METROLINX

# Motor Control Centres Specification

Specification 26 24 19



Revision 01
Date: March 2023

# Motor Control Centres Specification

Specification 26 24 19

Publication Date: August 2018
Revision Date: March 2023


an Agency of the Government of Ontario

## Amendment Record Sheet

| Amendment in Clause No. | Date of Amendment | Description of Changes |
|---|---|---|
| Cover page | March 2023 | Remove 'Capital Projects Group' to reflect organizational changes |
| 1.2.3, 1.3.3 | March 2023 | Add 'to current' and Updated numbering on Electrical Nomenclature and Identification specification |
| 2.4.1, 2.6.4, 2.9 | March 2023 | Update ground bus mounting height , metering requirements and source quality control |
| 2.5.1 | March 2023 | Added design requirement |

## LIST OF CONTENT

## 1. GENERAL

### 1.1. SCOPE OF WORK

1.1.1. Labour, products, equipment, and services necessary for Motor Control Centre (MCC) work in accordance with the Contract Documents.

### 1.2. DESIGN REQUIREMENTS

1.2.1. The equipment furnished and the equipment installation, wiring methods and materials used shall conform to the latest edition of the Ontario Electrical Safety Code, Electrical Safety Authority (ESA) Bulletins and Supplements issued by the Electrical Safety Authority, and the applicable Metrolinx Standards. In case of any conflicts, the more stringent requirement shall apply.

1.2.2. Design Electrical equipment and systems to all applicable standards of CSA, ULC, IEEE, ESA.

1.2.3. Design electrical equipment and systems to the latest GO DRM.

1.2.4. Design electrical equipment and systems to standards and codes to be latest editions adopted by and enforced by local authorities having jurisdiction (AHJ).

1.2.5. MCC(s), including components such as starters and controls, are to be CSA approved and bear CSA labels.

1.2.6. The MCC(s) shall be designed for 100 % continuous service for utilization as a control centre for 600 V power distribution. MCC(s) shall be rated for continuous operation at 100% of its ampere rating.

1.2.7. MCC(s) sizes and ratings shall be according to a detailed load calculation.

1.2.8. MCC(s) shall include motor circuit breaker protection as required by Code and Metrolinx standards.

1.2.9. All MCC starter features, ratings, options and accessories are to meet Metrolinx's approval.

1.2.10. Motor starters and contactors shall be in accordance with Section 26 29 10. In the case of any discrepancy to this Specification, this Specification shall take precedence.

1.2.11. Circuit Breakers shall be in accordance with Section 26 28 00. In the case of any discrepancy to this Specification, this Specification shall take precedence.

1.2.12. MCC design shall coordinate remote interface and control requirements with the remote supervisory system to Metrolinx's acceptance. Remote supervisory system could be a BAS, SCADA, PLC or other similar equipment.

1.2.13. Third party equipment related to motor control shall be located external to the MCC. This third-party equipment includes: Third party starters, Third party controllers, Third party automation systems, Third party supervisory systems. The MCC design shall consider the interface requirements with all third-party equipment to produce a completely functional MCC system.

## 1.3. RELATED WORKS

1.3.1. Section 26 05 00 Electrical General Requirements.

1.3.2. Section 26 05 21 - Electrical Conductors and Cables.

1.3.3. Section 26 05 53 – Electrical Nomenclature and Identification

1.3.4. Section 26 13 26 - Metal-Clad Switchgears.

1.3.5. Section 26 23 00 - Low Voltage Switchgears.

1.3.6. Section 26 24 13 - Switchboards and Panelboards.

1.3.7. Section 26 28 00 - Circuit Breakers and Fuses.

1.3.8. Section 26 28 23 - Disconnect Switches.

1.3.9. Section 26 29 10 - Motor Starters and Contactors.

## 1.4. REFERENCE STANDARDS

1.4.1. Ontario Electrical Safety Code (OESC).

1.4.2. Ontario Building Code (OBC).

1.4.3. Metrolinx Standards, Drawings and Specifications.

1.4.4. GO Design Requirement Manual (DRM).

1.4.5. ANSI, American National Standards Institute.

1.4.6. ANSI/ASA 61, Gray Powder Coating.

1.4.7. CAN/CSA C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures.

1.4.8. CAN/CSA C22.2 No. 14, Industrial Control Equipment.

1.4.9. CAN/CSA-ISO 9000, Quality Management Systems - Fundamentals and Vocabulary.

1.4.10. EEMAC, Electrical Equipment Manufacturer's Association of Canada.

1.4.11. ICE 947-4-1, Part 4, Contactors and Motor Starters.

1.4.12. NEMA, National Electrical Manufacturer's Association.

1.4.13. UL 845, Motor Control Centres.

1.4.14. C22.2 No. 0.22-11, Evaluation methods for arc resistance ratings of enclosed electrical equipment.

## 1.5. SPARE PARTS

1.5.1. Provide a list of spare parts for each distinct size and type of starter and MCC.

1.5.2. Manufacturer's recommended renewal parts list showing important maintenance part/components list for proper maintenance and normal operation of motor control centre.

## 1.6. TRAINING

1.6.1. There shall be a minimum of three (3) training sessions. Each session shall be eight (8) hours over a single day. Training shall be provided complete with videos and training materials for the Metrolinx staff on the maintenance and operation of aspects of the MCC(s).

1.6.2. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, circuit breaker, protective devices, and other major components.

## 1.7. WARRANTY

1.7.1. The contractor shall provide a manufacturer warranty for the work of this section with a minimum warranty period of two years after acceptance by Metrolinx.

## 1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Store MCC(s) on site in a protected, dry location. Cover with plastic to keep dust off.

1.8.2. Provide energized strip heater in each MCC compartment to maintain dry condition during storage.

1.8.3. Manufacturer responsible to ship product to site once approval to ship has been given to Contractor.

1.8.4. Contractor to accept equipment on site and inspect for shipping damage. Any damages shall be reported to Metrolinx immediately.

1.8.5. Contractor to protect equipment from weather and moisture by covering with heavy plastic or canvas and by maintaining heat within enclosure in accordance with manufacturer's instructions.

## 1.9. SUBMITTALS

1.9.1. Product Data Package

a) Submit manufacturer's Product data indicating:

1) Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists;

2) Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol; and

3) Product transportation, storage, handling, and installation requirements.

1.9.2. Shop Drawings Package

a) Submit Shop Drawings in accordance with indicating:

1) Front view elevation and top view complete with dimensions. Cable entry/exit locations to be identified;

2) Floor anchoring method, dimensioned foundation template;

3) Single line diagram;

4) Individual starter wiring diagrams complete with external field devices connection terminals marked and identified;

5) Individual starter and major component schedule and Bill of materials. Include product type, description, voltage/current rating; and

6) Individual starter and major component name plate schedule.

1.9.3. Commissioning Package:

a) Submit the following:

1) Commissioning Plan;

2) Commissioning Procedures;

3) Completed field test sheets;

4) Certificate of Readiness;

5) Deficiency Report; and

6) Commissioning Closeout Report.

1.9.4. Qualifications

a) Submit proof of specialization in manufacturing products specified in this section with minimum 10 years documented experience.

1.9.5. Closeout Submittals Package:

a) Submit the following for incorporation into the Operation and Maintenance Manuals:

1) Maintenance Data for Motor Control Centre:

i) Identification: Manufacturer's name, type, year, serial number, number of units, capacity, and identification of related systems;

ii) Include data for each type and style of starter and major components;

iii) Wiring diagram of starter and major components;

iv) Manufacturer's recommended renewal parts list showing important maintenance part/components list for proper maintenance and normal operation of motor control centre; and

v) Torque requirements.

2) Certified production ad factory test reports;

3) Copies of manufacturer's type test certificates, including short circuit fault damage certification up to short circuit values specified under bus bracing;

4) Copy of manufacturer's proof that quality control program is in accordance with CAN/CSA-ISO 9000;

5) Field quality control and commissioning test results; and

6) As-Built Drawings.

## 1.10. QUALITY ASSURANCE

1.10.1. All Quality Assurance submittals listed in this specification shall be provided.

1.10.2. Manufacturers Qualifications

a) Company specializing in MCC(s) with at least ten years documented experience. The manufacturer of the switchgear must be the same as the manufacturer of the circuit breaker.

b) Retain a Professional Engineer, licensed in the Province of Ontario, with experience in control devices work of comparable complexity and scope, to perform the following services:

1) Design of MCC, motor controls, starters, and protection; and

2) Review, stamp and sign fabrication and assembly shop drawings and design calculations.

c) Manufacturers are to provide proof of their quality control program to CAN/CSA-Q9000.

1.10.3. All electrical work shall be carried by licensed electrical contractors with experience and training in the equipment and systems (certified or manufacturer approved) being installed in Ontario.

1.10.4. All electrical work shall be inspected and approved by Metrolinx or it's representative(s) for acceptance. Interim and final inspections shall be performed with Metrolinx or it's representative present.

## 1.11. REGULATORY REQUIREMENTS

1.11.1. Furnish products listed and classified by CSA and ULC, as suitable for application.

1.11.2. Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Metrolinx.

# 2. PRODUCTS

## 2.1. GENERAL

2.1.1. This Specification does indicate specific number of items or amounts of material required. This Specification is intended to provide product data and installation requirements. Refer to Contract Documents for schedules, drawings (layouts, riser diagrams, schematics, details) and the Contract Specification to provide final quantities. Singular may be read as plural and vice versa.

2.1.2. Starter/MCC/VFD schedule drawings are both mechanical and electrical in nature and apply to work of Mechanical Divisions and Electrical Divisions. Each Division is responsible for reviewing starter, MCC, VFD, and motor specification requirements of their respective Divisions specifications and drawings. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions

2.1.3. The Contract Documents shall include the MCC Contract Documents. The MCC shall be configured per the Contract Documents and the Manufacturer Shop drawings.

2.1.4. In case of discrepancies or conflicts between Drawings and Specifications, Documents will govern in order specified in "General Conditions", however, when scale and date of Drawings are same, or when discrepancy exists within Documents, include most costly arrangement.

2.1.5. The MCC shall be able to withstand the environmental conditions stated in Section 26 05 00 without damage or degradation of operating characteristics.

2.1.6. The MCC shall be rated for the voltage, current, frequency and interrupting capacity indicated on the Contract Documents.

2.1.7. The current rating of the MCC main bus must be one size larger than required. The MCC design shall be capable of adding and supporting an additional vertical section.

2.1.8. The MCC shall be type 2 arc-resistant and tested in accordance with C22.2 No. 0.22-11.

2.1.9. The MCC wiring shall be Class I Type B.

2.1.10. The MCC enclosure shall be CSA type 1.

2.1.11. Devices and components shall be by one manufacturer to facilitate maintenance.

2.1.12. The responsibility for performance to this specification shall not be divided among individual component manufacturers but must be assumed solely by the primary manufacturer. This includes generating system design, manufacture, test, and having a local supplier responsible for service, parts, and warranty for the total system.

## 2.2. CONSTRUCTION REQUIREMENTS

2.2.1. The MCC shall be built-up of vertical sections of heavy gauge steel joined together to form a rigid freestanding, dead front assembly.

2.2.2. The assembly shall be constructed and packaged to withstand normal stresses occurring during transit and installation. A means shall be provided to perform vertical lifts.

2.2.3. The maximum overall height of the MCC shall be approximately 2286 mm (90 inches), exclusive of the base channel and lifting angles.

2.2.4. MCC(s) shall to be designed for top hat entry or bottom entry.

2.2.5. MCC(s) shall be mounted on a house keeping concrete pad 103 mm in height.

2.2.6. Base channels shall be provided. These shall be continuous steel channel floor sills with suitable floor mounting holes predrilled.

2.2.7. There shall be provisions for future extension at both ends of each MCC and extension openings shall be covered with removable steel cover plates. There shall be no need for further drilling, cutting or preparation in field.

2.2.8. Each vertical section divided into starter units, minimum 300 mm high, as indicated a maximum six (6) starter units can be accommodated in a vertical section. Starter units shall be fully isolated from adjacent compartments.

2.2.9. The rear of each vertical section shall have a bolted steel cover plate. All components shall be accessible from the front.

2.2.10. Each MCC shall be provided with a drip hood extending along the front and back of the MCC. It shall be possible to remove this hood without comprising the enclosure integrity.

2.2.11. A horizontal control wiring trough shall be provided at the top and bottom of each section such that when sections are fastened together, they shall form continuous wireway that extends the full length of the MCC. The trough shall be equipped with cable supports.

2.2.12. Each vertical section shall be provided with an individual full-height wiring trough, which shall connect to the horizontal troughs at the top and at the bottom. Access to this trough shall be through a hinged door having captive type fastenings. These wireways shall, when in service, provide complete isolation from all live busbars and terminations and shall provide sufficient space to easily accommodate all power and control cables related to that section. The trough shall be equipped with cable supports.

2.2.13. Dead front bus barriers are required.

2.2.14. The vertical bus shall have automatic shutters that isolate the bus from accidental contact when starters are withdrawn. Blank sections, or future spaces, shall have similar barriers complete with removable covers for the bus stab openings.

2.2.15. Back-to-back MCC(s) sharing common horizontal and vertical busbars are not permitted. Where specified, “back to back” construction will consist of two standard single front access units mounted back to back with a double steel wall between the front and back unit. The front and back units shall have two separate buses and be provided with a bus interconnection link so that either side of the unit may be disconnected from the incoming cables.

2.2.16. The incoming power supply cables shall enter at either the top or the bottom, as shown on the Contract Documents. Provide top hat or bottom entry cabinet with termination lugs for service feeds.

2.2.17. Provision for outgoing cables to exit via top or bottom. Cable compartments shall be provided with removable plates to facilitate cutting conduit or cable gland openings.

## 2.3. BUSBAR

2.3.1. The MCC will consist of main horizontal busbars and branch vertical busbars.

2.3.2. The busbars shall be high conductivity tin-plated copper

2.3.3. The busbars shall be in separate a compartment extending the entire width and height of the MCC. Each phase of the vertical bus shall be isolated and insulated from each other.

2.3.4. No other cables, wires, or equipment are permitted in the busbar compartments.

2.3.5. Where a neutral bus is required it shall be the same rating as the phase busbars.

2.3.6. Busbars rated based on 65°C maximum temperature rise in a minimum 40°C ambient. Busbars shall be naturally-cooled (forced cooling not accepted).

2.3.7. Branch vertical busbars shall be rated for minimum 300 A.

2.3.8. The busbars shall be braced to withstand stresses developed by the fault current shown on the Contract Documents.

2.3.9. Bus supports shall be high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

## 2.4. GROUND BUS

2.4.1. The MCC shall include a horizontal ground bus. It shall be tin plated copper, 6.0 mm x 25 mm, extending the entire width of the MCC mounted in the bottom 150 mm of space.

2.4.2. Provide predrilled connection points suitable for #4/0 AWG ground cables at both ends.

2.4.3. The MCC shall include a vertical ground bus in each vertical section. It shall be the full height of the section and be tied to the horizontal ground bus.

2.4.4. All hinged doors shall be bonded to the ground bus by flexible copper straps.

## 2.5. STARTER COMPARTMENTS

2.5.1. MCC starters can be fixed or withdrawable as well as combination type depending on the rating. Starters rated below 200 A shall be withdrawable. Withdrawable or combination starters shall connect to the vertical bus through strongly reinforced stab-on connectors. Fixed starters be connected directly to the bus with appropriately sized cable or riser bus.

2.5.2. Each starter shall be in a single enclosure equipped with the following minimum requirements:

a) A line side disconnect device;

b) A door mounted disconnect device operating handle with disconnect device ON/OFF status clearly displayed;

c) A switching device (power contactor/ variable speed drive as required);

d) A door mounted stop pushbutton and a start pushbutton;

e) A door mounted control panel for variable speed starters;

f) A door mounted manual/off/auto switch with indicator lights;

g) A dedicated 120 V control transformer. This shall be connected downstream of the line side disconnect device;

h) Overload protection on each phase. The overload device shall be equipped with one normally open contact and one normally closed contact for remote use by others; and

i) Visual running indication lights. Include one normally open contact and one normally closed contact for remote running indication (by others).

2.5.3. All conductive parts on line side of starter disconnect device shall be shrouded by suitable insulating material to minimize possibility of accidental contact.

2.5.4. The line side disconnect device shall be a 3 pole, Moulded Case Circuit Breaker unless the application requires a different device, in which case Metrolinx approval will be required.

2.5.5. Starter mounting shelves to include hanger brackets to support unit weight during installation and removal.

2.5.6. The following withdrawable starter positions shall be provided:

a) Engaged position - unit stabbed into vertical bus; and

b) Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block shall be accessible for electrical testing of starter.

2.5.7. Provide a means for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

2.5.8. Provide an interlock to prevent installing or removing withdrawable starters unless the disconnect device is in the “OFF” position. Authorized personnel to have ability to override interlock.

2.5.9. Provide an interlock to prevent opening the starter door unless the disconnect device is in the “OFF” position. Authorized personnel to have ability to override interlock.

2.5.10. Provide provision for three (3) padlocks to lock disconnect device operating handle in "OFF" position and lock door closed.

2.5.11. Starter compartment doors to be hinged on the same side throughout the MCC.

2.5.12. All circuit breakers shall include a separate "TRIPPED" position. Tripped circuit breakers to be reset without opening starter compartment.

2.5.13. All overload devices to be manually reset without opening starter compartment.

2.5.14. Pull-apart terminal blocks are required to allow removal of starter without removal of field wiring.

## 2.6. METERING

2.6.1. Metering shall be as shown on the Contract Documents.

2.6.2. Metering shall be provided by multi-function digital meters.

2.6.3. Metering devices shall be:

a) Complete with Modbus RTU communications module or as indicated on the Contract Documents; and

b) Complete with 2 PTs and 3 CTs. Provide fuse blocks for PTs and shorting blocks for CTs. Only dead front fuse holders shall be utilized in metering circuits.

2.6.4. Main incomer metering shall be housed in a separate compartment having no exposure to the live bus or terminations. This meter shall be installed at approximately 1.6 m above finished floor level. The main incoming meter shall connect to the remote supervisory system such as a SCADA or BAS for local and remote monitoring. The digital monitoring meter shall be capable of storing data for minimum 3 years.

## 2.7. IDENTIFICATION

2.7.1. Furnish colour coding in accordance with Metrolinx Section 26 05 53 – Electrical Nomenclature and Identification

2.7.2. Provide identification for equipment and the sub-components in accordance with Metrolinx Section 26 05 53 – Electrical Nomenclature and Identification.

2.7.3. Provide nameplates, warning signs and labels as required by the AHJ.

2.7.4. Component identification shall be consistently and thoroughly applied for the complete MCC.

2.7.5. Component identification shall match the final shop drawings.

2.7.6. Equipment nameplates shall be provided for the following at minimum:

a) MCC Name – size 8;

b) Each starter compartment – size 7; and

c) Each main MCC compartment – size 7 (metering, incomer, etc.).

## 2.8. FINISHES

2.8.1. Finishes shall provide a means of corrosion resistance and inhibiting rust for the entire assembly.

2.8.2. The exterior of the MCC enclosure shall be light gray ANSI/ASA 61. Paint interior of enclosure white for improved interior visibility. The manufacturer's standard colours may be used if approved by the client.

## 2.9. SOURCE QUALITY CONTROL

2.9.1. Perform all factory tests required by latest ANSI, NEMA and CSA standards. Manufacturer to provide certified copies of factory test reports to Metrolinx or its designated representative(s) for review.

2.9.2. Perform each visual inspection, mechanical inspection and electrical test stated in the latest NETA Acceptance Testing Specifications. Certify compliance with test parameters. Provide certified copies of test reports to Metrolinx or its designated representative(s) for review.

2.9.3. Metrolinx to witness factory testing of complete MCC(S) including functional testing of switches, circuit breakers, starters and controls. Notification of witness testing to be provided a minimum of 21 days prior to witness testing.

# 3. EXECUTION

## 3.1. INSTALLATION AND COMMISSIONING

3.1.1. Manufacturer's service representative to provide supervision and assistance to the client at no additional cost to the client during installation and commissioning of the. MCC(s)

3.1.2. Manufacturer's service representative shall oversee:

a) Lifting of the MCC sections into position;

b) Assembly of the MCC sections;

c) Installation and connection of all internal wiring and buswork;

d) Verification and entry of all component settings; and

e) Operation of all starters under load to prove satisfactory performance of MCC during an 8-hour period.

**END OF SECTION**