

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Contract Administrator submittals listed for review in accordance with the Specifications, or as requested by the Contract Administrator.
- .2 Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .1 Allow 10 Working Days for review of submittals by the Contract Administrator.
- .3 Do not proceed with Work affected by submittal until review is complete.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .7 Notify Contract Administrator, in writing at time of submission for review, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify:
 - .1 Field measurements
 - .2 Field construction criteria
 - .3 Catalogue numbers and similar data
 - .4 Ensure affected adjacent Work is co-ordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .11 Acceptance of Shop Drawings for a component or a subassembly does not constitute acceptance of the complete assembly of which it is a part.
- .12 The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.

- .13 After Contract Administrator's review and return of copies, distribute copies to sub-trades as appropriate.
- .14 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, weights, dimensions, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.
- .3 Have Shop Drawings stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba where required in the Specifications or by the Contract Administrator.
- .4 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract Documents.
- .5 Submittals shall be in one of the following formats:
 - .1 Submit one electronic PDF copy.
- .6 Shop Drawing reviews by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.
- .7 Shop Drawings will be returned to the Contractor with one of the following notations:
 - .1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.
 - .2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".
 - .3 When stamped "REVISE AND RESUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.
 - .4 When stamped "NOT REVIEWED" or "REJECTED", submit other Drawings, brochures, etc., for review consistent with the Contract Documents.

- .5 Only Shop Drawings bearing "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS", or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.
- .8 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.
- .9 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.
- .10 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.
- .11 Only two (2) reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates. The Contract Administrator's charges for the additional Work will be deducted from the Contractor's Progress Certificates.
- .12 Show the following information in lower right hand corner of shop drawings.
 - .1 Project Title.
 - .2 Tender number or other project number assigned by the Contract Administrator.
 - .3 Name of the depicted item in accordance with the Specifications and Drawings.
 - .4 Project series number and location where the item is used if applicable.
 - .5 Specification section number if applicable
 - .6 Proposed option if applicable.
 - .7 Name of Contractor.
- .13 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Specification Section, Title, Number, and Clause
 - .6 Other pertinent data.
 - .7 Date and revision dates.
 - .8 Project title and Bid Opportunity number.
 - .9 Name of:
 - .1 Contractor
 - .2 Subcontractor
 - .3 Supplier
 - .4 Manufacturer

- .5 Separate detailer when pertinent
- .10 Identification of product of material.
- .11 Relation to adjacent structure or materials.
- .12 Field dimensions, clearly identified as such.
- .13 Specification section name, number and clause number or drawing number and detail/section number.
- .14 Applicable standards, such as CSA or CGSB numbers.
- .15 Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

1.3 PROCEDURES

- .1 The Contractor shall, if required by the Contract Administrator, submit for the review of the Contract Administrator method statements which describe in detail, supplement with Drawings where necessary, the methods to be adopted for executing any portion of Work.
- .2 These statements shall also include details of constructional plant and labour to be employed. Acceptance by the Contract Administrator shall not relieve the Contractor of any of his responsibilities, nor shall reasonable refusal to approve entitle the Contractor to extra payment or an extension of time.
- .3 Other Considerations
 - .1 Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.
 - .2 Material and equipment delivered to the site of the works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.
 - .3 Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.
 - .4 No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Copy will be returned after final inspection, with Contract Administrator's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Furnish evidence, if requested, for type, source and quality of products provided.
- .5 Pay costs of transportation.

1.2 AS-BUILT DRAWINGS

- .1 On completion, submit As-Built Drawings to Contract Administrator for review.
- .2 Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Provide maintenance instructions where applicable.
- .3 Quantity and Format
 - .1 Submit for review and comments:
 - .1 One (1) electronic CD copy.
 - .2 Final Copies:
 - .1 One (1) electronic CD copy.
- .4 Include the following with the as-built drawings:
 - .1 Overall Title sheet, labelled "As-Built Drawings", and containing project name and date, components covered in the manual, City's Contract number, the name and address of the Supplier and the issue date.
 - .2 Overall list of contents.
 - .3 List of contents for each section.
 - .4 Include:
 - .1 Brochures/catalogue excerpts of all components of the Work.
 - .2 Documentation of all test results.
 - .3 Complete set of equipment and assembly drawings
 - .4 Installation, start-up, O&M Manuals
 - .5 Any specific requirements from the Specifications
 - .6 Reviewed Shop Drawings of all equipment.
 - .7 Names, addresses, and telephone numbers of supplier.
- .5 Modify and supplement the electronic CD as required by the Contract Administrator.
- .6 Electronic CD format to be as follows:

- .1 Organize into logical PDF files, arranged into a directory structure that is similar to the paper binder format. Organize in a manner to make it easy to find documents from the Table of Contents.
 - .2 Where practical, provide PDF documents in native, searchable format rather than scanned documents. Do not simply scan in the paper copies.
 - .1 Where comments are required to clarify the applicable equipment, utilize electronic editing of the PDF files rather than handwritten comments and scanning.
 - .3 Where documents are scanned, they shall be provided at a sufficient resolution to prevent distortion. Unsuitable scanned documents will be rejected.
 - .4 Other data as applicable
- .7

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .4 Submit shop drawings and indicate:
 - .1 Outline dimensions.
 - .2 Configuration of identified compartments.
 - .3 Floor anchoring method and dimensioned foundation template.
 - .4 Cable entry and exit locations.
 - .5 Dimensioned position and size of busbars and details of provision for future extension.
 - .6 Schematic and wiring diagrams.
 - .7 Layout of all customer starter assemblies.
- .5 Closeout Submittals: provide as-built drawings and supplemental information for motor control centre as specified in Section 01 78 00 - Closeout Submittals.
 - .1 Include data for each type and style of starter.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

- .1 600 V, 60Hz, wye connected, 3 phase, 3 wire, grounded neutral.

2.2 GENERAL DESCRIPTION

- .1 Compartmentalized vertical sections with common power busbars.
- .2 Floor mounting, free standing, enclosed dead front.
- .3 Indoor NEMA Type 1A (gasketed) enclosure, front mounting.
- .4 Suitable for service entrance.
- .5 Wiring class: Class 1, Type B-D or B-T as shown on the drawings.
- .6 Nameplates: white with black letters.
- .7 SCCR: 18 kA minimum.

- .8 Acceptable manufacturer:
 - .1 Schneider Electric.
 - .2 Or approved equal in accordance with B5. Submissions for approved equal approval must include a layout drawing for the MCC along with detailed component data.

2.3 VERTICAL SECTION CONSTRUCTION

- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
- .2 Dimensions: 2324 mm (91.5") high, 508 mm (20") deep and 508 mm (20") wide, except as noted on the Drawings.
- .3 Assembled sections into a group having a common power bus and forming an enclosure to which additional sections may be readily added.
- .4 Design for all power and control connections to be made from the front. All bus and feeder bolted connections shall be accessible from the front.
- .5 Sections with horizontal wiring spaces top and bottom and with 102 mm full height vertical wiring spaces with cable tie supports. Insulate wireways from horizontal and vertical bus.
- .6 Each vertical section divided into compartment units, minimum 152 mm high, as indicated.
- .7 Each unit to have complete top and bottom steel plate for isolation between units.
- .8 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
- .9 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
- .10 Stab opening protection: Removable protective caps.
- .11 Isolation barriers between units and wireways.
- .12 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.
- .13 Incoming cables to enter at top and/or bottom.
- .14 Provision for outgoing cables to exit via top and/or bottom.
- .15 Removable lifting means.
- .16 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

- .17 Divide assembly for shipment to site, complete with hardware and instructions for re-assembly.
- .18 Provide all spaces complete with bussing hardware and other accessories required so that additional combination starter units can be readily installed. Provide barriers to isolate the space from all buswork.
- .19 Provide barriers to isolate all buswork to prevent accidental contact when starter units are removed or spaced are provided. Barriers shall also provide phase-to-phase isolation of the vertical bus.
- .20 Master nameplate lamacoid: text as shown on the drawings.

2.4 SILLS

- .1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

- .1 Main horizontal and branch vertical, three phase high conductivity, tin plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
 - .1 Main horizontal busbars: 600 A.
 - .2 Branch vertical busbars: 300 A or 600 A as required.
- .2 Branch vertical busbars for distribution of power to units in vertical sections.
- .3 No other cables, wires, equipment in main and branch busbar compartments.
- .4 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical.
- .5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.
- .6 Location: Top

2.6 GROUND BUS

- .1 Copper ground bus extending entire width of motor control centre.
 - .1 Size: 6 x 25 mm (1/4" x 1")
 - .2 Plating: Tin
 - .3 Location: Bottom
- .2 Vertical ground bus, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.
 - .1 Material: tin plated copper.

2.7 TRANSIENT VOLTAGE SURGE SUPPRESSOR

- .1 Supply and install a Transient Voltage Surge Suppressor (TVSS) where shown on the drawings.
- .2 Requirements:
 - .1 TVSS units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).
 - .2 Voltage: Refer to drawings.
 - .3 Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.
 - .4 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
 - .5 Protection Modes – The TVSS must protect all modes of the electrical system being utilized. The required protection modes are:
 - .1 3Ø, 3W System: L-L, and L-G
 - .2 3Ø, 4W Wye System: L-L, L-N, L-G, and N-G
 - .3 1Ø, 3W Wye System: L-L, L-N, L-G, and N-G
 - .6 Nominal Discharge Current (In) – All TVSSs applied to the distribution system shall have a 20kA In rating regardless of their TVSS Type (includes Types 1 and 2) or operating voltage. TVSSs having an In less than 20kA shall be rejected.
 - .7 ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:
 - .1 L-N, L-G, N-G:
 - .1 120/208 V: 700V
 - .2 347/600 V: 1500V
 - .2 L-L:
 - .1 120/208 V: 1200V
 - .2 347/600 V: 3000V
- .3 TVSS Design
 - .1 Maintenance Free Design – The TVSS shall be maintenance free and shall not require any user intervention throughout its life. TVSSs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. TVSSs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. TVSSs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
 - .2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable TVSS modules shall not be accepted.

- .3 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.
- .4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall utilize low impedance conductors.
- .5 Monitoring Diagnostics – Each TVSS shall provide the following integral monitoring options:
 - .1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.
 - .6 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
- .4 Overcurrent Protection
 - .1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
- .5 Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

.1	600V Equipment – Service Entrance:	240 kA
.2	600V Panelboards – Not Service Entrance:	120 kA
.3	240V or less Panelboards – Service Entrance:	120 kA
.4	240V or less Distribution Panelboards – Not Service Entrance:	40 kA
- .6 Installation Requirements:
 - .1 The TVSS shall be installed immediately following the load side of the main breaker or main switch.
 - .2 The MCC shall be capable of re-energizing upon removal of the TVSS.
 - .3 Utilize a breaker, appropriately rated as directed by the TVSS manufacturer, to connect the TVSS to the MCC. The TVSS shall be located directly adjacent to the circuit breaker.
 - .4 The TVSS shall be included and mounted within the MCC by the manufacturer of the MCC where shown on the drawings.
 - .1 The complete MCC including the TVSS shall be CSA/cUL listed.

2.8 POWER METER

- .1 Where indicated on the drawings, provide a microprocessor based multifunction power meter.

- .2 Requirements:
 - .1 Multifunction electrical measurement on 3 phase power systems.
 - .2 User programmable for voltage range to any PT ratio.
 - .3 Integrated display.
 - .4 Accept a direct voltage input range of up to 347 Volts Line to Neutral, and a range of up to 600 Volts Line to Line.
 - .5 Accept a current input of up to 5 Amps nominal, 10 Amps full scale.
 - .6 Fault Current Withstand:
 - .1 20 Amps continuous.
 - .2 500 Amps for 1 second, non-recurring.
 - .7 Programmable for current to any CT ratio. The use of DIP switches for selecting fixed ratios shall not be acceptable.
 - .8 Maximum burden of 0.0625 VA at 10 Amps.
 - .9 The meter shall have an accuracy of +/- 0.25% or better for volts and amps, and 1.5% for power and energy functions.
 - .10 The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.
 - .11 Function Requirements:
 - .1 Volts, Amps, kW, kVAR, PF, kVA (per phase)
 - .2 Frequency, kWh, kVAh, kVARh
 - .3 Harmonics measurement, individual, even, and odd, up to 15th.
 - .12 Operating Temperature:
 - .1 -20 to +60 °C ambient.
- .3 Communications ports:
 - .1 10 Mbps Ethernet supporting Modbus-TCP.
 - .2 RS-485 supporting Modbus-RTU.
- .4 Acceptable products:
 - .1 Schneider Electric ION7300.

2.9 VOLTAGE MONITORING RELAY

- .1 Requirements,
 - .1 Suitable for direct connection to MCC bus having nominal operating voltage of 600 V line-to-line.
 - .2 Adjustable nominal input voltage via potentiometer from 500 V to 600 V.
 - .3 Undervoltage trip point:
 - .1 Adjustable from 88% to 92% of nominal voltage.
 - .4 Voltage unbalance:
 - .1 Adjustable from 2% to 10%.
 - .5 Phase loss detection:
 - .1 Triggered upon $\geq 15\%$ unbalance.

- .2 Response time \leq 200 msec.
- .6 Trip delay:
 - .1 Adjustable from 0.25 to 30 sec.
- .7 Automatic reset (restart) delay:
 - .1 Adjustable from 0.25 to 64 sec.
 - .2 Adjustable random restart delay from 3 to 15 sec.
- .8 Faults stored in non-volatile memory.
 - .1 Storage of the last 10 faults.
- .9 Status and faults displayed on LED readout.
- .10 Remote reset input.
- .11 CSA approved.
- .2 Relay output:
 - .1 Equipped with, at minimum, one Form C electromechanical dry contact output for monitoring.
 - .1 Relay contact to be normally open, held-closed during normal operation, and open upon an alarm condition.
 - .2 Actuate relay on any of the following:
 - .1 Phase A-B, B-C, or C-A voltage less than 550 V.
 - .2 Voltage unbalance greater than 10%.
 - .3 Rated at 10A resistive @ 250 VAC, 6A inductive (0.4 PF) @ 250 VAC.
 - .4 Mechanical life of 1×10^7 operations.
- .3 Acceptable products:
 - .1 SSAC WVM011AL.

2.10 MOTOR STARTERS AND DEVICES

- .1 Equip the MCC with combination starters as specified and shown on the drawings.
- .2 Refer to Section 26 29 10 – Motor Starters to 600 V.

2.11 STARTER UNIT COMPARTMENTS

- .1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 Unit mounting:
 - .1 Engaged position - unit stabbed into vertical bus.
 - .2 Withdrawn position - unit isolated from vertical bus but supported by structure.
 - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
 - .4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.

- .3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for padlock to lock operating handle in "off" position and lock door closed.
- .4 Hinge unit doors on same side.
- .5 Overload relays manually reset from front with door closed.
- .6 Pushbuttons and indicating lights mounted on door front.
- .7 Devices and components by one manufacturer to facilitate maintenance.
- .8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.
- .9 Control wiring shall be extended from each starter module to the control terminal section, including all auxiliary contacts. A multi unit style terminal block having screw type terminal connections shall be installed on standoff supports on back plate.
- .10 All terminals shall be number coded or otherwise suitably identified to indicate which section or module of the MCC they are associated with and their function.
- .11 Complete control wiring diagrams for each starter with conductor identification clearly shown shall be affixed to the interior cover of the starter section or provide a book of wiring diagrams for all starters in each MCC.
- .12 Primary and secondary high rupturing capacity (HRC) fusing shall be installed on the control transformer.
- .13 Equip door of each individual unit with a removable plate replaceable with similar plate complete with pushbuttons, pilot lights or selector switches as required. Use pilot lights of push-to-test type and push button of heavy-duty oil tight construction.

2.12 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.
 - .1 Wire tags to be heat shrink type with black letters on white background.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.13 EQUIPMENT IDENTIFICATION

- .1 Identify Motor Control Centre with nameplates as follows:
- .2 Nameplates:

- .1 Lamicoid 3 mm thick plastic lamicoïd nameplates, white face, black lettering, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Motor control centre main nameplate	70 x 120 mm	1 line	40 mm high letters
Individual compartment nameplates	30 x 90 mm	3 lines	5 mm high letters

- .3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.

2.14 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .4 Paint motor control centre exterior light gray and interiors white.

2.15 SOURCE QUALITY CONTROL

- .1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.
- .2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

2.16 SPARE PARTS

- .1 One (1) set of fuses of each type and size.

Part 3 Execution

3.1 NONE

- .1 None.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers and circuit breakers.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, and Circuit breakers to CSA C22.2 No. 5
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
- .4 Circuit breakers to have minimum 18kA symmetrical rms interrupting capacity rating, or higher as indicated.
- .5 Thermal magnetic moulded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .6 Include:
 - .1 On-off locking device.
 - .2 Neutral and Ground bus bars, fully rated.

2.2 MCC-F71.MCB

- .1 Requirements:
 - .1 Frame Size: 600 A
 - .2 Trip Unit Rating: 600 A

- .3 Interrupting Rating: 18 kA @ 600 VAC
- .4 Trip Unit Type: Electronic LSI, Factory Sealed
- .5 Long Time PU: 200 – 600 A (Adjustable)
- .6 Long Time Delay: 0.5 – 16 sec (Adjustable)
- .7 Short Time Pickup: 1.5 - 10 x LTPU (Adjustable)
- .8 Short Time Delay: 0 – 0.4 sec (Adjustable)
- .9 Instantaneous: 1.5 – 11 x Trip Unit Rating (Adjustable)
- .10 Poles: 3
- .11 Model: Schneider Electric PowerPact LGL36600U43X
or approved equal in accordance with B5.

2.3 CB-F01

.1 Requirements:

- .1 Frame Size: 250 A
- .2 Trip Unit Rating: 250 A
- .3 Interrupting Rating: 18 kA @ 600 VAC
- .4 Trip Unit Type: Electronic LS, Factory Sealed
- .5 Long Time PU: 70 – 250 A (Adjustable)
- .6 Long Time Delay: 0.5 – 16 sec (Adjustable)
- .7 Instantaneous: 1.5 – 15 x Trip Unit Rating (Adjustable)
- .8 Poles: 3
- .9 Model: Schneider Electric PowerPact JGL36250U31X
or approved equal in accordance with B5.

2.4 CB-F02

.1 Requirements:

- .1 Frame Size: 400 A
- .2 Trip Unit Rating: 400 A
- .3 Interrupting Rating: 18 kA @ 600 VAC
- .4 Trip Unit Type: Electronic LS, Factory Sealed
- .5 Long Time PU: 125 – 400 A (Adjustable)
- .6 Long Time Delay: 0.5 – 16 sec (Adjustable)
- .7 Instantaneous: 1.5 – 15 x Trip Unit Rating (Adjustable)
- .8 Poles: 3
- .9 Model: Schneider Electric PowerPact LGL36400U31X
or approved equal in accordance with B5.

2.5 THERMAL MAGNETIC BREAKERS < 100A

.1 Requirements:

- .1 Trip Rating: As shown on the drawings.
- .2 Interrupting Rating: 18 kA @ 600 VAC

- | | | |
|----|--------|---|
| .3 | Type: | Thermal Magnetic |
| .4 | Poles: | As shown on the drawings. |
| .5 | Model: | Schneider Electric PowerPact HGL series
or approved equal in accordance with B5. |

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 National Electrical Manufacturer's Association (NEMA)
 - .1 NEMA Standards Publication ICS 2-2000: Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Head load calculations.
 - .1 Provide heat load calculations, detailing the total head load within the starter and the required fan C.F.M. (cubic feet per minute) air-flow required to maintain a maximum temperature of 45°C within the enclosure. Utilize a maximum ambient air temperature of 30°C in the calculations.
- .4 Shop Drawings:
 - .1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Provide shop drawings for each starter, indicating:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout and components or internal units and front panels.
 - .4 Enclosure types.
 - .5 Wiring diagram.
 - .6 Interconnection diagrams, as applicable.
 - .7 When air-cooled systems are provided, the following shall also be shown:
 - .1 Air inlet and outlet passages.
 - .2 Cooling fans.
 - .3 Filters.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit as-built drawings for each type and style of motor starter in accordance with Section 01 78 00 - Closeout Submittals

Part 2 Products

2.1 GENERAL

- .1 Starters: to NEMA ICS 2-2000.
- .2 Equipment Identification:
 - .1 Colour: White nameplate, black letters.
 - .2 Text Size: 8mm high letters.
 - .3 Text as shown on the drawings.
- .3 Control Wiring:
 - .1 Copper, 16 AWG, TEW unless otherwise indicated.
- .4 Wire Identification:
 - .1 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram. Markings are to be computer generated.
- .5 Device Identification:
 - .1 Door-mounted indicating lights, push buttons, selector switches, as indicated on the drawings. Identification to be lamacoids.
 - .2 On the door interior, install identification labels adjacent to each pilot device containing the identifier of the pilot device (i.e. HS-F010). The identification is to be provided by a lamacoid or permanent machine-made stick-on label.
 - .3 Internal components such as contactors and relays must be identified by a lamacoid or permanent machine-made stick-on-label. Relays comprised of a base and removable relay are to be identified on the base or enclosure back-panel rather than on the removable relay component.
- .6 Finishes:
 - .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.
 - .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.
 - .1 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.2 SOFT STARTERS

- .1 Design requirements:
 - .1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed 18 kA.
 - .1 Soft starters with a current rating of 150A or greater must not require the use of fuses to achieve the rating.

- .2 Soft starters with a rating of less than 150A may require Class J fuses to achieve the required SCCR.
- .2 Ventilation system designed for ambient temperature range of 5°C to 35°C. Enclosure temperature not to exceed 45°C.
- .2 Soft Starter Module:
 - .1 Equipped with integral bypass contactor.
 - .2 Equipped with individually replaceable power poles.
 - .3 Equipped with preset slow speed (slow speed jog) function.
 - .4 Continuous current rating: as indicated on the drawings.
 - .5 Rated operation voltage: 600 VAC, 60 Hz
 - .6 Control circuit voltage: 120 VAC, 60 Hz
 - .7 Acceptable products: Allen Bradley SMC-Flex
- .3 Isolation Contactor:
 - .1 NEMA rated, Size as indicated on the drawings.
 - .2 120 VAC, 60 Hz Coil.
- .4 Control Transformer:
 - .1 Single phase, dry-type, with 600V primary and 120V secondary, complete with primary and secondary fusing, installed in enclosure with soft starter, as indicated.
 - .2 Calculate required size of the control transformer. The size shown on the drawings is the minimum size. Provide size as required for appropriate operation of the starter, plus 20% spare capacity.
- .5 Cooling:
 - .1 Provide cooling system as required to maintain an acceptable enclosure.
 - .2 Intake fan located at bottom of enclosure.
 - .3 Exhaust vent located at top of enclosure.
- .6 Door-mounted soft starter Human Interface Module (HIM).
- .7 Pilot Devices:
 - .1 Pushbuttons and selector switches: Heavy-duty, oil tight, NEMA rated, 30 mm, labelled as indicated.
 - .2 Indicating lights: Heavy-duty, oil tight, NEMA rated, 30 mm, LED bulb, type and color as indicated.
 - .3 Start pushbuttons to utilize a green cap, and stop pushbuttons to utilize a red cap.
- .8 Documentation:
 - .1 Provide door pocket with complete set of drawings for each starter.

Part 3 Execution

3.1 INSTALLATION

.1 None.

3.2 FIELD QUALITY CONTROL

.1 None.

END OF SECTION