

## SECTION 16421 - MOTOR CONTROL CENTERS

### PART 1 - GENERAL

#### 1.01 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product Data: Submit manufacturer's technical product data on NEMA Class 2, Type B motor control centers (MCCs).
  - 2. Submit layout Drawings of MCCs showing accurately scaled basic equipment sections including, but not limited to, motor starters, controllers, device panels, and circuit breakers. Show spatial relationships of MCC components to proximate electrical equipment. Clearly differentiate on wiring diagrams those conductors which are factory installed and those which are field installed.
  - 3. Circuit Breaker, Fuse and Overload Sizes: Submit a compiled list of motors, circuit breaker sizes, fuse sizes, overload sizes, and types for motors actually installed.
- B. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01782, operation and maintenance manuals for items included under this Section. Include data and parts list for each MCC and troubleshooting maintenance guide.

#### 1.02 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. NEMA Compliance: Comply with NEMA Standards Pub/No. ICS-2, pertaining to construction, testing, and installation of MCCs, and with applicable NEMA standards for circuit breakers and fuses.
  - 2. UL Compliance: Comply with applicable requirements of UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," and UL Standard 845, "Electric Motor Control Centers." Provide MCCs and ancillary equipment which are UL listed and labeled.
  - 3. IEEE Compliance: Comply with applicable requirements of IEEE Standard 241 pertaining to construction and installation of MCCs.
  - 4. ANSI Compliance: Comply with applicable requirements of ANSI as applicable to MCCs.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Square D Company.
  - 2. Allen-Bradley Co.
  - 3. Siemens, Inc.

## 2.02 MOTOR CONTROL CENTERS AND COMPONENTS

- A. Provide MCCs and ancillary components of sizes, ratings, classes, types, and characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information and as required for complete installation and as specified herein.
- B. MCCs: For operation on power source rating indicated, consisting of one or more vertical sections, each with groupings of control units containing motor starters, thermal overload units, disconnects, and including such other electrical equipment as controls, control transformers, metering panels, current transformers, and auxiliary devices as indicated. Provide MCC with NEMA Class 2, Type B wiring, wire units using 90°C SIS or MTW stranded copper wire; No. 14 AWG minimum. Tag all wires at each termination.
- C. MCC Supporting Structures: Factory assembled, dead-front, MCC standard supporting structures with enclosed vertical sections, fastened together to form rigid freestanding assembly. Construct each section 90-inch-high with 9-inch horizontal wireways at top and bottom, 20 inches wide, and with 20-inch section depth for front-of-board unit arrangement. Provide NEMA Type 1A enclosure. Provide gasketing on all enclosing sheet steel, wireways, and unit doors. Construct units with 4-5/8-inch wide, 8-inch deep, 90-inch high vertical wireway in each vertical structure on right side of unit, accessible through hinged doors, and with supports at proper intervals within for fastening wires/cables. Form supporting members of not less than 13 gauge hot-rolled steel. Construct structure doors with removable pin hinges and secure with quarter-turn indicating type fasteners. Provide front-accessible main lug compartment for connection of incoming cables in top or bottom as indicated. Provide removable lifting angle full length of MCC. Design lifting angle to support entire weight of MCC section. Design bottom channels to be removable; provide holes for bolting MCC units to floor.
  - 1. Provide shipping splits in MCC lineup to allow for shipment of maximum 60-inch-long units. Design MCCs so matching vertical sections of same current rating and manufacturer can be added later at either end of lineup without use of transition sections. Provide removable end and top plates to close off openings.
- D. Bus System: copper, braced to withstand faults of 65,000 rms symmetrical amperes minimum unless indicated otherwise. Provide main horizontal bus with rating shown, and vertical bus rating of 300 amperes minimum; and construct vertical bus bars with protective barriers to prevent accidental contact of personnel with bus. Vertical bus shall be full length.
  - 1. Provide 0.25-inch by 1-inch minimum copper ground bus running full width of MCC at bottom of lineup. Drill ground bus and furnish 1 lug per starter unit, minimum.
- E. Starter/Circuit Breaker Units: Draw-out type, magnetic motor starters with fusible switch, motor circuit protector type disconnects, or feeder circuit breakers, auxiliary control devices, and NEMA size as indicated. Construct each starter unit with doors, unit support pans, saddles, and disconnect operators; enclose and isolate each unit from adjacent units. Design units so that faults will be contained within compartments. Equip with thermal and magnetic overload protection device for each motor circuit, unit-mounted pilot devices, timers, selector switches, indicating lights, and control relays. Provide 2 spare normally open/normally close auxiliary contacts for each control relay. Provide draw-out units with de-energized position where unit is still supported by structure, but no electrical connection is made. Provide method of locking unit in de-energized position. Design draw-out units of same NEMA size and branch feeder units of same trip rating, to be interchangeable with each other.

1. Three-phase starter may be following types:
  - a. Full Voltage Nonreversing (FVNR): One 3-pole magnetic contactor with a set of 3 overload devices.
  - b. Full Voltage Reversing (FVR): Two 3-pole magnetic contactors with a common set of 3 overload devices.
  - c. Two-speed (for two-winding motor): Two 3-pole magnetic contactors, each with its own set of 3 overload devices.
  - d. Two-speed (for single winding motor): Two magnetic contactors, a 5-pole for high speed, and a 3-pole for low speed, each with its own set of 3 overload devices.
  - e. Reduced Voltage (for wye connected part winding motors): Two 3-pole magnetic contactors, each with its own set of 3 overload devices and a timer for closing of the running contactor. Running contactor shall be sized for motor full load current and starting (half winding) contactor shall be sized for at least 75 percent of full load current and shall be capable of interrupting at least 10 times full load current.
  - f. Reduced Voltage (closed transition autotransformer type): Three magnetic contactors, two 2-pole and one 3-pole with a common set of 3 overloads, a timing relay, and an auto-transformer with taps at 50, 65, 80, and 100 percent and an integral temperature switch or timing relay to protect transformer windings.
- F. Unit Draw-out: Provide plug-on connections for each electrical power phase. Design contact fingers to be floating and self-aligning; silver plate contacts for obtaining low-resistance connections.
- G. Disconnect Operators: Provide external operator handles for switches and circuit breakers. Design handle with up-down motion and with down position indicating OFF. Construct handles which permit locking handle in OFF position with 3 padlocks.
- H. Unit Doors: Securely mounted with rugged concealed-type hinges which allow doors to swing open minimum of 115 degrees for ease of unit maintenance and withdrawal. Fasten doors to structure so that they remain in place when unit is withdrawn.
  1. Closed door must cover unit space when unit has been temporarily removed. Provide interlock for each unit door with associated disconnect mechanism to prevent door from opening when unit is energized.
- I. Control and Pilot Devices: Provide an individually fused control power transformer in each starter unit. Provide 2 fuses in transformer primary circuit and 1 in transformer secondary circuit. Size transformers such that they can supply 100VA in excess of unit requirements or provide 150VA rated transformer, whichever is greater.
  1. Provide synchronous type timers unless otherwise noted.
  2. Provide 300 volt-rated, oil-tight type LED push to test pilot lights, push buttons, and selector switches. Equip Start push button with extended guard and black color insert. Equip Stop push buttons with half guard and red color insert.
  3. Provide 3PDT octal type relays and socket, each with 1 spare N.O. contact.
  4. Provide 6-digit elapsed time indicators with 1/10 hour increments.
- J. Motor Circuit Protector: Adjustable trip magnetic-only instantaneous molded-case circuit breakers for use in starter units. Provide a continuous current rating of at least 125 percent of the motor full load current and an interrupting capacity of 65,000 amps symmetrical. Provide a field adjustable instantaneous trip unit capable of being adjusted from 7 to 13 times motor full load current.

- K. Circuit Breakers: Factory assembled, molded-case circuit breakers with permanent instantaneous magnetic and thermal trips in each pole and with fault-current limiting protection; ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make quick-break action and positive handle indication. Provide push-to-trip feature for testing and exercising circuit breaker trip mechanism. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees. Provide with AL/CU rated mechanical screw type removable connector lugs.
- L. Power Monitor: Microprocessor-based device capable of measuring each phase current, line-to-line voltage, line-to-neutral voltage, watts, VARS, power factor, demand watts, and frequency.
  - 1. Unit shall contain kilowatt hour totalizer.
  - 2. 3-CT's and 3 (fused)-PT's shall be provided, and factory installed as required.
  - 3. Unit shall have two Form C, 2-amp rated output contacts, one to alarm upon abnormal voltage level and one to alarm on power failure.
  - 4. Unit shall have Ethernet based communication and a panel face mounted display.
  - 5. Unit shall have internal storage sized to provide 1 week of back up. The unit shall have a minimum sample rate of 256 samples per cycle.
- M. Surge Protection: In each motor control center, provide surge protection device (SPD). The SPD shall be rated for 277/480 VAC, 300 kA per mode (600 kA per Phase). Unit shall have module status LEDs and two (2) Form C contacts for remote use. Manufacturer shall be Thor Electrical Systems, TSri series.
- N. Finishes: Thoroughly clean interior and exterior prior to coating of MCC, including bolted joints, with rust-inhibiting prime coat. Provide 2 finish coats of manufacturer's standard color baked-on enamel finish.
- O. Spare Units: In each motor control center, provide a spare Size 2 full voltage, nonreversing combination starter. Provide a Hand-Off Auto switch and red "running" pilot light in this unit.
  - 1. In each motor control center, provide spaces for the addition of a Size 2 motor starter and a 60 amp circuit breaker.
  - 2. Provide spare circuit breaker units to match each size used and turn over to the Owner.

### PART 3 - EXECUTION

NOT USED

END OF SECTION