

SECTION 16420

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 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
- B. Related Sections include the following
 - 1. Section 16269 for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on constant torque loads in ranges up to 200 hp
 - 2. Section 16289 for low-voltage power, control, and communication surge suppressors

1.3 SUBMITTALS

- A. In accordance with Section 01340
- B. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes
- C. 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
 - 2. Wiring diagrams: Power, signal, and control wiring
- D. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01730 include the following

1. Routine maintenance requirements for enclosed controllers and all installed components
 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices
- E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents

1.4 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
- 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

1.5 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

1.6 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 Section 03300
- C. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect

- D. 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

1.7 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, 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. General Electrical Company; GE Industrial Systems
 - 5. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group
 - 6. Siemens/Furnas Controls
 - 7. 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 with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity
 - 2. 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

2.3 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

- A. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with motors indicated
 - 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. Automatic voltage-reduction controls to reduce voltage when motor is running at light load
 - 5. 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 specified on drawings, or otherwise indicated to comply with environmental conditions at installed location
 - 1. Outdoor locations: NEMA 250, Type 3R
 - 2. Kitchen areas: NEMA 250, Type 4X, stainless steel
 - 3. Other wet or damp indoor locations: NEMA 250, Type 4
 - 4. 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
 - 1. Pilot lights shall be LED type. Include pilot lights indicating "RUN" and "FAIL" conditions
- 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. Elapsed Time Meters: Heavy duty with digital readout in hours
- F. Push-to-Test pushbutton for indicating lights
- G. Current-Sensing, Phase-Failure Relays for Bypass Controllers: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay
- H. Hand-Off-Auto Switches: Furnish for all enclosed controllers, except where indicated for manual control only

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.
- B. Install freestanding equipment on concrete bases
- C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Section 16491

3.4 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer

3.5 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Section 16075

3.6 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Section 16120
- 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 16 Sections
- B. Ground equipment according to Section 16060

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
- B. Manufacturer's Field Service: For solid-state controllers, engage a factory-authorized service representative to perform the following:
 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment
 2. Assist in field testing of equipment including pretesting and adjusting of solid-state controllers
 3. Report results in writing

3.9 DEMONSTRATION

- A. For solid-state controllers, engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers

END OF SECTION