

**SECTION 26 24 19**  
**LOW VOLTAGE MOTOR CONTROL CENTERS, ARC RESISTANT**

**PART 1 - GENERAL**

1.1 SCOPE

- A. The requirements of the contract, Division 26 applies to work in this section. Motor Control Centers as specified and as shown on the contract drawings shall be furnished and installed by the contractor.

1.2 RELATED DOCUMENTS

- A. *[Related sections include the following:*
1. *Section 26 29 23 – Variable-Frequency Motor Controllers*
  2. *Section 26 29 13.16 – Reduced Voltage Motor Controllers*
  3. *Section 26 36 23 – Automatic Transfer Switches*
  4. *Section 26 43 13 - Transient Voltage Suppression for Low-Voltage Electrical Power Circuits*
  5. *Section 26 09 13.xx.xx – Electrical Power Monitoring and Control*
  6. *Section 26 24 16 – Panelboards*
  7. *Section 2628 16 – Enclosed Switches and Circuit Breakers]*

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data.
- B. Drawings: Submit shop drawings for approval. Drawings shall include all dimensions, weights, electrical ratings, wiring diagrams and required clearances.

1.4 RELATED STANDARDS

- A. The Motor Control Center shall be manufactured and tested according to the latest applicable standards of the following agencies:
1. UL 845 – Motor Control Centers
  2. NEMA ICS 18-2001 – Motor Control Centers
  3. NEMA ICS 1-2001 – Industrial Control and Systems: General Requirements
  4. NEMA ICS 2.3-2008 – Industrial Control and Systems: Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers
  5. ANSI/IEEE C37.20.7-2007 – Guide for Testing Metal-Enclosed Switchgear Rated up to 38kV for Internal Arcing Faults. *[Testing shall be witnessed by UL.]*
- B. *[Manufacturer Seismic Qualification: The low voltage motor control center(s) shall meet and be certified to seismic requirements specified in the [IBC 2012 International Building Code] [CBC 2013 California Building Code] [ASCE American Society of Civil Engineers 7-10].*
1. *The low voltage motor control center(s) shall be complaint with IBC 2009 parameters:*
    - a. *Building Occupancy Category (as defined in Table 1.1 from ASCE 2005): [I] [II] [III] [IV]*
    - b. *Seismic Design Category: [A] [B] [C] [D] [E] [F]*
    - c. *Site Class: [A – Hard Rock] [B - Rock] [C – Very dense soil and soft rock] [D – Stiff soil profile] [E – Soft Soil Profile] [F – Soil vulnerable to potential failure or collapse under seismic loading] as defined in IBC 2006 Table 1613.5.2 Site Class Definitions*
    - d. *Ip – Importance Factor: [1.5 – Components must function after an earthquake for life safety purposes (Building Occupancy Code IV)] [1.25 - Buildings and structures that represent a substantial hazard to human life in the event of failure or that can cause substantial economic impact or mass disruption of*

*day-to-day civilian life (Building Occupancy Code III)] [1.0 – Non-essential buildings. Function not life critical. (Building Occupancy Code I and II)]*

- e. *S<sub>s</sub> – Mapped Spectral Accelerations for Short Periods at 0.2 seconds – 300%g*
- f. *S<sub>ds</sub> – 5% Damped Design Spectral Response Accelerations for Short Periods at 0.2 seconds – 2.0*
- g. *z/h – Height factor ratio: [ ] Note: Ratio is a calculated value equal to the floor the gear is installed on divided by 12. A 6th floor installation is a 0.5 value. A basement or ground floor installation is a 0.0 value.*

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer: For equipment required for the work of this section, provide products which are the responsibility of one manufacturer.
- B. Manufacturer shall have had produced similar electrical equipment for a minimum of 5 years.
- C. Manufacturer shall be ISO 9001; 2008 certified.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manual. One (1) copy of this document shall be provided with the equipment at the time of shipment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The low voltage arc resistant motor control center shall be manufactured by Siemens, type tiastar Low Voltage Arc Resistant Motor Control Center or pre-approved equal. Approved manufacturers are as follows:
  - 1. SIEMENS - type tiastar Low Voltage Arc Resistant Motor Control Center
  - 2. [ ]

### 2.2 RATINGS

- A. System Configuration: Motor Control Center suitable for application in three-phase, *[60 Hz] [50 Hz], [3 wire] [4 wire] [grounded-neutral] [3 wire ungrounded] [3 wire high-impedance grounded]* system.
- B. Electrical Ratings:
  - 1. Nominal System Voltage: *[600 V] [480 V] [240 V] [208 V] [Other (specify)]*.
  - 2. Maximum Design Voltage: 600V
  - 3. Short-Circuit Current: *[42] [65]* kA
  - 4. Main-Bus Continuous Current: *[600] [800] [1200] [1600]* A.
  - 5. Accessibility Type: 2
  - 6. Internal Arcing Short-Circuit Current: 65 kA without the need of a current limiting main device.
  - 7. Arcing Duration: 50 msec
  - 8. Internal arcing short-circuit current rating and arc duration shall be met without a current limiting main device.

### 2.3 GENERAL REQUIREMENTS

- A. STRUCTURES
  - 1. The enclosure shall be NEMA Type *[1], [1-with gasketed doors]*. Vertical sections shall be constructed with steel divider sheet assemblies formed or otherwise fabricated to eliminate open framework between adjacent sections or full-length bolted-on side sheet assemblies at the ends of the MCC(s).

2. Vertical sections shall be 102" high excluding mounting sills and including a 12" modified pull-box or top-hat with pressure flaps installed throughout the MCC for Arc Resistant purposes, 20" wide and 20" deep for front mounting of units. The width of the vertical section may be increased for special oversize units that cannot be accommodated in the standard 20" wide structure up to 30".
3. Vertical structures shall be divided into six (6) full space factors (12") and shall accommodate up to six (6) NEMA size 1 or 2 Full Voltage Non-Reversing FVNR combination starters. MCC unit sizes shall be multiples of 1/2 space factor (6"). The vertical structures shall accommodate up to twelve (12) 6" high density units. The vertical structures shall accommodate up to six (6) 12" units with dual mounted feeders, for a total of up to twelve (12) 125 AF feeders.
4. Each standard 20" wide structure shall be supplied with a 4" wide vertical wireway. Wireways shall be completely isolated from all power busses. The rear surface of the vertical wireway shall be painted white and include openings for pressure release in case of an Arc Flash event. A minimum of three (3) formed wire cable supports, extending the full depth of the vertical wireway shall be supplied in each vertical section. A separate hinged door shall cover the vertical wireway.
5. Each standard structure shall be supplied with a 12-inch top and six (6) inch bottom horizontal wireway that are continuous for the entire length of the MCC. The minimum horizontal wireway opening between sections is 40 square inches for the top and 30 square inches for the bottom horizontal wireway. A hinged door shall be supplied to cover the top horizontal wireway.
6. Unit doors shall be hinged on the left and vertical wireway doors on the right for unobstructed access to the units and associated vertical wireway. All doors shall be mounted on removable pin-type hinges and secured with steel quarter-turn, into a secured support tested to withstand an Arc Flash event, indicating type fasteners.
7. Wireways shall be completely isolated from bus compartments by suitable barriers. Sliding barriers between the horizontal bus and top horizontal wireway are not acceptable.
8. Removable top cover plates shall be provided for conduit entry to the top horizontal wireway and shall provide a minimum of 116 square inches of area for conduit location. Top cover plates shall be fabricated from 13-gauge steel.
9. All MCC structures shall be supplied with 1-1/8" high X 3" wide base channel sills that are continuous for the entire length of the shipping split. The base channel sills shall be fabricated of 7-gauge steel and shall be suitable for grouting the base channel sills in place, welding to leveling plates or securing to the floor with 1/2" anchor bolts. MCC structures shall be supplied with reversible bottom end cover plates to cover the bottom horizontal wireway and ends of the base channel sills. The bottom end cover plates shall be factory installed to cover the ends of the base channel sills to prevent entrance of dirt and rodents into the MCC when installed flush on the floor and shall be removable to expose the ends of the base channel sills if they are to be grouted into the floor.
10. A removable, full length lifting angle shall be provided for each shipping split of each MCC. The lifting angle shall be bolted to each side sheet or divider sheet of the shipping split to evenly distribute the weight of the MCC during lifting.
11. MCC's shall be assembled in such a manner that it is not necessary to have rear accessibility to remove any internal devices or components.

#### B. BUSSING

1. The main horizontal bus shall be **(Pick a. or b. Delete the other. If a. is selected, then make decisions within the paragraph.)**
  - a. *[[Tin] [Silver] plated copper rated at [600] [800] [1200] [1600] amperes with a conductivity rating of 100% IACS. The horizontal bus bars shall be fully sized to carry 100% of the rated current the entire length of the MCC. Horizontal bus bars shall be mounted edge wise and located at the top of the MCC. Tapered horizontal bus is not acceptable.] All power bus shall be braced to withstand a fault current of 65,000 RMS symmetrical amperes.]*

- b. *[The entire horizontal bus assembly must be located behind the top horizontal wireway at any amperage. Horizontal bus bars located behind usable unit space are not acceptable.]*
  - c. The horizontal bus shall be isolated from the top horizontal wireway by a clear, flexible, polycarbonate, barrier allowing visual inspection of the horizontal bus without removing any hardware.
2. The vertical bus:
    - a. Shall be rated *[300] [600]* amperes. Vertical bus bars shall be fabricated of *[tin] [silver]* plated solid copper bars with a conductivity rating of 100% IACS.
    - b. The vertical bus barrier support shall be designed as to effectively enclose each vertical bus bar, providing both isolation and insulation. Automatic shutter mechanisms shall be provided to close off all unused stab openings when a plug-in unit is moved to the "TEST" position or removed from the structure. Unused stab openings shall be covered with snap-in covers
  3. All bus ratings are to be based on a maximum temperature rise of 50°C over a 40°C ambient temperature.
  4. Horizontal to vertical bus and horizontal bus splice connections shall be made with two (2) 3/8" grade 5 bolts and conical washers at each connection point. All connecting hardware shall be designed to be tightened from the front of the MCC without applying any tools to the rear of the connection.
  5. The horizontal ground bus shall be rated *[300-amp copper] [600-amp copper]*.

C. UNITS

1. Plug-in units shall connect to the vertical bus by means of self-aligning, tin plated copper stab-on connectors provided with spring steel back-up springs to insure positive connection to the vertical bus.
2. When vertical ground bus is specified, plug-in units shall include a ground stab which engages the vertical ground bus before the power stabs engage the vertical bus when the unit is inserted into the structure. When the plug-in unit is withdrawn from the vertical bus, the vertical ground stab shall release after the power stabs.
3. The interior of all MCC units shall be painted white, including unit top and bottom plates or isolation barriers.
4. All plug-in units 30" tall and larger will be secured to the structure in four (4) points to withstand an Arc Flash event.
5. All plug-in units 12" tall and larger will include two (2) auxiliary handles to aid in installation, removal and transporting plug-in units.
6. All plug-in units will include a racking mechanism to assure full engagement with the stab-on connectors with the vertical bus.
7. Plug-in units shall be provided with interference type draw-out to prevent complete removal of the plug-in unit from the structure in one motion. The interference mechanism shall also provide clear indication when the plug-in unit has been withdrawn to the "TEST" position.
8. A mechanical interlock shall be supplied on all plug-in units to prevent insertion or removal of a unit from the structure when the unit operator handle is in the ON position. This interlock may not be defeated.
9. Each 12" tall and larger plug-in unit shall be secured in the structure by two (2) readily accessible devices, one of which is tool operated. These devices shall be located at the front of the unit.
10. Plug-in units with NEMA Type B or C wiring shall be supplied with unit terminal block mounted on the right-hand side of the unit, adjacent to the vertical wireway. The terminal blocks shall be mounted on a movable bracket that maintains the terminals inside the unit structure for normal operation and pivots into the vertical wireway exposing the terminals for wiring, test and maintenance.
11. All plug-in units shall include a positive means of grounding the unit to the structure at all times.

12. All units that need ventilation (VFD units, RVSS units) shall have a protective plate in front of the louvers to deflect material exiting the unit in case of an Arc Flash event.
13. The MCC unit disconnect operator for 600 ampere maximum units shall operate in a vertical, up-down, plane. High density units shall have horizontal motion. All unit disconnects shall remain engaged with the disconnect device at all times, regardless of the unit door position. The operating handles shall be interlocked with the unit door so that the door can neither be opened with the disconnect device in the ON position, nor can the disconnect device be turned ON with the unit door open except by operation of a def eater mechanism. Indication of the disconnect device shall be clearly indicated by the position of the operating handle. When applied with circuit breaker devices, the handle shall also provide clear indication of a circuit breaker trip.
14. When pilot lights, push buttons or sector switches are specified. The devices shall be mounted in a formed metal device panel that is capable of accepting four (4) such devices in any combination. The device panel shall be secured to the unit door for normal operation or mounted on the plug-in unit as required for unit removal and bench testing.
15. Pilot devices shall be *[22 mm in diameter, rated for NEMA 4 (IP 67) applications. Connections to 22 mm pilot devices shall be made to touch resistant screw type terminations. Pilot device contacts shall be rated at 10A, 600VAC (NEMA A600 Same Polarity).] [heavy duty, oil tight 30mm devices with a NEMA 4 rating. Pilot device contacts shall be rated at 10A, 600VAC (NEMA A600). The pilot device bodies shall be fabricated from metal.]*
16. Unit identification nameplate shall be provided for each unit. Nameplates shall be a black surface with white core. Engraving shall cut through the gray surface exposing white lettering of the unit designation. Nameplates shall be 1" tall by 3 1/2" wide. Adhesives or glues are not an acceptable means of mounting unit nameplates.

D. WIRING

1. The wiring shall be NEMA Class *[1] [2]*, Type *[A] [B] [C]*.

E. COMBINATION MOTOR STARTERS

1. The combination starters shall be full voltage, non-reversing and provided with a Siemens *[magnetic only circuit breaker] [fused disconnect]*, unless noted otherwise on the drawings.
  - a. Starters and disconnects shall be rated equal to or greater than the AIC rating of the gear.
2. Overload Protection
  - a. The overload protection shall be:
    - 1.) *[Bi-Metal Ambient compensated overload.]*
    - 2.) *[Self power ESP solid state overload relay with NEMA Class [10] [20] [30] trip curve.]*
3. Control Power
  - a. Each starter unit shall be provided with an encapsulated control power transformer of sufficient size to accommodate the contactor coil burden plus all specified auxiliary devices.

F. FEEDERS

1. Feeder disconnects shall be Siemens *[thermal-magnetic circuit breaker] [fused disconnect]*.

G. *[METERING EQUIPMENT*

1. *Provide a multi-function, high accuracy digital power metering instrumentation module equipped with LCD display. The power metering module shall provide simultaneous measurements for current, voltage and power parameters. Power meter shall be Siemens type [PAC3120] [PAC3220] [PAC4200] [9410] [9810] equipped with a communications port for standard RS-485 connection.]*

H. *[ARC FLASH]*

1. **[Labeling Delete one or both of the next 2 sentences on arc flash.]**
  - a. *[Apply in the field, the factory supplied arc flash warning label to all motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized to warn qualified persons of potential electrical arc flash hazards.]*
2. **[Dynamic Arc Flash Sentry [OPTIONAL]]**
  - a. *The main circuit breaker shall be a Siemens WL equipped with an ETU776 trip unit; field programmed with two trip curves. One curve shall be set to the levels determined by a coordination study. The second setting shall be set with instantaneous set down to a minimum acceptable level to trip the main rapidly on an arc flash event.*  
**[Delete one or both of the next 2 items.]**
    - 1.) *[The settings shall be adjusted via terminals for connecting a field installed motion sensor. A blue light shall illuminate on the front of the MCC to denote when Dynamic Arc Flash Sentry is on.]*
    - 2.) *[The settings shall be adjusted via a 2-position selector switch. A blue light shall illuminate on the front of the MCC to denote when Dynamic Arc Flash Sentry is on.]]*

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be per the manufacturer's recommendations, written instructions, final shop drawings, and contract documents. Installation shall be coordinated with adjacent work to ensure proper sequence of construction, clearances and support.
- B. The Motor Control Center shall not be placed in hazardous locations. The location shall be well ventilated and free from humidity, dust, and dirt. The temperature shall be no less than 32°F and no greater than 104°F. Protection shall be provided to prevent moisture from entering the enclosure.

### **3.2 TESTING**

- A. Perform factory and installation tests in accordance with applicable NEMA and UL requirements.

### **3.3 WARRANTY**

- A. Equipment manufacturer warrants that all goods supplied shall be free of non-conformities in workmanship and materials for one year from date of initial operation, and not more than eighteen months from date of shipment.

**END OF SECTION**