Section 16443-2.1
Low Voltage Motor Control Centers
(MNS-MCC)
Part 1  GENERAL INFORMATION

1.01 SUMMARY

A  This specification defines the requirements for low voltage motor control centers utilizing ABB MNS-MCC Low Voltage Motor Control Centers as shown on the contract drawings shall be furnished and installed by the contractor.

1.02 STANDARDS

A  Equipment shall be designed, manufactured and tested in accordance with the most current applicable version of the following:

1.  UL 845 – Low Voltage Motor Control Centers
2.  CSA C22.2 – Canadian Standard Assemblies
3.  NOM NMXJ353 – Official Mexican Norms
4.  UL 489 – Molded Case Circuit Breakers
5.  UL1066 – Low Voltage AC and DC Power Circuit Breakers Used in Enclosures
7.  NEMA ICS-1, NEMA ICS-2 – Industrial Controls and Systems and Industrial Controls and Systems Controllers, Contactors, and Overload Relays
8.  NEMA ICS-18 – Motor Control Centers
1.03 SUBMITTALS

A  Product Data: Submit manufacturer’s printed product data

B  Submittal Drawings for Approval:
   1. Table of Contents for the drawings package
   2. Elevations drawings including Front/Top/Bottom/Side Views and General Notes.
   3. Estimated shipping weights and dimensions
   4. One Line Diagram for showing basic electrical power diagram
   5. Component/Unit Information for tabulating a schedule of unit ratings and options.
   6. Elementary for unit control and power schematic

C  MCC Installation and Maintenance Manual

1.04 QUALIFICATIONS

A  The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B  The manufacturer of this equipment shall be ISO 9001, 14001, and 18001 certified.

C  The manufacturer shall provide Seismic tested equipment that complies with the following standards:
   2. AC156, “Shake-Table Testing for Nonstructural Components and Systems”

D  ASCE/SEI 7-05, “Minimum Design Loads for Buildings and Other Structures”

1.05 SHIPMENT, STORAGE, AND HANDLING

A  Equipment shall be properly packed for shipment, handled at site, and stored in accordance with the manufacturer’s instructions in the MCC Installation and Maintenance Manual. One (1) copy of the MCC Installation and Maintenance Manual shall be provided at time of shipment.
2.01 MANUFACTURER

A The motor control centers shall be ABB, product name MNS-MCC.

B Additions to the existing MCC's shall be the same as the original manufacturer.

2.02 RATINGS

A Voltage – Unless shown differently on the drawings, the MCC shall be rated for a 480VAC or 600VAC, 3-wire and 4-wire systems.

B Short Circuit Withstand Rating – 480V MCC shall be rated for [42,000] [65,000] [100,000] RMS symmetrical amperes. [600V MCC shall be rated for [25,000] [42,000] [65,000] RMS symmetrical amperes]

2.03 STRUCTURE

A The enclosure shall be a NEMA [1A (gasketed general purpose)]

B The basic structure shall provide a rigid platform based on a C-channel design. The structure shall be comprised of 12 and 14 gauge Aluzinc steel. The components of the framework shall be secured by self-tapping screws which require little or no maintenance.

C Each section shall be equipped with removable rear and side panels secured with threaded screws.

D Full height barriers shall be provided to isolate each vertical section.

E Removable end plates on each end of the MCC shall cover all horizontal bus and horizontal wireway openings.

F Four roof-mounted lifting eyes shall be provided for each section.

G Vertical sections shall be 90.5" high excluding lifting eyes, 19.7" (500 mm) wide and 19.7" (500 mm) deep. The widths for incoming main sections shall be either of 19.7", 23.6", 27.6", 31.5", or 39.4" as required.

H Structures shall allow a maximum quantity of [6] 12” Units or [12] 6” Units per vertical section.

I Removable 14 gauge top [and bottom] plates shall be provided for top conduit entry/exit.

J No rear access shall be required to remove any internal control components.
K  MCC Finish:

1. Steel parts shall be prepared for painting by a four-stage wash system consisting of:
   
   - Degreasing process
   - Fresh water rinse
   - Zinc phosphate immersion
   - Fresh water rinse

   Following the wash system all steel parts are dried in an oven. After cleaning and drying, the steel parts are coated with a minimum 3.0 mils dry film thickness of light gray Interpon polyester powder, followed by a 15 minute curing process. The paint shall have a salt spray rating according to ASTM B117-07a of 2000 hours. Paint finish color shall be textured ANSI # 61 light gray.

L  Each enclosure shall contain an engraved stainless steel nameplate with white background and black lettering located on the top of the vertical wireway door.

M  Handling

1. The line up shall be divided into shipping splits. The maximum shipping length shall not exceed 60” (1524 mm). Any lineup that is in excess of 60” (1524 mm) shall be divided into shipping splits accordingly.

2. Each MCC shall be provided with adequate lifting eyes.

3. A removable shipping base shall be provided with every shipping split.
2.04 WIREWAYS

A Each 19.7" structure shall contain a 4" wide vertical wireway with an option for an 8" wide wireway. The vertical wireway depth shall be 11.5" providing 40.25 square inches of cross sectional area for control and load wiring. The wireway shall be isolated from the main bus compartment by use of suitable barriers.

B Each vertical wireway shall be equipped with a window over the bus splices to allow for visual inspection and ease of routine maintenance.

C Each wireway shall be equipped with a 14-gauge full height hinged door securely fastened with three steel quarter-turn latches. The vertical wireway doors shall swing open 105 degrees opposite of the unit doors for maximum accessibility.

D Each vertical wireway shall contain field-wiring terminals for power and control. Terminal block assembly must be finger safe rated and meet IP20.

E The top horizontal wireway shall be 10" high. The top horizontal wireway shall be covered by a 14 gauge steel hinged door secured by a steel quarter turn latch.

F The bottom horizontal wireway shall be 7" high. The bottom wireway shall contain the ground bus and be covered by a 14-gauge steel hinged door secured by a steel quarter turn latch.
2.05 BUSSING

A The main horizontal bus shall be rated at [800] [1200] [1600] [2000] [2500] [3200] [4000] amperes; 3200A and 4000A NEMA-1 only.

B The horizontal bus shall be mounted in the rear portion of the MCC.

C All power bussing shall be braced to withstand a fault current of 65,000 RMS symmetrical amperes at 600V; optional 100,000 RMS symmetrical amperes at 600V to be available.

D The horizontal bus shall be [tin] [silver] plated copper; aluminum bussing not acceptable.

E The main horizontal bus bar shall be sectionalized, allowing shipping splits to be separated.

F Horizontal bus splice connections shall be made with grade 5 hardware at each connection point. All connecting hardware shall be designed to be tightened from the front of the MCC without applying any tools to the rear of the connection.

G The horizontal bus shall be completely isolated from the front of the section by the use of barriers and the vertical distribution bus bar wall (multi-function separator).

H The horizontal bus shall be connected to the adjacent section by means of shipping split splice bar kits. The splice kits are provided on the left side of each section and front accessible through the front side of the vertical wireway. The bus splice kits shall be secured by grade 5 hardware.

I The horizontal-to-vertical bus connects shall be maintenance-free by utilizing a liquid thread-lock epoxy.

J The standard vertical bussing shall be rated 800A minimum no exceptions; optional 1600 amperes shall be available.

K Vertical bussing shall be silver plated copper.

L The standard vertical bus shall be arranged in between the main bus bar and the equipment compartment of the panel. The standard vertical bus bar shall be embedded in an insulated, non-flammable, and nonhygroscopic wall known as “multi-function separator.” The multi-function separator shall be used as a barrier between the bus bar and cable compartment, preventing personnel from accidental and unintentional contact with the vertical bus bars offering a touch-proof design (IP20).

1. Barriers which rely on moving parts (shutters) shall not be acceptable.

M All bus bar ratings are to be based on a maximum temperature rise of 65°C over a 40°C ambient temperature.

N A bottom-located bare copper ground bus shall be provided that runs the width of each MCC section and is connected to adjacent sections with bus splice kits. The ground bus shall be 1 3/16” x 3/8” and be rated for 400 amps. The ground bus shall
be provided with several 0.4 inch holes in each section to accept ground lugs. Steel ground bus is not acceptable.

2.06 PLUG-IN UNITS

A Plug-in units shall be allowed for incoming main circuit breakers up to 800A and main lugs up to 1000A.

B Plug-in units shall connect directly to the distribution bars by means of plug-in contacts. The complete unit is mounted directly on the frame and connected through its own contact elements to the distribution bars.

C The plug-in unit’s technology shall consist of a rear mounting plate made of sheet steel painted white.

D For plug-in units containing a circuit breaker a rotary handle shall be installed on the outside of the hinged door with an interlocking system; flange-type operators shall not be acceptable.

E A unit identification nameplate shall be provided for each unit.
2.07 WITHDRAWABLE UNITS

A Withdrawable units shall be use for NEMA Size 00 to NEMA Size 6 starters; for 6” high (480V only) to 48” high units.

B Withdrawable units shall be 14 gauge sheet steel.

C Withdrawable units shall be provided with an integral front hinged door securely fastened by a steel quarter-turn key latch. Unit doors attached to the structure are not acceptable. The door shall be provided with two lifting handles for removal and installation.

D Withdrawable Units 24” and larger shall be equipped with hinged side handles for ease of installation and removal.

E Withdrawable units, sized from NEMA Size 00 to NEMA Size 6, shall consist of a bottom plate, guide rails, and the sheet metal sidewall with outgoing control circuit connections.

F The front door shall be designed to allow mounting of pilot devices and measuring/indicating instruments as specified.

G Withdrawable units shall be equipped with a five position rotary handle mechanism for breaker units that is used for electrical as well as mechanical interlocking. The following positions shall be available as follows:

1. ON: The unit is inserted, main is closed, main and control circuit is connected
2. OFF: The unit is inserted, main is open, main and control circuit is disconnected, padlocking is possible
3. TRIP (breaker only): The unit is inserted, the main has tripped, and main circuit and control circuit are disconnected.
4. MOVE: The unit may be completely withdrawn from the motor control center.

H Withdrawable units to be equipped with a physically ISOLATED position where all power and control circuits are disconnected. ISOLATED position to be padlockable to prevent the unit from being inserted or fully withdrawn from structure when padlock is installed. Unit to provide physical indication when in ISOLATED position.

I Withdrawables unit shall be equipped with a guiding wheel on the bottom of each unit used for mechanical interlocking.

J Withdrawable units shall contain 300VAC/5A control terminal pull-apart connections. Standard 12-point terminal blocks shall be used. Optional 24 and 28 terminal blocks shall be available. Terminal block connections must be finger safe rated and meet IP20.

K No tools shall be required to remove the unit

L Steel wheels shall be provided on the shelf located beneath the unit. These wheels shall allow ease of installation and removal of the unit.
M Unit guide rails shall be provided on the lower left side of each unit in the structure. This guiderail shall ensure proper stab alignment between the unit power stabs that insert into the multi-function separator.

N Power stabs from the unit to the multi-function separator vertical bus shall be shrouded between phases.

O All motor and control wiring shall be terminated in the vertical wireway allowing removal of the unit from the structure without the use of any tools. All wiring shall remain intact for insertion or removal of the unit.

P Standard unit grounding shall be provided by means of the structure frame.

Q Opening of the unit door to remove the unit shall not be necessary.

R A unit identification nameplate shall be provided for each unit.

S Each withdrawable unit shall be identified with a location numbering nameplate on either of the two handles in front of the unit or on both. The location numbering nameplate shall identify what section the unit corresponds to followed by a sequential number and then by a letter identifying the position in the vertical structure. All letter identifiers shall run from top to bottom.

2.08 FULL HEIGHT UNITS

A Full section units shall accommodate large main units, VFD’s, soft starters and NEMA Size 6 and 7 starters. Each full height unit shall be provided with a full height hinged door securely fastened by (3) quarter-turn fastener latches.

B Full height units shall connect directly to the horizontal distribution bars by means of bus bars. Cabled connections are not acceptable.

C All components within a full height unit shall be mounted on steel plates securely fastened by self-tapping screws to the frame.

2.09 DISCONNECTS

A Main Disconnects

1. If no overcurrent protection is indicated, a main incoming lug compartment shall be provided.

2. Main circuit breaker disconnects (if specified in drawings)
   a. The circuit breaker shall be sized as shown on the drawings.
   b. For circuit breakers less than 1200A an ABB electronic trip molded case breaker shall be used.
   c. Air circuit breakers type ABB Emax shall be used for amperages above 1200A.
B Feeders

1. Feeder disconnects shall be ABB thermal-magnetic circuit breakers

2. The minimum frame size shall be 100 Amps.

C Across the line NEMA Starters and Softstarters

1. The disconnecting means for the across the line starters shall be an ABB magnetic only circuit breaker or thermal-magnetic circuit breaker. All disconnects shall include fingersafe isolation to prevent exposure to primary voltage when the disconnect is in the OFF position.

2. The minimum frame size shall be 100 amps.

D Variable Frequency Drives

1. The disconnecting means for the variable frequency drives shall be an ABB [thermal-magnetic].

2. The short circuit withstand rating shall be rated 100kA.

3. All disconnects shall include fingersafe isolation to prevent exposure to primary voltage when the disconnect is in the OFF position.
2.10 COMBINATION NEMA RATED ACROSS THE LINE STARTERS

A  Starters shall be provided with a NEMA rated ABB A-series contactor; application rated starters are not acceptable.

B  [Overload Protection – Bi-metallic

1. The overload protection shall be ABB type TA model (thermal overload), trip class 20.

2. Overload reset buttons from the front of the unit door shall be available via a cable-actuated plunger.

3. Thermal overload relays shall be 3 poles that are indirectly heated. The relay trips and the position of the auxiliary contacts change under the effects of heating.]

C  [Overload Protection – Electronic

1. The overload protection shall be ABB type E (electronic overload), trip class 10, 20, 30.

2. Overload reset buttons from the front of the unit door shall be available via a cable-actuated plunger.

3. Thermal overload relays shall be 3 poles that are indirectly heated. The relay trips and the position of the auxiliary contacts change under the effects of heating.

4. Electronic overloads shall be able to be close coupled with the A-line contactor series. The overload shall have a selectable reset (manual or automatic), trip indication, stop button, current setting dial, isolated alarm contact.]

D  [Overload Protection – Solid State Universal Motor Controller

1. The overload protection shall be ABB type UMC100, trip classes 5, 10, 20, 30, and 40.

2. Thermistor motor protection (PTC)

3. Earth fault detection when used in IT networks

4. One device for current range: 0.24 up to 63 A

5. Provide six digital inputs, three relay outputs and one 24V output

6. Supports standard configurations for direct starter, reversing starter, star-delta starter, actuator, inching mode etc...

7. Allow function blocks for signal adjustment, boolean logic, timers, counters, etc…

8. Capable of metering, monitoring and diagnosis
9. Fully graphic multi-language LCD panel to allow configuration and control and monitoring

E Starters shall be provided with a minimum of one N.O. and one N.C. auxiliary contact in addition to the hold in contact and auxiliary contacts shown on the drawings.

F Control Power

1. If required, the control power transformer shall include two primary fuses and one secondary fuse.

2. If required, each starter unit shall be provided with an encapsulated 120VAC control power transformer of sufficient size to accommodate the contactor coil burden plus all specified auxiliary devices.

G 30mm metal bezel pilot devices shall be provided as standard, 22mm pilot are available as an option. All pilot devices shall be part of the unit mounted directly to the unit door. Pilot lights shall use LED lights.

2.11 SOFTSTARTERS

A The Softstarter unit shall be provided with an ABB type softstarter model PST or PSTB featuring:

1. Display and keypad
2. Torque control
3. Settable current limit function
4. Electronic motor overload protection
5. PTC input for motor protection
6. Phase imbalance protection
7. Phase reversal protection
8. Locked rotor protection
9. Thyristor over temperature protection
10. Under load protection
11. Programmable warning functions
12. Analog output
13. Field Bus communication
14. Event Log
B  PST applications shall incorporate a separate bypass contactor that is energized once the motor is up to full voltage. The softstart shall also include and internal electronic overload protection with adjustable trip class and configurable auxiliary contacts.

C  PSTB applications shall incorporate a built-in bypass contactor that automatically closes when the motor reaches full voltage. The softstart shall also include and internal electronic overload protection with adjustable trip class and configurable auxiliary contacts.

D  Reversing softstarter units shall have two additional ABB contactors.

E  If specified, provide door mounted pushbuttons for start-stop control.

F  If specified, provide a door mounted human interface module for programming and display.

G  IP20 Fingersafe terminals

H  30mm metal bezel pilot devices shall be provided as standard, 22mm pilot are available as an option. All pilot devices shall be part of the unit mounted directly to the unit door. Pilot lights shall use LED lights.
2.12 VARIABLE FREQUENCY DRIVES

A If required, Variable Frequency Drives rated 25HP and below, [ACS355] [ACS550] [ACS800] series shall be required.

B If required, Variable Frequency Drives rated 30Hp and above,[ACS550] [ACS800] series shall be required.

C The unit shall be provided with a 120V control power transformer. All remote control wiring shall be in the 120V circuit. The control power transformer shall be provided with primary and secondary fusing.

D Provide a door mounted human interface module for programming, control and display.

E If required provide 30mm metal bezel pilot devices shall be provided as standard, 22mm pilot are available as an option. All pilot devices shall be part of the unit mounted directly to the unit door. Pilot lights shall use LED lights.

F Provide an ABB ACS model drive with the following functions:
   1. Flash Drop with Drive PM (Parameter Manager)
   2. MPOT (Speed Pot, Start/Stop & Fwd/Rev Switch)
   3. Built-in brake chopper
   4. Built-in environment EMC filter
   5. IP20 Fingersafe terminals
   6. I/O

2.13 WIRING

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

2.14 QUALITY CONTROL

A The entire MCC shall go through a quality inspection before shipment. This inspection will include:
   1. Physical Inspection
      a. Structure
      b. Electrical conductors, including:
         1). Bussing
         2). General wiring
         3). Units
2. Electrical Tests
   a. General electrical test shall include: power circuit phasing, control
circuit wiring, instrument transformers, and device electrical operation.
   b. AC dielectric tests shall be performed on the power circuit prior to
shipment.

3. Markings/Labels
   a. Instructional type
   b. Underwriters Laboratory (UL)/Canadian Standards Association (CSA).

4. The manufacturer shall use integral quality control checks throughout the
manufacturing process to ensure that the MCC meets operating specifications.

Part 3 EXECUTION

3.01 INSTALLATION
   A Install motor control center in accordance with manufacturer's written guidelines and
all applicable national and local codes.
   B All necessary hardware required to secure the electrical equipment in place shall be
provided by Contractor.

3.02 FIELD QUALITY CONTROL
   A Adjustments
      1. Adjust all operating mechanisms per manufacturer's requirements.
      2. Adjust circuit breaker trip and time settings per values required per site
engineer.
      3. Tighten all bolted bus connections per manufacturer's written guidelines.
   B Cleaning
      1. Touch up damaged or scarred surfaces to match original finish.

3.03 TESTING
   A Perform installation test in accordance with applicable NEC, NEMA, and UL
requirements.
3.04 WARRANTY

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

3.05 FIELD TEST

A Check tightness of all accessible mechanical and electrical connections to assure they are torqued per manufacturer’s recommendations.