifier.
4. Motor running contactor operating automatically when full voltage is applied to motor.

#### 2.4 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
  1. Outdoor Locations: NEMA 250, Type 3R.
  2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

#### 2.5 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Auxillary contacts (normally open/ normally closed) for Building Management System (BMS) interface and control.

#### 2.6 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

#### 3.3 INSTALLATION

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Install freestanding equipment on concrete bases.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

#### 3.4 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

#### 3.5 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

### 3.6 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.7 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.8 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
  - 3. Perform test to demonstrate that controllers are operational and functioning in accordance with the manufacturer's recommendations and the contract documents.

### 3.9 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

END OF SECTION