

SECTION CSI: LOW VOLTAGE ENCLOSED MOLDED CASE CIRCUIT BREAKERS

PART 1 GENERAL

The requirements of the contract contained in Division XX shall also apply to the work/requirements of this section.

1.01 SECTION INCLUDES

- A. This specification covers low voltage molded case circuit breakers and molded case switches mounted in separate enclosures as detailed below and as shown on the contract drawings.

1.02 RELATED SECTIONS

- A. Not Applicable – No related sections

1.03 REFERENCES

- A. As applicable to the specifics of the project drawings and the specifics of the application for this project, the low voltage safety enclosed molded case circuit breaker, shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted on the project drawings or annotated in any sections below).
 - 1. NFPA 70, National Electrical Code
 - 2. UL 489, Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures

1.04 DEFINITIONS

- A. NEMA 1 Enclosures. Indoor use to provide a degree of protection to personnel against access to hazardous parts and to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt).
- B. NEMA 3R Enclosures. Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); and that will be undamaged by the external formation of ice on the enclosure.
- C. NEMA 4 Enclosures. Indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow,

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splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.

- D. NEMA 4X Enclosures. Indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.
- E. NEMA Type 12 Enclosures. Constructed for indoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and circulating dust, lint, fibers, and flyings); and to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (dripping and light splashing).
- F. UL Listed and cUL Listed. Products that have been tested by Underwriters Laboratories and have met the construction and performance requirements of the applicable UL standards number.

1.05 Molded Case Circuit Breakers

A. General characteristics:

1. Circuit breakers shall be ABB SACE Tmax XT molded case circuit breakers, ABB SACE Formula molded case circuit breakers, Q-Line miniature circuit breakers, or Thermal Magnetic E150 molded case circuit breakers.
2. The MCCB trip amps shall be as shown on drawings.
3. MCCBs shall have double insulation between the live power parts (excluding the terminals) and the front of the apparatus where the operator works during normal operation of the device. The placement of each electrical accessory shall be completely segregated from the power circuit, preventing risk of contact with live parts.
4. MCCB operating mechanism shall include quick-make, quick-break, non-welding silver alloy contacts, and a common Trip, Open and Close mechanism such that all poles open and close simultaneously.
5. Arc Extinction shall be confined to arc chutes internal to the MCCB.
6. The MCCB handle shall indicate the precise position of the moving contacts of the MCCB, thereby providing safe and reliable indication. The MCCB operating mechanism shall be trip-free regardless of the pressure on the lever.
7. The MCCB handle shall reside in a tripped position between on and off to provide local trip indication. The MCCB escutcheon shall be clearly marked on and off.

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8. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and their corresponding interrupting ratings shall be clearly marked on the face of the MCCB.
 9. Each MCCB shall be equipped with a test button, located on the face of the MCCB to mechanically operate the MCCB trip mechanism for maintenance and testing purposes.
 10. Every MCCB must have a hologram on the front of the device, obtained using special anti-counterfeit techniques, which guarantees the quality and that the MCCB is an original ABB product.
 11. MCCBs shall be UL listed for reverse fed.
 12. Unless otherwise noted in the project drawings or specifications, MCCBs shall be UL listed for standard duty and are to be applied at 80% of their continuous current rating.
 13. [Molded Case Switches (MCSs) derived from the MCCB range shall be provided. MCSs up to 1200A will be able to be used in alternating current applications.]
 14. [UL Current Limiting MCCBs up to 600A shall be provided. Current Limiting MCCB will be marked "Current Limiting" on the front and will have a label on the right-hand side specifying peak current and specific let through energy values.]
- B. Trip unit for molded case circuit breakers
- A. General:
 - i. Trip ratings shall range from 15A to 1200A.
 - ii. MCCB shall be available in fixed thermal magnetic (TMF), adjustable thermal magnetic (TMA), and electronic adjustable long time, short time, instantaneous, and ground fault. where indicated. Available trip unit types vary by MCCB frame.
 - B. Thermal Magnetic (800A Frame and Below):
 - i. Basis of Design: Thermal Magnetic Fixed (TMF) and Thermal Magnetic Adjustable (TMA) trip units.
 - ii. General:
 1. Thermomagnetic trip units shall be fitted with bimetal thermal element for overload protection and magnetic element for short circuit protection.
 2. For adjustable trip units, the overload protection shall be continuously adjustable from 70% to 100% of trip rating.

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3. Thermomagnetic trip units shall be available from 15A to 800A trip, fixed rating MCCBs shall be available up to 250A. MCCBs with both adjustable thermal and magnetic elements shall be available from 80A to 800A.

C. Electronic Trip MCCB:

i. Basis of Design: Ekip DIP

1. Electronic trip unit must be unaffected by electromagnetic interference in compliance with the EMC directive and Annex F of IEC 60947-2
2. MCCB trip unit shall be electronic adjustable with true RMS sensing and thermal memory.
3. The standard electronic trip unit shall be fitted with a dip switch interface to ensure accuracy while adjusting protection settings.
4. The basic electronic trip unit shall have adjustable protection for Long Time, Short Time, Instantaneous, [and Ground Fault]. This protection is commonly referred to as LSI, LIG, or LSIG. All protective elements (LSIG) shall be independent of each other. Trip units with tracking short time are not approved. Short circuit protection may be either Instantaneous type (function I) or, alternatively, with intentional delay (function S). The ability to disable the adjustable instantaneous trip is required. The adjustable instantaneous shall be capable of being disabled; an instantaneous override shall provide protection.
 - a. (L) protection shall be adjustable from 40% to 100% I_n at increments of 4% I_n where I_n is the nominal current rating of the MCCB.
 - b. (S) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - c. Both (L) and (S) protection shall be available in two different time delay curves.
 - d. (I) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - e. Ground fault protection, (G) shall be available where indicated with an external neutral sensor for protection of 4 wire loads.
 - f. Accuracy of electronic trip units shall not be affected by ambient temperature.

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- g. Electronic trip units shall be suitable for use on AC circuits only and they shall be available from 10A to 1200 A.
- h. Electronic trip unit shall be fitted with a dip switch interface in order to ensure the best accuracy in tuning the protection thresholds.

D. Advanced Electronic Trip Units:

- i. Basis of Design: Ekip Touch / Hi-Touch.

1. General:

- a. MCCB trip system shall be an electronic trip unit with true RMS sensing and thermal memory.
- b. [Portable configuration and test unit shall be available for setting and testing each protective function.]
- c. [Trip units shall incorporate Bluetooth unit for wireless communication.]
- d. The advanced electronic trip unit shall be fitted with protection functions against extended time overload (L function), high current overload or short circuit (S function), high short circuit current / instantaneous (I function) and optional Ground Fault (G function) or alarm. Instantaneous short circuit protection (I function) may be disabled allowing instantaneous override to provide UL required protection.
 - i. The minimum pickup threshold for protection against overload will be 40% times I_n .
 - ii. (S) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - iii. Both (L) and (S) protection will be available in five different time delay curves.
 - iv. Two different kinds of (S) protection (with inverse or definite time) shall be available.
 - v. (I) protection pickup shall allow fifteen settings from 1 to 10 times I_n .
 - vi. (G) protection pickup shall allow at least seven settings from 20% to 1 times I_n .

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- vii. (G) protection shall be available with four different time delay curves.
 1. The trip thresholds on electronic trip units shall not be affected by ambient temperature.
 2. Trip units shall have the capability to be adjusted locally or remotely. Increments for pickup adjustments shall be 0.1% I_n for (L) and (G) protection, and 10% I_n for (S) and (I) protection.
 3. Electronic trip unit with the [Touch][Hi-Touch] shall have LEDs on the front to indicate the status of MCCB, pickup status, and cause of trip.

1.06 SUBMITTALS

- A. The contractor/installer shall provide electronic copies of the following documents in PDF format as APPROVAL drawings to the engineer/owner for review and evaluation. It is preferred that the drawing format be provided in letter/size "A" (8.5" x 11") or tabloid/size "B" (11" x 17") format to facilitate easy copying. Manufacturing of the equipment will not begin until the submitted documents are stamped/noted "approved" or "approved as noted" by the engineer/owner and officially released for manufacturer by the contractor/installer/distributor/owner.
- B. APPROVAL documents for the specified product shall include:
 1. Molded Case Circuit Breaker Enclosure Information Drawing – by the equipment manufacturer. This "by each type" document shall contain at least the following information for each type of enclosed molded case circuit breaker on the project. For exactly identical types, quantities of the enclosed molded case circuit breaker shall also be indicated.
 - a. Overall enclosure dimensions
 - b. Current rating
 - c. Voltage rating
 - d. Knockout dimensions
 - e. Neutral connection / block (if applicable)
 - f. Ground connection / block

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2. Enclosed Molded Case Circuit Breaker Brochure – detailing the general construction of the product – by the equipment manufacturer
- C. The contractor/installer shall provide electronic copies of the following documents in PDF format to reflect the AS BUILT condition of the equipment to the engineer/owner for their record documentation. It is preferred that the drawing format be provided in letter/size “A” (8.5” x 11”) or tabloid/size “B” (11” x 17”) format to facilitate easy copying. ‘D. AS BUILT documents for the specified product shall include:
 1. Molded Case Circuit Breaker Enclosure Information Drawing – by the equipment manufacturer. This “by each type” document shall contain at least the following information for each type of enclosed molded case circuit breaker on the project. For exactly identical types, quantities of the enclosed molded case circuit breaker shall also be indicated.
 - a. Overall enclosure dimensions
 - b. Number of switching poles
 - c. Current rating
 - d. Voltage rating
 - e. Knockout dimensions
 - f. Neutral connection / block (if applicable)
 - g. Ground connection / block

1.07 QUALITY ASSURANCE (QUALIFICATIONS)

- A. The manufacturer shall have specialized in the manufacture of Enclosed Molded Case Circuit Breakers for at least 15 years.
- B. The low voltage circuit breaker enclosures shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in the “REFERENCES” section of this specification above.
- C. Equipment shall be qualified for use in for any site with a site specific SDS equal or less than the values below and at any location within a building as follows:
 1. High seismic loading as defined in IEEE Std 693-2005, with 1.33 amplification factor.
 2. IBC-2015, $I_p = 1.5$, for z/h equal to in accordance with ICC-ES-AC156.
 - a. NEMA 1/3R/5/12, 30A – 100A: Sds = 2.71 g
 - b. NEMA 1/3R/5/12, 200A – 600A: Sds = 1.59 g

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- c. NEMA 1/3R/5/12, 800A – 1200A: Sds = 1.21 g
 - d. NEMA 4/4X, 30A – 600A: Sds = 1.22 g
- 3. The Enclosed Molded Case Circuit Breakers shall be seismic certified as documented in OSP-0320-10.
 - 4. Seismic compliance shall be qualified only through shake table testing.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The manufacturer shall ship each Enclosed Circuit Breaker in an individual carton for ease of handling.
- B. The contractor/installer shall inspect and if necessary, report any concealed damage to carrier within 48 hours of the enclosed molded case circuit breaker being delivered. The contractor/installer shall be responsible for all claims with the shipper.
- C. The contractor/installer shall store the enclosed circuit breakers in a clean, dry space and shall maintain factory protection and/or cover the products with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic.
- D. The contractor/installer shall handle the enclosed molded case circuit breakers in accordance with all appropriate NEMA instructions to avoid damaging them.

1.09 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

- A. The contractor/installer shall follow all appropriate standards and service conditions before, during and after the enclosed molded case circuit breaker installation.
- B. The enclosed molded case circuit breaker shall be located in well ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials.
- C. Indoor locations shall be protected to prevent moisture from entering enclosure.

1.10 WARRANTY

- A. The Manufacturer warrants the enclosed molded case circuit breaker to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of shipment, whichever occurs first.
- B. In the event of that any warranty work needs to be performed, a representative of the manufacturer shall be notified in writing of the problem. The factory will then issue instructions and any materials to correct the problem. All warranty work

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must be performed by the manufacturer at the manufacturer's discretion in order to maintain the manufacturer's warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER & DESIGN

- A. ABB products have been used as the basis for design and is the preferred provider for the equipment. Other possible acceptable manufactures are listed below. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
 - 1. GE by ABB Circuit Breaker Enclosures (basis of design):
<https://www.geindustrial.com/publibrary/product/spec-setter-emergency-power-transfer/application-and-technical>
- B. Request for acceptance as an approved equal manufacturer must be submitted to the engineer in writing (letter, fax or e-mail) at least 10 business days prior to the bid date. A written (letter, fax or email) response from the engineer/owner will then be issued determining the acceptance or rejection of the request.
- C. Any and all exceptions to the requirements detailed in this specification shall be included in the manufacturer's proposal so that the engineer/owner can easily make a comparison to this base specification document.
- D. If no exceptions or qualification are contained in the manufacturer's proposal, the manufacturer shall provide exactly what is detailed in this section of the specification. Failure to meet the requirements of the specification or to note any exceptions or qualifications will result in the technical rejection of the proposal.
- E. The first source of general information shall be these general specifications; however, detailed and specific information contained in the drawings will take precedence over these general specifications as the drawings contain project specific information. In the event of a conflict the owner/engineer will determine which is correct.

2.02 PRODUCT INFORMATION

- A. Refer to the project drawings and the molded case enclosed circuit breaker schedules for the locations and quantities. The drawings and schedules shall also include information about the current and voltage ratings of devices.
- B. Enclosures
 - 1. Where indicated on drawings, provide [NEMA 1] [NEMA 3R] [NEMA 4/4X] [NEMA 12] deadfront enclosures.

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2. NEMA 12 enclosures, when furnished, shall be provided without knockouts.
3. [NEMA 4/4X enclosures shall be fabricated using [304 stainless steel] [and optional as 316 stainless steel where available].

2.03 ACCESSORIES

- A. Provide the following accessories where indicated on drawings.
 1. Neutral Kit
 2. Equipment Ground Kit
 3. Auxiliary contacts. Auxiliary contacts shall be designed to open before circuit breaker contacts part.
 4. Copper Line and Load Lugs

PART 3 EXECUTION

3.01 EXAMINATION

- A. The contractor/installer shall make all necessary field measurements to verify that the enclosed molded case circuit breaker shall fit in the allocated space in full compliance with the minimum required clearances recommended by the manufacturer, specified in National Electrical Code and/or Canadian Standards Association required by any applicable local/facility constraints. The following examinations shall include but not be limited to the following.
 1. Verify that the field measurements of the enclosed molded case circuit breaker are the same as shown on factory drawings.
 2. Inspect the enclosed molded case circuit breaker and confirm that they are ready to be installed.
 3. Check walls or the mounting structure for uniformity and a level plumb surface.
 4. Examine the installation area to assure there is enough clearance to install the enclosed molded case circuit breaker such that it will fit in the allocated space in full compliance with the minimum required clearances recommended by the manufacturer, specified in National Electrical Code and required by any applicable local/facility constraints.
 5. Confirm that required utilities are available, in proper location and ready for use.

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- B. Commencement of installation means that the contractor/installer accepts these conditions.

3.02 LOCATION

- A. Refer to the projects site layout drawings for details regarding the proper area to place the enclosed molded case circuit breakers.

3.03 INSTALLATION

- A. The contractor/installer shall furnish and completely install the low voltage enclosed molded case circuit breaker as shown on the project drawings. All necessary hardware to secure the enclosed molded case circuit breaker in place shall be provided by the contractor/installer.
- B. The contractor/installer shall provide and install any required safety labels and identification labels.
- C. The contractor/installer shall mount the enclosed molded case circuit breaker in full compliance with NEC 404.8(A). The center handle shall not be more than 6'7" above the floor or working platform. The contractor/installer shall also verify any minimum ground clearance that is required.
- D. The contractor/installer shall be responsible for procuring and installing any required fuses for fusible enclosed molded case circuit breakers according to the manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

- A. The following quality control checks shall be performed by the contractor/installer.
 - 1. Inspect the installed enclosed molded case circuit breaker for proper anchoring, alignment and grounding as well as inspecting for any internal and external physical damage.
 - 2. Confirm that all shipping and packing material has been removed.
 - 3. Check the tightness of all accessible mechanical and electrical connections with a calibrated torque wrench. The minimum acceptable values are specified in the manufacturer's instructions.
 - 4. Check each electrical connection for proper phasing and identification.
 - 5. With power off, check each enclosed molded case circuit breaker for proper mechanical operation, preferable with the door open, and confirm the continuity of each pole by continuity tester.
 - 6. With the door closed confirm the door will not open with the enclosed molded case circuit breaker is in the ON position.

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3.05 CLEANING

- A. The contractor/installer shall clean the interior and exterior of the enclosed molded case circuit breaker to remove construction debris, dirt, and shipping materials.
- B. The contractor/installer shall perform minor touch-up on scratched or marred exterior surfaces to match original finish using an approved paint.

3.06 TRAINING

- A. Not Applicable – no training on the enclosed molded case circuit breaker is required.

END OF SECTION