PROCUREMENT SPECIFICATION

Low Voltage NEMA Motor Control Centers

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PART 1 General

1.01 SCOPE

A. This section includes the requirements for 600 V class Low Voltage Motor Control Centers (MCCs) for use on alternating current power systems
B. The MCCs shall be furnished and installed as specified in this section and as shown on the contract drawings

1.02 RELATED SECTIONS

A. Section 26 28 00 Circuit Breakers and Fusible Switches
B. Section 26 29 13.13 Low Voltage Controllers - Across the Line Motor Controllers
C. Section 26 29 13.16 Low Voltage Controllers - Solid State Reduced Voltage Starters
D. Section 26 29 23 Variable Frequency Drives
E. Section 26 36 00 Automatic Transfer Switch
F. Section 26 43 13 Transient-voltage Suppression for Low-voltage Electrical Power Circuits

1.03 REFERENCES

A. The MCC shall meet or exceed the requirements within the following standards for MCCs.

1. NEMA ICS 18 - Industrial Control and Systems: Motor Control Centers
2. UL 845 - UL Standard for Safety for Motor Control Centers.
   NOTE: UL 845 is a harmonized standard consisting of:

   a) Underwriters Laboratories Inc. (UL) UL 845
   b) Association of Standardization and Certification (ANCE) NMX-J-353-ANCE-2006
   c) Canadian Standards Association (CSA) C22.2 No. 254-05

3. NFPA 70 - National Electrical Code

B. The MCC shall be designed, manufactured, and tested in facilities registered to ISO 9001

C. Arc Resistant or Arc Containing Low Voltage MCCs shall be tested, rated and labeled in accordance with the requirements of IEEE C37.20.7-2007 "IEEE Guide for Testing Metal-enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults".

1.04 DESIGN REQUIREMENTS

A. Provide MCC based upon applicable NEMA and UL standards and in accordance with the detailed contract specifications and drawings.
B. The manufacturer of the MCC shall also be the manufacturer of the across-the-line motor starters, across-the-line contactors, solid-state reduced voltage starters, and variable frequency drives. The use of third-party supply and assembly for these components in the motor control center is not acceptable and will be rejected.
C. The contractor shall confirm motor full-load amperage ratings and provide those to the MCC manufacturer to ensure proper sizing of the motor branch circuit and overload protection.

1.05 PRE-MANUFACTURE SUBMITTALS

A. Refer to Section [xx xx xx] for submittal procedures
B. Manufacturer Drawings

1. MCC elevations showing dimensional information including details such as, but not limited to, the following:

a) MCC height (less any removable lifting angles or eyes)
b) MCC width
c) MCC depth
d) Location of shipping splits

2. Structure descriptions showing the following:

a) Bus ratings
b) Enclosure ratings
c) Short-circuit withstand ratings
d) Other information as required for approval

3. Conduit locations
4. Required bus splices
5. Unit descriptions including starter sizes, circuit breaker frame sizes, circuit-breaker continuous ampere ratings, pilot devices, etc.
6. Nameplate information
7. Schematic wiring diagrams
8. Manufacturer drawings shall be provided in DWG format
9. Manufacturer drawings do not need to be stamped if a drawing schedule is provided that lists the drawing numbers, revision levels, and status of drawings (Preliminary, Approval, Final, etc.)

C. Product Data

1. Data sheets and publications on all major components including but not limited to the following

a) Motor starters
b) Overload relays
c) Circuit breaker and fuse information including time current characteristics
d) Control power transformers
e) Pilot devices
f) Relays

D. Specification Response

1. All clarifications and exceptions must be clearly identified

E. Installation Instructions

1. Provide a copy of the manufacturer's installation instructions that includes the following:

a) Receiving, handling, and storage instructions
b) General description for reading nameplate data, serial numbers, UL markings and short circuit ratings
c) Installation procedures including splicing procedures
d) Conduit and cable installation
e) Installing and removing plug-in units
f) Operation of operator handles and unit interlocks
g) Checklist before energizing
h) Procedure for energizing equipment
i) Maintenance procedures

1.06 FINAL SUBMITTALS

A. Refer to Section [xx xx xx] for the procedure on submittal of final documentation.
B. The contractor shall provide certification that the MCC has been installed in accordance with the manufacturer's instructions and with local codes and standards that govern MCC installations.
C. The contractor shall provide certification that all circuit breaker settings have been adjusted per field requirements.
D. The contractor shall provide certification that all power fuses have been selected and installed per field requirements.
E. The contractor shall provide certification that all solid-state motor overload settings have been adjusted per installed motor characteristics.
F. The contractor shall provide certification that all settings for solid state devices such as reduced voltage solid-state controllers and variable frequency drives have been adjusted per the specific application requirements.
G. The contractor shall provide certification that any timing devices have been properly adjusted.
H. Final Drawings

1. The manufacturer shall provide final drawings reflecting the "As-Shipped" state of the MCC documents previously submitted.
2. Manufacturer drawings shall be provided in DWG format.
3. Manufacturer drawings do not need to be stamped if a drawing schedule is provided that lists the drawing numbers, revision levels, and status of drawings (Preliminary, Approval, Final, etc)
4. The contractor shall be responsible for making any changes to the "As-Shipped" drawings from the manufacturer to reflect any field modifications.

I. Test reports indicating manufacturer's standard testing was performed.
J. Maintenance Data

1. MCC installation instructions
2. Installation/operation instructions for major components such as automatic transfer switch, circuit breakers, etc.
3. MCC spare parts listing and pricing

1.07 QUALITY ASSURANCE

A. The manufacturer of the MCC shall have a minimum of 35-years experience in the manufacturing and assembly of NEMA low-voltage motor control centers.
B. The manufacturer shall have ISO 9001 registered facilities for the design, manufacture and testing of MCCs.
C. MCC sections and individual MCC units shall be designed and manufactured in accordance with UL 845 requirements.
D. MCC sections and individual MCC units shall be UL listed, where possible.

1.08 REGULATORY REQUIREMENTS

A. Contractor shall ensure that the installation conforms to the requirements of the latest edition of the NFPA 70 ‘National Electrical Code’ and/or other applicable installation standards.

1.09 DELIVERY, STORAGE, AND HANDLING

A. The contractor shall coordinate the shipping splits with the MCC manufacturer for entry into the building.
B. Shipping splits shall be noted on the MCC manufacturer drawings.
C. The contractor shall store the MCCs in a clean, dry and heated space.
D. The contractor shall protect the units from dirt, water, construction debris and traffic.
E. During storage the contractor shall connect internal space heaters (if specified) with temporary power.
F. MCCs are to be shipped with external lifting angles at the top and running continuously for each shipping split. Lifting eyelets are not acceptable.

1.10 ENVIRONMENTAL REQUIREMENTS

A. The MCC enclosure rating shall be appropriate for the environment where the MCC is to be located.

1.11 FIELD MEASUREMENTS

A. The contractor shall verify all field measurements prior to the fabrication of the MCC.

1.12 WARRANTY

A. The manufacturer shall provide their standard parts warranty for 18 months from the date of shipment or 12 months from the date of being energized, whichever occurs first.
B. The manufacturer shall confirm this warranty as part of the submittal.

1.13 SPARE MATERIALS

A. The contractor shall review the manufacturer's recommended spare parts list and discuss it with the owner to determine requirements for spare parts.
B. The contractor is to provide the quotation for spare parts to the owner.

PART 2 Motor Control Center Specifications

2.01 MANUFACTURERS

A. MCCs shall be Allen-Bradley® CENTERLINE® 2100

2.02 RATINGS

A. The MCC shall be rated for the system voltage as indicated on the contract drawings.
B. The MCC horizontal and vertical power bus bracing shall be rated to meet or exceed the available fault current as shown on the contract drawings, but shall not be less than 42,000 A rms symmetrical.
C. All MCC units shall have a full rated short-circuit rating that meets or exceeds the available fault current as shown on the contract drawings.

    1. The use of series short-circuit ratings shall be permitted only for panelboards; series short-circuit ratings for other types of units is not acceptable.

D. All circuit breakers used in the motor control center shall have full-rated short-circuit interrupting ratings based on the applied MCC voltage.

    1. Slash rated short-circuit interrupting ratings for circuit breakers are not acceptable except for branch circuit breakers in panelboards, and then only if the power system specified in the contract drawings is a Wye with a solidly grounded neutral.

E. The MCC shall provide **[Type 1] [Type 2]** Accessibility as defined by IEEE C37.20.9-2007 'IEEE Guide for Testing Metal-enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults'.

2.03 ENCLOSURE

A. The MCC enclosure shall be NEMA Type **[1] [1 with gasket around perimeter of doors] [12] [3R, non-walk-in] [4, non-walk-in, with stainless steel outer enclosure]**.
B. Each section shall be equipped with two full metal side sheets to isolate each vertical section and to help reduce the likelihood of fault propagation between sections.
C. All interior and exterior surfaces shall be painted ANSI 49 medium light gray. The vertical wireways and unit back plates shall be painted high visibility gloss white.
D. All unpainted parts shall be plated for corrosion resistance.
E. Removable closing plates on each end of the MCC shall cover all horizontal bus and horizontal wireway openings.

F. Insulating sheets shall be provided on the inside of end closing plates for horizontal bus openings to help prevent burn-through of the end closing plate in the event that an internal arcing fault occurs in the horizontal bus compartment.

2.04 STRUCTURE

A. The MCC shall be of dead front construction and shall consist of one or more vertical sections bolted together to form a rigid, free-standing assembly. The systems shall be designed to allow for the addition of future sections at either end and to permit the interchanging of units.

B. Vertical sections shall be rigid, free-standing structures.

1. Vertical sections shall have internal mounting angles running continuously within the shipping block.
2. An external mounting channel that is required to maintain structure integrity is not acceptable.
3. Vertical sections shall be 90 in. high, **[15]** or **[20]** in. deep and 20 in. Wide, except where larger dimensions are required.
4. 71 in. high, reduced height sections shall be provided, if specified on the contract drawings.
5. Vertical sections shall be provided with a removable steel lifting angle on all shipping blocks. The angle shall run the length of the shipping block.
6. Lifting eyes are not acceptable.
7. Each standard section shall be capable of being subdivided into 12 usable, unit spaces.
8. Two unit spaces shall constitute one space factor and shall be 13 in. in height.
9. One unit space shall constitute one-half space factor and shall be 6.5 in. in height.

C. C. Horizontal wireways

1. Horizontal wireways shall be located at the top and bottom of the MCC.
2. Horizontal wireways shall be 6 in. in height and extend the full depth of the vertical section to allow maximum flexibility in locating conduit for MCC feeds and loads.

    a) Pull-boxes to extend the height of the top horizontal wireway by 12 in. shall be provided, if specified on the contract drawings.

3. Horizontal wireways shall be continuous across the length of the MCC, except where access needs to be denied due to electrical isolation requirements.
4. The horizontal wireways shall be isolated from the power bus.
5. The horizontal wireways shall have removable covers held in place by captive screws.

D. Provide a full height vertical wireway, independent of the plug-in units, in each standard vertical section.

1. The vertical wireway shall be isolated from the vertical and horizontal buses.
2. The vertical wireway shall be covered with a hinged and secured door.
3. Wireway tie bars shall be provided.
4. Isolation between the wireway and units shall be provided.
5. Vertical wireway doors shall be provided with arc resistant latches to help keep the door latched in the event that an internal arcing fault occurs.

2.05 BUS BARS

A. Horizontal Power Bus

1. The horizontal bus shall be rated as shown on the drawings.
2. The horizontal bus material shall be copper with tin plating.
3. The horizontal bus shall be supported, braced and isolated from the vertical bus with a high strength, non-conductive, non-tracking, glass polyester material.
4. For standard sections the horizontal bus shall be continuous within each shipping block and shall be braced within each section
5. Horizontal bus splices shall have at least two bolts on each side.

B. Vertical Bus

1. The vertical power bus shall have an effective rating of 600 A. If a center horizontal bus construction is utilized, then the rating shall be 300 A above and below the horizontal bus for an effective rating of 600 A. If a top or bottom mounted horizontal bus is utilized, then the full bus must be rated for 600 A.
2. The vertical bus material shall be copper with tin plating.
3. The vertical bus shall attach to the horizontal bus with at least two bolts.
4. The vertical bus shall be continuously braced by a high strength, non-conductive, non-tracking, glass-filled polyester material and isolated from the unit spaces by a non-conductive, polycarbonate molded cover.
5. The vertical bus shall be isolated from the horizontal power bus except where necessary to connect the vertical power bus to the horizontal power bus.
6. Automatic shutters shall cover plug-in stab openings when units are removed.

C. Ground Bus

1. Provide a ground bus system consisting of a horizontal ground bus connected to vertical ground buses mounted in each section.
2. Provide an **[unplated] [tin-plated]** copper (0.25 x 1 in. or 0.25 x 2 in.) horizontal ground bus mounted in the bottom of the MCC unless otherwise specified in the drawings.
3. Provide a pressure-type mechanical lug mounted on the ground bus in the incoming line section.
4. Provide a unit ground stab on all unit inserts. The ground stab shall establish unit insert grounding to the vertical ground bus before the plug-in power stabs engage the power bus. The grounding shall be maintained until after the plug-in power stabs are disengaged.

The following two specification points are required only if a unit load ground bus is required. The vertical load ground bus provides a means to terminate incoming unit ground cables at the unit. This avoids wastage associated with power conductors when using multi-conductor cable when only a horizontal ground bus is provided, because extra cable must be pulled in order to be able to connect the ground conductor to the horizontal ground bus.
Delete if a unit load ground bus is not required.

5. Provide a copper vertical-unit load ground bus in each section that can accommodate plug-in units.
6. Provide a unit load connector on all units that require load wire connections. The load connector shall provide a termination point for the load ground conductor at the unit.

D. Neutral Bus

1. In a 4-wire system with a main incoming device rated 400 A or less, if there are no neutral loads in the MCC, an incoming neutral termination plate in the MCC main device unit is acceptable in lieu of a horizontal neutral bus.
2. In a 4-wire system with a main incoming device rated more than 400 A, if there are no neutral loads in the MCC, an incoming neutral termination plate in the MCC main device unit connected to horizontal neutral bus in the section with the main is acceptable.
3. If neutral loads are specified within the MCC, provide neutral connection plates in sections with horizontal neutral bus as indicated on the contract drawings.

4. Horizontal neutral bus shall be provided in **[main incoming section only] [main incoming and adjacent sections as specified on the contract drawings] [all sections]**.
5. Neutral bus rating shall be **[same as] [half of]** the horizontal power bus rating.

2.06 ETHERNET/IP COMMUNICATION

A. The MCC shall have Ethernet wiring incorporated into its design.

1. The MCC shall have Ethernet cabling incorporated throughout the vertical section.
2. Each motor starter, AC drive and soft starter unit in the MCC shall be supplied with a means to communicate via EtherNet/IP network.

B. Ethernet Cabling

1. Ethernet Cable Ratings

a) The Ethernet cable shall be 600V UL PLTC rated.
b) The use of a 300V rated cable is not acceptable

2. Layout

a) Cable shall connect each section to one another in the top or bottom wireways.
b) Ethernet cable through the MCC section shall be routed from the top or bottom wireways. To prevent accidental mechanical damage during MCC installation, the cable shall be located behind barriers to isolate the cable from the unit space and wireways.
c) Eight Ethernet ports shall be provided in the rear of each vertical wireway of standard sections to simplify installation, relocation, and addition of plug-in units.
d) The EtherNet/IP device within each unit shall be factory connected to an Ethernet port in the vertical wireway by using a 600V-rated Ethernet cable.

3. Power Supplies

a) The power supply shall provide 24V DC for the devices that require it.
b) The MCC manufacturer shall check the user's design to ensure that adequate power supplies have been specified to conform with network requirements.
c) Power supply output shall be rated 8 A, 24V DC.
d) The power supply shall be Allen-Bradley Bulletin 1606-XLSDNET8 or approved equal.
e) The power supply unit shall be provided with a buffer module to provide a minimum of 500 ms ride-through at full load.
f) The buffer module shall be Allen-Bradley Bulletin 1606-XLBUFFER or approved equal.

C. EtherNet/IP Interface for Motor Starter Units

1. Motor starter units shall have an electronic overload relay that incorporates the following features:

a) Built-in EtherNet/IP communication
b) LEDs for status indication

c) Test/Reset button
d) Selectable trip of NEMA Class 5 to 30. Unless indicated, the trip class shall be set for NEMA Class 20 operation
e) Four inputs and two outputs. Refer to the contract drawings for connection requirements
f) Protective functions

i. Functions shall provide a programmable trip level, warning level, time delay, and inhibit window.
ii. Protective functions shall include Thermal overload, Phase loss, Stall, Jam, Underload, Current imbalance, Remote trip, and PTC thermistor input.
iii. Ground fault protection **[is] [is not]** required.

a. If ground fault protection is required, the protection range shall be 1 A to 5 A for NEMA Size 3 and smaller starters, and 20 mA to 5 A for NEMA Size 4 and larger starters.

g) Current monitoring functions shall include phase current, average current, full load current, current imbalance percent, percent thermal capacity utilized, and ground fault current (if required).
h) Voltage, energy, and frequency measuring capabilities shall be included.
i) Diagnostic information shall include device status, warning status, time to reset, trip status, time to overload trip, and history of last five trips.
j) Preventative maintenance information shall include Allowable starts per hour, required Time between starts, Starts counter, Starts available, Time until next start, total operating hours, and elapsed operating time.
k) Overload relay shall include an on-board logic processor to allow basic logic to be performed within the overload relay based on network data and the status of the inputs to the overload relay.
l) The overload relay shall support the following CIP messaging types: Polled I/O messaging, Change-of-state/cyclic messaging, Explicit messaging, Group 4 offline node recovery messaging, and Unconnected Message Manager (UCMM).
m) The overload relay shall provide the following functions to minimize network configuration time: Full parameter object support, Configuration consistency value, and Add-on Profile.

2. The overload relay shall be Allen-Bradley 193-EC2/592-EC2, 193-EC3/592-EC3, or 193-EC5/592-EC5 ‘E3 Plus’ models or approved equal.

D. EtherNet/IP Interface for Variable Frequency AC Drives and Solid-State Reduced Voltage Motor Controllers

1. The EtherNet/IP communication interface shall be supplied to allow for communication between the solid-state component and the Ethernet network.

E. EtherNet/IP Interface for Other Units

1. Provide a EtherNet/IP interface for other units as indicated on the contract drawings.
2. Refer to the contract drawing wiring diagrams for points to be monitored.

F. Programming and Testing

1. The MCC manufacturer shall load the IP Address into each unit.
2. The IP Address shall be as indicated on the contract drawings or as provided by the contractor.
3. The MCC manufacturer shall test the MCC to ensure that each unit communicates properly prior to shipment.
4. Each unit shall have a label showing the IP Address for the devices within it.
5. The MCC manufacturer shall provide a disk containing applicable electronic data sheet (EDS) files for the EtherNet/IP devices.

2.07 DEVICENET COMMUNICATION

A. The MCC shall have DeviceNet wiring incorporated into its design.

1. The MCC shall have DeviceNet cabling incorporated throughout the vertical section.
2. Each motor starter, AC drive and soft starter unit in the MCC shall be supplied with a means to communicate via the DeviceNet network.

B. DeviceNet Cabling

1. DeviceNet Cable Ratings

a) The DeviceNet cable shall be in compliance with Article 300.3(C)(1) of the National Electrical Code, 2005.
b) The insulating rating shall be equal to at least the maximum circuit voltage applied to any conductor within the enclosure or raceway.
c) No special separation, barriers or internal conduit shall be required for the DeviceNet conductors.
d) The trunk line cable shall be flat cable rated 8 A, 600V, Class 1.
e) The drop cable used to connect a unit to a DeviceNet port in the vertical wireway shall be round cable rated 8 A, 600V, Class 1.
f) The use of a Class II network is not acceptable.

2. Layout

a) A DeviceNet trunk line shall be routed through the MCC lineup. To prevent accidental mechanical damage during MCC installation, the trunk line shall be located behind barriers to isolate the trunk line from the unit space and wireways.
b) Six DeviceNet ports shall be provided in the rear of each vertical wireway of standard sections to simplify installation, relocation, and addition of plug-in units.
c) Dual port connectors shall be provided when more than six DeviceNet unit connections are required in an MCC section.
d) The DeviceNet device within each unit shall be factory connected to a DeviceNet port.

3. Power Supplies

a) All power supplies shall be ODVA approved for the DeviceNet network.
b) The power supply shall provide 24V DC for the DeviceNet system and shall be rated no less than 8 A.

c) The power supply for the MCC DeviceNet system shall be supplied as a separate plug-in unit.
d) The MCC manufacturer shall check the user's design to ensure that adequate power supplies have been specified to conform with DeviceNet requirements.
e) The power supply output shall be rated 8 A, 24V DC.
f) The power supply shall be Allen-Bradley Bulletin 1606-XLSDNET8 or approved equal.
g) The power supply unit shall be provided with a buffer module to provide a minimum of 500 ms ride-through at full load.
h) The buffer module shall be Allen-Bradley Bulletin 1606-XLBUFFER or approved equal.

C. DeviceNet Interface for Motor Starter Units

1. Motor starter units shall have an electronic overload relay that incorporates the following features:

a) Built-in DeviceNet communication
b) LEDs for status indication
c) Test/Reset button
d) Selectable trip of NEMA Class 5 to 30. Unless indicated, the trip class shall be set for NEMA Class 20 operation
e) Four inputs and two outputs. Refer to the contract drawings for connection requirements
f) Protective functions

i. Functions shall provide a programmable trip level, warning level, time delay, and inhibit window.
ii. Protective functions shall include Thermal overload, Phase loss, Stall, Jam, Underload, Current imbalance, Remote trip, and PTC thermistor input.
iii. Ground fault protection **[is] [is not]** required.

a. If ground fault protection is required, protection range shall be 1 A to 5 A for NEMA Size 3 and smaller starters, and 20 mA to 5 A for NEMA Size 4 and larger starters.

g) Current monitoring functions shall include phase current, average current, full load current, current imbalance percent, percent thermal capacity utilized, and ground fault current (if required)
h) Voltage, energy, and frequency measuring capabilities shall be included
i) Diagnostic information shall include device status, warning status, time to reset, trip status, time to overload trip, and history of last five trips
j) Preventative maintenance information shall include Allowable starts per hour, required Time between starts, Starts counter, Starts available, Time until next start, total operating hours, and elapsed operating time
k) Overload relay shall include an on-board logic processor to allow basic logic to be performed within the overload relay based on network data and the status of the inputs to the overload relay
l) The overload relay shall support the following DeviceNet messaging types: Polled I/O messaging, Change-of-state/cyclic messaging, Explicit messaging, Group 4 off-line node recovery messaging, and Unconnected Message Manager (UCMM)

m) The overload relay shall provide the following functions to minimize network configuration time: Full parameter object support, Auto-baud rate identification, Configuration consistency value, and Automatic Device Replacement (ADR)

2. The overload relay shall be Allen-Bradley 193-EC2/592-EC2, 193-EC3/592-EC3, or 193-EC5/592-EC5 ‘E3 Plus’ models or approved equal.

D. DeviceNet Interface for Variable Frequency AC Drives and Solid-state Reduced Voltage Motor Controllers

1. The DeviceNet communication interface shall be supplied to allow for communication between the solid-state component and the DeviceNet system.

E. DeviceNet Interface for Other Units

1. Provide a DeviceNet interface for other units as indicated on the contract drawings.
2. The DeviceNet interface shall have four inputs and two outputs.
3. Refer to the contract drawing wiring diagrams for points to be monitored.
4. The DeviceNet interface shall include an on-board logic processor to allow basic logic to be performed within the interface based on network data and the status of the inputs to the overload relay.
5. The DeviceNet interface shall be Allen-Bradley Bulletin 100-DNY "DeviceNet Starter Auxiliary™ (DSA) Module" or approved equal.

F. Programming and Testing

1. The MCC manufacturer shall load the DeviceNet MAC ID number (node address) into each unit.
2. The DeviceNet MAC ID number shall be as indicated on the contract drawings or as provided by the contractor.
3. The DeviceNet network shall be designed and programmed for use at 250 kB or 500 kB.
4. The MCC manufacturer shall test the MCC to ensure that each unit communicates properly prior to shipment.
5. Each DeviceNet device shall have a label showing the unit location, node address, and communication rate.
6. The MCC manufacturer shall provide a disk containing applicable electronic data sheet (EDS) files for the DeviceNet devices.

2.08 UNIT INFORMATION

A. The minimum compartment height shall be 6.5 in. and this shall be considered one-half space factor.
B. NEMA Size 5 FVNR starters and below shall be provided as plug-in units.
C. Plug-in units

1. Plug-in units shall consist of a unit assembly, unit support pan and unit door assembly.
2. Units shall be supplied with removable doors. The unit doors shall be fastened to the structure so that the doors can be closed when the unit is removed.
3. A unit support pan shall be provided for support and guiding units. Unit support pans shall remain in the structure when units are removed to provide isolation between units.

4. A service position shall be provided for plug-in units that allows for the unit to be supported, but disengaged from the bus. The unit shall be capable of being padlocked in the service position. This position is to be used to isolate a unit from the bus to allow service to be performed on the connected load equipment.

D. Power Stabs

1. Unit stabs for engaging the power bus shall be tin-plated copper and provided with stainless back-up springs to provide and maintain a high pressure 4-point connection to the vertical bus.
2. Wiring from the unit disconnecting means to the plug-in stabs shall not be exposed on the rear of the unit. A separate isolated pathway shall be provided for each phase to minimize the possibility of unit fault conditions reaching the power bus system.
3. The power cable termination at the plug-in stab shall be a maintenance-free crimp type connection.

E. Withdrawable Power Stabs

1. Plug-in units shall have the capacity of withdrawing the power stabs, allowing the primary voltage to be disconnected with the unit door closed.
2. The withdrawable assembly shall accept a standard 1/4" hex-style drive socket.

    a) A complete power engagement shall occur when turning the mechanism ¼ turn in clockwise direction.
    b) Complete power disengagement shall occur when turning the mechanism ¼ turn in counter-clockwise direction.

3. The withdrawable stabs design shall include a set of stab assembly-mounted shutters.

    a) The shutters shall automatically open before the power stabs can extend and connect to the vertical bus.
    b) The shutters shall close as soon as the power stabs are disconnected from the vertical bus and are completely inside the stab housing.

4. The withdrawable stabs design shall include interlock mechanisms.

    a) The through-the-door mechanism shall allow the unit to be locked in the “Power Stabs Disconnected” position.

        i. This mechanism shall be such that it can be padlocked to prevent the connection of the stabs to the vertical bus even when the unit is inserted into the vertical section.
        ii. The unit door shall be capable of opening with the padlock and lockout engaged.

    b) The unit disconnect handle must be in the OFF position (load side of the disconnect device removed from line power) before the stabs can be disconnected from the vertical bus.

        i. This mechanism shall also allow the removal of the unit from the vertical section but only after the disconnect handle has been turned OFF and the power stabs have been disconnected from the vertical bus.

ii. The unit stabs have to be disconnected (withdrawn) before the unit can be re-inserted into the vertical section.

5. The withdrawable stabs design shall include feedback mechanisms that are verifiable with the unit door closed.

   a) A two-position indication system shall be provided (Power Stabs Connected/Disconnected) and shall be visible from the door.

      i. Connected with Red Indication–Primary voltage stabs fully engaged and connected to the vertical bus.
      ii. Disconnected with Green Indication–Primary voltage stabs fully disconnected from the vertical bus.

   b) A set of probes shall be located on the front of the unit.

      i. Power stabs position: a positive continuity check between these probes shall verify that all three power stabs have been disconnected from the vertical bus and completely withdrawn inside the stabs housing.
      ii. Stab-mounted shutters position: a positive continuity check between these probes shall verify that the shutters are closed, meaning that all three power stabs have been disconnected and withdrawn inside the stab housing.

6. The withdrawable power stabs with door closed mechanism shall not increase the original unit height design so total space in the motor control center is optimized.
7. A remote operating device shall be supplied to allow the connection and disconnection of the power stabs with the door closed.

   a) The minimum distance shall be not less than three times the minimum default value recommended by the NFPA 70E (Arc Flash Protection Boundary–Annex D).

F. Disconnect Handle

1. Plug-in units shall be provided with a heavy-duty, non-conductive, industrial duty, flange mounted handle mechanism for control of each disconnect switch or circuit breaker.
2. Use of rotary operators is not acceptable
3. The disconnect handle may pivot in the vertical or horizontal plane.
4. The on-off condition shall be indicated by the handle position, red and green color indicators with the words ON and OFF, and the international symbols 1 and O along with a pictorial indication of the handle position.
5. Handles shall be capable of being locked in the OFF position with up to three padlocks.
6. Plug-in units shall be provided with interlocks per NEMA and UL requirements. Interlocks shall be provided for the following:

   a) Prevention of unit insertion or withdrawal with the disconnect in the ON position
   b) Prevention of the unit door from being opened when the disconnect is in the ON position.

      i. A feature for intentionally defeating this interlock by qualified personnel shall be provided

c) Prevention of the disconnect switch from being moved to the ON position if the unit door is open.

i. A feature for intentionally defeating this interlock by qualified personnel shall be provided

G. Pilot Devices

1. Where specified, units shall be furnished with pushbuttons, selector switches or pilot lights as shown on the contract drawings.
2. Pilot devices shall be rated NEMA Type 4/13 water tight/oil tight.
3. For units with vertically operated disconnect handles:

a) When three or less pilot devices are utilized, they shall be Allen-Bradley Bulletin 800T or 800H 30.5mm devices or approved equal.
b) When more than three devices are required, the use of Allen-Bradley Bulletin 800F 22.5mm devices (or approved equal) is permitted.

4. For units with horizontally operated disconnect handles:

a) The devices shall be Allen-Bradley Bulletin 800F.

H. Terminal Blocks

1. Control terminal blocks shall be provided on all contactor and starter units.
   a) Control terminal blocks shall be a pull-apart design on all plug-in units for easy removal of the unit from the structure.
2. Control terminal blocks on non-plug-in contactor and starter units shall be fixed type.
3. Power terminal blocks shall be provided on all contactor and starter units, rated NEMA size 3 (100 A) and below that utilize vertically operated disconnects.
   a) Power terminal blocks shall be pull-apart for NEMA size 1 and 2 (30 A and 60 A contactors).
   b) Power terminal blocks for NEMA size 3 starters (100 A contactors) shall be non-pull-apart.
4. Terminal blocks shall not be located adjacent to or inside the vertical wireway.

I. Doors

1. Each unit shall be provided with a removable door mounted on removable pin-type hinges.
2. The unit doors shall be capable of being opened at least 110 degrees.
3. The unit doors shall be removable from any location in the MCC without disturbing any other unit doors.
4. The unit door shall be fastened to the structure so it can be closed to cover the unit space when the unit is removed.
5. The unit doors shall be held closed with quarter-turn latches.
6. Unit door latches shall be provided with arc resistant latches to help keep the door latched in the event that an internal arcing fault occurs.

2.09 METERING COMPARTMENT

A. The MCC shall include a plug-in metering unit
B. The unit shall include the following

1. Fusible disconnect with fuses

a) The disconnect must be operable with the unit door closed.

2. Fused control circuit transformer
3. Current transformers shipped loose to be installed by the contractor onto incoming power conductors
4. Solid-state power monitor with door mounted display

C. Power Monitor

1. The power monitor shall be capable of displaying the following:

a) Line current for all three phases with plus or minus 0.2 percent full-scale accuracy
b) Average three phase current with plus or minus 0.2 percent full-scale accuracy
c) Line-to-neutral and line-to-line voltage with plus or minus 0.2 percent of full-scale accuracy
d) Current and voltage unbalance
e) Real, reactive, apparent and true power with plus or minus 0.4 percent full-scale accuracy
f) KWh, KVARh and kVAHnet
g) True RMS to the 45th harmonic
h) Frequency at plus or minus 0.5%
i) Power factor at plus or minus 0.4%

2. The power monitor shall include min/max logs and trend logs with up to 45,867 data points.
3. The power monitor shall be capable of performing distortion analysis with THD, Crest Factor (I, V) and Distortion power factor.
4. The power monitor shall include a RS-485 communication port as standard and shall include **[DeviceNet] [EtherNet/IP] [ControlNet] [Remote I/O] [RS-232] [no additional**] communication capability.
5. The power monitor shall include two form-C relays.
6. The power monitor shall be Allen-Bradley Powermonitor 3000 or approved equal.

2.10 DISCONNECTS

A. Main Disconnect

1. If no overcurrent protection is indicated, provide a main incoming-line lug compartment.

a) Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by **[contractor] [MCC Manufacturer]**.

2. Main Fusible Disconnect Switch (if specified in contract drawings)

a) Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by the MCC manufacturer.
b) Power fuses to be provided by **[contractor] [MCC manufacturer]**.
c) Size fuses as shown on the drawings. Provide **[Class J] [Class R]** fuses through 600 A. Provide Class L fuses above 600 A.
d) Provide a removable protective barrier to reduce the possibility of contact with the line terminals.
e) Provide one normally open and one normally closed auxiliary contact.

3. Main Circuit Breaker Disconnect (if specified in contract drawings)

a) Lugs to accommodate the incoming power conductors as indicated on the contract drawings shall be provided by the MCC manufacturer.
b) Size the circuit breaker frame and trip rating as shown on the drawings.
c) The interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings

i. Interrupting capacity based on a slash rating is not acceptable.

d) Provide a circuit breaker with thermal magnetic trip unit for 400A and smaller frames; provide electronic trip unit for 600A and larger frames.
e) Provide a removable protective barrier to reduce the possibility of contact with the line terminals.
f) Provide one normally open and one normally closed circuit breaker auxiliary contact that follows the position of the circuit breaker main contacts for indication of “On” or “Off/Tripped”.
g) For circuit breakers rated 1000 A and above, on Wye connected systems with a solidly grounded neutral, provide integrated ground fault protection with adjustable pick-up and adjustable time delay.

B. Feeder Disconnects and Transformer Disconnects

1. The disconnecting means for feeders and transformers shall be circuit breakers with thermal-magnetic trip units for 400 A and smaller frames; provide ann electronic trip unit for 600 A and larger frames.
2. The interrupting capacity rating shall meet or exceed the available fault current as shown on the contract drawings.

a) Interrupting capacity based on a slash rating is not acceptable.

3. The minimum frame size shall be 150 A.
4. Provide one normally open and one normally closed circuit breaker auxiliary contact which follows the position of the circuit breaker main contacts for indication of “On” or “Off/Tripped”.

C. Motor Starter Disconnect

1. Electro-mechanical NEMA starters:

a) The disconnecting means for the across the line starters shall be motor circuit protectors.

b) The unit short circuit rating shall be greater than or equal to the available fault current as shown on the contract drawings.
c) Units shall be supplied based upon the rules/requirements set forth in the UL 845, NEMA ICS-18, and NFPA 70.
d) Units shall be shipped as the motor circuit protector set at lowest setting per UL standards. The contractor shall field adjust the units based upon the particular motor application.
e) The minimum frame size shall be 150 A.
f) Provide one normally open and one normally closed circuit breaker auxiliary contact that follows the position of the circuit breaker main contacts for indication of “On” or “Off/Tripped”.

2. Solid State Controllers (solid-state reduced voltage motor controllers and variable frequency drives)

a) The disconnecting means for solid-state controllers shall be a fusible disconnect with current limiting fuses.
b) The short circuit rating shall be 100,000 A (rms symmetrical).

2.11 AUTOMATIC TRANSFER SWITCH

A. Provide an automatic transfer switch if indicated on the contract drawings.
B. Provide the automatic transfer switch in compliance with the automatic transfer switch specification. Refer to section 26 36 00.
C. The automatic transfer switch shall be provided integral to the MCC and connected as indicated on the contract drawings.

2.12 COMBINATION NEMA RATED ACROSS THE LINE STARTERS

A. Starters shall meet applicable NEMA and UL requirements.
B. Starters shall be minimum NEMA Size 1.

1. Fractional NEMA sizes are not acceptable.

C. The motor starter shall be Allen-Bradley Bulletin 500 or 300 or approved equal.
D. Starters shall be provided with a 3-pole solid state overload relay that includes the following features:

1. If EtherNet/IP communication is required, refer to the part of this section titled ‘EtherNet/IP Interface for Motor Starter Units’, which takes precedence over this overload relay requirement.
2. If DeviceNet communication is required, refer to the part of this section titled ‘DeviceNet Interface for Motor Starter Units’, which takes precedence over this overload relay requirement.
3. Selectable trip classes of 10, 15, 20, or 30.
4. Set for class 20 unless otherwise indicated on the contract drawings.
5. Overload protection.
6. Phase loss protection.
7. Trip current adjustment range of 5:1.
8. Visual trip status indication.
9. Test/Reset button.

10. Bipolar latching relay with one normally open and one normally closed contact, rated NEMA B600 for use in motor contactor control circuits.
11. Thermal memory circuit to model the heating and cooling effects of motor on and off periods.
12. **[Jam] [Ground Fault] [Ground Fault and Jam] [no additional]** protection shall be provided.
13. If ground fault protection is required, it shall have a selectable trip value between 20 mA and 5 A.
14. The overload relay shall be Allen-Bradley 193-EE or 592-EE "E1 Plus".

E. In addition to the hold-in contact, starters shall be provided with **[one normally open and one normally closed auxiliary contact] [auxiliary contacts shown on the contract drawing wiring diagrams]**. The starter shall be capable of accommodating up to six contact in addition to the hold-in contact.
F. Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.
G. Overload relays shall have a reset button located on the outside of the unit door.
H. Provide a door mounted selector switch for Hand-Off-Auto operation. The Hand mode shall provide local control at the MCC unit door. In the Auto mode, control shall be provided through a remote contact.
I. Provide door mounted 120V AC **[push-to-test] [non-push-to-test]** pilot lights with **[incandescent] [LED]** lamps for On **[Red]** and Off **[Green]** status indication.

2.13 SOLID-STATE REDUCED VOLTAGE MOTOR CONTROLLERS (SSRV)

A. Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.

Choose one of the following two paragraphs depending on the type of SSRV required

B. The controller shall be Allen-Bradley SMC Flex and shall include the following features:

1. Integrated bypass contactor that is closed once the motor is up to full speed
2. Electronic overload protection with adjustable trip class
3. Four programmable auxiliary contacts
4. Selectable control capabilities: soft start, kickstart, current limit start, dual ramp, full voltage, linear speed, preset slow speed, soft stop
5. Additional control capabilities: **[Pump Control] [Braking control selectable - SMB™ Smart Motor Braking, Accu-Stop™, Slow Speed with Braking] [none required]**
6. LCD display
7. Keypad programming for configuration
8. Built-in, selectable protective functions for: overload, jam, stall, excessive starts per hour, underload, over/under voltage, voltage unbalance
9. Metering capabilities for: current, voltage, kW, kWH, power factor, motor thermal capacity utilized, elapsed time
10. Ground fault protection (1 A to 5 A) **[required] [not required]**

C. The controller shall be Allen-Bradley SMC-3 and shall include the following features:

1. Integrated bypass contactor that is closed once the motor is up to full speed
2. Electronic overload protection with adjustable trip class

3. Selectable control capabilities: soft start, kickstart, current limit start, soft stop
4. Built-in, selectable protective functions for: Overload, Phase Reversal, Phase Loss/Open Load, Phase Imbalance, Shorted SCR, SCR Over temperature

D. Provide an input isolation contactor.
E. The SMC unit shall be provided with line side protective modules. The modules shall contain capacitors and metal oxide varistors (MOVs) that protect the internal power circuitry from severe electrical transients and/or high electrical noise.
F. Provide door-mounted pilot devices as shown on the contract drawing wiring diagrams.
G. Provide door-mounted 120V AC **[push-to-test] [non-push-to-test]** pilot lights with **[incandescent] [LED]** lamps for On **[Red]** and Off **[Green]** status indication.
H. Emergency run bypass contactor **[is] [is not]** required.

1. If required, emergency run bypass shall be fully rated for the motor load and be capable of starting the motor at full voltage. The emergency run bypass shall be provided with the same type of solid-state overload relay protection as for the electromechanical starter units.

2.14 VARIABLE FREQUENCY DRIVES

A. Refer to section 26 29 23 for specifications.
B. Variable frequency drives shall be Allen-Bradley PowerFlex® 40, 70, 700 or 753.
C. Provide a control power transformer with a rated secondary voltage of 120V AC. The control power transformer shall be provided with primary and secondary fusing.
D. Provide door-mounted pilot devices per the contract drawing wiring diagrams.
E. Provide door-mounted 120V AC **[push-to-test] [non-push-to-test]** pilot lights with **[incandescent] [LED]** lamps for On **[Red]** and At-Speed **[White]** status indication.
F. Provide a door-mounted human interface module for programming, display and control.
G. Provide one isolated, configurable analog input and output.

Include the following paragraph for any drives required to be 18-pulse:

H. For 18-pulse applications, the drive unit shall conform to the following:

1. Meets IEEE519-1992 at the drive input terminals
2. UL/cUL listed
3. Continuous horizontal power bus
4. Allow splicing to other CENTERLINE 2100 MCC sections
5. Utilize patented 18 Pulse converter bridge and phase-shifting autotransformer

Include the following paragraph for any drives required to be provided with manual, isolated bypass to allow a load to run at full voltage/full-speed while servicing the drive:

I. Manual isolated drive bypass applications shall conform to the following:

1. Design Overview

a) The manual isolated drive bypass unit will consist of two units: an MCC bypass starter unit and an MCC variable frequency drive (VFD) unit. The intent of the manual isolated drive bypass unit is to isolate the variable frequency AC drive for servicing. When in Bypass mode, the MCC VFD unit shall meet NFPA 70E Hazard/Risk level 0. The MCC VFD unit door shall be interlocked with the MCC

bypass starter unit. When in the Bypass mode, the motor can be energized and de-energized with the across-the-line bypass starter.

b) All power components shall have a normal duty rating suitable for the nominal horsepower of the application.

c) MCC Bypass Starter Unit

i. The MCC bypass starter unit shall include the fusible disconnect or circuit breaker, the bypass contactor and overload relay, control circuit transformer and terminal blocks. “DRIVE ON” and “BYPASS ON” pilot lights shall be provided to indicate operational status.

d) MCC VFD Unit

i. The MCC VFD component shall be a PowerFlex® 70 or PowerFlex 700 VFD. A “HAND-OFF-AUTO” selector switch, a “HAND START” pushbutton and a “HAND STOP” pushbutton shall be provided. These pilot devices shall be located in the same control station as the “DRIVE ON” and “BYPASS ON” pilot lights on the MCC bypass starter unit.
ii. HAND operation is available in either Drive or Bypass mode.
iii. AUTO operation is available in Drive mode only.

2. Isolating Disconnect

a) The isolating disconnect shall be a 6-pole device capable of making and breaking the load. Auxiliary isolating disconnect contacts will permit the operation of either only the bypass or the drive unit at one time.

3. Isolation Switch Operation

a) Bypass Mode

i. When in Bypass mode, the “BYPASS ON” pilot light shall be energized when the bypass motor control circuit is energized. When in Bypass mode, the MCC bypass starter unit and the MCC VFD unit are isolated from one another. In addition, the isolation switch shall have means to be padlocked, to prevent being switched to Drive mode. In this mode no power shall be present in the MCC VFD unit. The MCC VFD unit shall be available for service at NFPA 70E Hazard/Risk Level 0.

b) Drive Mode

i. When in Drive mode, the isolating disconnect shall permit the MCC starter bypass unit to supply power to the MCC VFD unit and connect the MCC VFD unit to the motor. When the isolation switch is in the Drive mode, the “DRIVE ON” pilot light shall be energized. In addition, the isolation switch shall have means to be padlocked to prevent being switched to Bypass mode.

4. Assembly

a) The MCC bypass starter unit and the MCC VFD unit shall be factory assembled and wired to complete the manual isolated drive bypass unit.

5. Testing

    a) The manual isolated drive bypass unit shall be cUL US listed according to safety standard UL 845 (UL) and be tested in an ISO9001 facility to ensure each unit conforms with this specification.

2.15 CONTROL AND LIGHTING TRANSFORMER

A. Refer to section [26 22 00] for transformer specifications.

    1. Specifications in the MCC section override corresponding specifications in the transformer section.

B. Provide control and lighting transformers as shown on drawings. The rating shown on the drawings shall be the minimum acceptable rating.
C. The insulation shall be 180 ℃ insulation with 80 ℃ rise.
D. Provide a circuit breaker with thermal magnetic trip for primary protection.
E. Provide a secondary fuse protection for the transformer.
The primary circuit breaker compartment and transformer compartment shall be interlocked together and factory wired together.
F. Unit construction is dependent on the MCC NEMA enclosure type.

    1. Units in a NEMA Type 1 enclosure shall be provided with vented doors.
    2. Units in a NEMA Type 1 enclosure with gasketed doors shall be provided with filters over the vent openings.
    3. Units in a NEMA Type 12 enclosure shall be provided with a non-vented door. If transformer derating is required, then the transformer shall be upsized to provide equivalent rating as shown on the contract drawings.

G. Control and power transformers that are specifically designed for use in motor control centers and for use with motor control circuits are exempt from NEMA TP-1 energy efficient requirements.

2.16 LIGHTING and POWER PANELBOARD

A. Provide lighting panel as shown on the drawings.
B. The lighting panel shall be rated for 10kA interrupting capacity.
C. Provide bolt-on branch breakers as shown on the drawings.

2.17 SCADA/PANEL

A. Provide a SCADA panel or PLC as shown on the drawings.
B. The SCADA/panel shall be provided with a thermal magnetic circuit breaker disconnect.
C. The programmable controller as specified in Section [xx xx xx] shall be mounted in the SCADA panel.
D. The manufacturer of the MCC shall provide all interwiring between the SCADA panel and the specified points within the MCC.

2.18 SOFTWARE

A. Preconfigured Software

1. The software shall be capable of viewing multiple MCC lineups.
2. The software communication driver shall allow the software to be installed and operated on the EtherNet/IP, ControlNet, or DeviceNet network.
3. The software shall be capable of functioning as a standalone software package or as an ActiveX control in a Human Machine Interface (HMI).
4. The software shall be capable of displaying the following.

    a) Elevation View

        i. Dynamically displays status information based on reading data from devices in the MCC lineup
        ii. Sizeable view to allow ease of viewing multiple MCC lineups
        iii. Unit nameplate information
        iv. Unit status indicators (ready, running, warning, fault, no communication)

    b) Unit Monitor View

        i. Preconfigured for a specific unit
        ii. Real time monitoring via analog dials and trending
        iii. Data configurable for customized viewing
        iv. Modifying device parameters

    c) Spreadsheet View

        i. User configurable for customized monitoring
        ii. Sorting and cascading functions
        iii. Custom user fields

    d) Event Log

        i. Track history of MCC unit
        ii. Automatic logging of trips, warnings, and changes
        iii. Manual entry of events

    e) Documentation

        i. Front elevation drawings
        ii. Unit wiring diagrams
        iii. User manuals
        iv. Spare parts lists

PART 3 Execution

3.01 INSTALLATION

A. Contractor shall install MCC in accordance with manufacturer's instructions.
B. Contractor shall tighten accessible bus connections and mechanical fasteners to the manufacturer's torque requirements.
C. Contractor shall select and install fuses in fusible switches based upon field requirements.
D. Contractor shall adjust circuit breaker settings based upon field requirements.
E. Contractor shall adjust solid state overloads to match the installed motor characteristics.

3.02 MANUFACTURER'S SERVICES

A. The manufacturer of the MCC shall be capable of providing the programming for the programmable logic controller and the operator interface if provided within the MCC.
B. The manufacturer of the MCC shall be capable of providing start-up services as part of the supply of the MCC.

3.03 TRAINING

A. A course outline shall be submitted as part of the MCC submittals.
B. The manufacturer shall offer off-site training on the concepts, knowledge and tools necessary to design, specify, install, troubleshoot and use a networked MCC.

Supplemental information regarding Arc Resistant Low Voltage MCCs

CENTERLINE 2100 Low Voltage MCCs from Allen-Bradley are available in an arc resistant design that meets the performance criteria described in IEEE C37.20.7-2007 "IEEE Guide for Testing Metal-enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults".

It should be noted that the safety standard for MCCs (UL845) has specific equipment performance criteria for LV MCCs during "bolted fault" short circuits, however, UL845 does not address equipment performance during arc fault/arc flash conditions.

There currently is no recognized standard in North America for arc resistant low voltage MCCs that also meet UL 845 requirements. Therefore, the CENTERLINE 2100 MCC with ArcShield™ was designed and tested in accordance with the IEEE C37.20.7 switchgear standard.

When provided within specific criteria requirements, the CENTERLINE 2100 MCC with ArcShield provides Type 2 accessibility as defined by IEEE C37.20.7. Type 2 accessibility provides improved protection to personnel located at the front, sides, and rear of the MCC from the effects of an internal arcing fault.

NOTE: IEEE C37.20.7 also defines a Type 1 accessibility level that provides improved protection to personnel located only at the front of the equipment from the effects of an internal arcing fault.

Required criteria for being able to specify Arc Resistant LV MCCs with Type 2 accessibility:

A. Main overcurrent and short circuit protective device must be one of the following:

   1. UL Listed Fuses

      a) Class L - Ferraz-Shawmut A4BQ ≤1200 A
      b) Class J - Any Fuse ≤ 600 A
      c) Class R - Any Fuse ≤ 600 A

   2. UL Listed Molded Case Circuit Breaker

      a) Allen-Bradley -Bulletin 140U, Frame I, JD, or K
      b) Cutler Hammer - Series C, Frame F, J, K, L, M, or N

      The main protection is allowed to be located remotely from the MCC.

B. Available bolted fault, short circuit current must be 65,000 A or less.
C. MCC voltage must be 600V or less.
D. Horizontal power bus must be 1200 A or less.
E. The NEMA Type 1 (or 1 with gasket) enclosure available for all unit types.

   1. Vented units will be provided with arc resistant baffles and cannot use filters over vent openings.
      Arc resistant baffles maintain the Type 2 accessibility level while providing unimpeded airflow during normal operating conditions.

F. The NEMA Type 12 enclosure is available only if all units are a non-vented design.
G. All equipment listed in arc resistant MCC specification points must be provided.

NOTE: If your application does not meet the preceding criteria, please contact your local Rockwell Automation Distributor or Sales Office to develop a custom arc-resistant MCC solution that will work for you.

If all of the criteria listed above can be met, include the arc resistant MCC specification points in your MCC specification.

NOTE: There are many other options that are available to help increase the level of electrical safety in a low-voltage motor control center, such as, finger safe terminal blocks, barriers and guards over fusing and contactors, viewing windows in the doors of units with fusible disconnect switches to verify blade position, insulated horizontal power bus, etc. If you need these types of options, please include specification language concerning those options in the appropriate sections of the MCC specification.

End of section.

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