الشركة السعودية للكهرباء
Saudi Electricity Company
نعمل بإتقان من أجلكم

37-SDMS-01

REV. 04 (11-07-2018)

SPECIFICATION FOR LOW-VOLTAGE MOLDED CASE CIRCUIT BREAKERS (MCCB) FOR SERVICE CONNECTIONS

Saudi Electricity Company

1. SCOPE

This specification defines the minimum technical requirements for design, engineering, manufacture, testing, inspection and performance of molded-case circuit breakers (MCCB) for indoor and outdoor installation in an enclosure and intended to be used for service connections in the low-voltage distribution system of Saudi Electricity Company (SEC) in Saudi Arabia.

2. CROSS REFERENCES TO OTHER SEC STANDARDS

This specification shall always be read in conjunction with SEC General Specification No. 01-SDMS-01 (latest revision) titled "General Requirements for all Equipment/Materials," which shall be considered as an integral part of this specification. It shall also be read in conjunction with SEC purchase order and/or contract schedules, and scope of work/technical specifications for projects, as applicable.

3. APPLICABLE CODES AND STANDARDS

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacturer may propose equipment/materials conforming to alternate codes or standards. However, the provisions of SEC standards shall supersede the provisions of these alternate standards in case of any difference.

Table 1: List of applicable standards

Standard #	Title
IEC 60947-1	Low-Voltage Switchgear and Controlgear – Part 1: General Rules
IEC 60947-2	Low-Voltage Switchgear and Controlgear – Part 2: Circuit-Breakers
ASTM B633	Specification for Electrodeposited Coatings of Zinc on Iron and Steel

4. SERVICE AND SYSTEM CONDITIONS

The MCCBs shall be suitable for operation under the service conditions specified in the latest revision of SEC specification 01-SDMS-01.

All fittings and attachments of the MCCBs shall be capable of withstanding the effects of direct solar radiation at their installed locations. The temperature of surfaces exposed to direct solar radiation shall be regarded as 75°C plus the effect of any internal heating.

The MCCBs shall be suitable for installation in a system with the following parameters:

Table 1: Low-voltage system parameters

System Condition	Low-Voltage System
Frequency	60 Hz
Wiring Configuration	3-Phase, 4-Wire
Voltage Level	230/133 ±5% 400/230 ±5%
Grounding System	Solidly Grounded

5. MATERIAL, DESIGN AND CONSTRUCTION REQUIREMENTS

5.1. GENERAL

5.1.1 The MCCBs shall be 3-pole, with thermal and magnetic releases, arc suppression device, operating handle, lock and key system, and encased in a sealed cover permanently attached to the base. The incoming and outgoing terminal shall be provided with terminal covers, as applicable.

5.1.2 Thermal interaction shall not affect the performance of any component of the MCCBs.

5.1.3 All bolted electrical joints shall be secured with corrosion-proof steel nuts and bolts. All bolts, nuts and washers are Type-II plated per ASTM B633.

5.2. CASING

5.2.1 Casings shall be molded from high-grade, virgin materials, strong heat-resistance resin, with a sturdy sealed cover that is attached permanently to the base.

5.3. TERMINALS

5.3.1 All terminals of the MCCBs shall be made of tinned copper, with a minimum coating thickness of 5µm.

5.3.2 The incoming supply terminals shall be at the bottom and the outgoing load terminals at the top as viewed from the front per Figure-1, 2, 3, and 4.

5.3.3 Incoming Terminals

Incoming terminal shall be suitable for both copper and aluminum conductors of sizes according to the following ratings:

a. MCCBs rated 20A up to 150A: incoming terminals shall be box-type with hex-socket screws suitable for direct connection (without cables lugs) of copper conductor up to 35mm².

b. MCCBs rated 200A and 250A: incoming terminals shall be box-type with hex-socket screws suitable for direct connection (without cable lugs) of copper conductor up to 120mm².

c. MCCBs rated 300A, 400A, 500A, 600A, 800A, and 1000A: incoming terminals shall be suitable for copper or aluminum conductors up to 300mm² with the use of cable lugs conforming to latest revision of SEC specification 12-SDMS-02. Bolted-type terminal spreaders shall be used to increase the pole pitch and to allow provision to connect two (2) cables with lugs (back-to-back) on these terminals and fastened with M12 bolts and nuts.

   Each terminal spreader shall be provided with 1-bolt, 1-nut, 2-flat washers, and 1-spring washer. The minimum length of the bolt shall comply as per Figure-5.

5.3.4 Outgoing Terminals

a. MCCBs rated 20A up to 250A: outgoing terminals shall be the same as the incoming terminals.

b. MCCBs rated 300A and 400A: outgoing terminals shall be box-type with hex-socket screws for direct connection (without cable lugs) of copper conductors 185mm² and 240mm².

c. MCCBs rated 500A, 600A, 800A, and 1000A: outgoing terminals shall be suitable for bolted-type direct connection of tinned copper busbars.

5.4. TERMINAL COVERS

5.4.1 All MCCBs shall be provided with self-fitting knock-out type terminal covers with removable rubber phase-separators for both incoming and outgoing terminals. Provision for sealing should be available, and can be sealed using any standard seals.

5.4.2 MCCBs rated 800A and 1000A: incoming terminals can be provided with removable rubber phase-separators without terminal covers.

5.5. OPERATING MECHANISM

5.5.1 All MCCBs shall be single-handled manually operated toggle-type that will operate all poles simultaneously at close, trip or open. MCCBs rated 400A, 500A, 600A, 800A, and 1000A shall be provided with extension handle.

5.5.2 Thermal and magnetic automatic trip, quick-make and quick-break mechanism that is mechanically trip-free shall be provided. This shall include the overload trip elements and magnetic short-circuit non-adjustable trip elements.

5.5.3 The MCCB position indicators, i.e. "ON" - "TRIPPED" - "OFF" shall be indicated by the handle position on top, center and bottom, respectively. The "ON" and "OFF" positions, at top and bottom of the handle position respectively, shall be engraved or marked by indelible print. All the positions shall be clearly visible from the front.

5.5.4 A cylindrical mechanical lock (Ronis Cylinder, Ø12mm, Profile No. 5) shall be fitted to the right side of the operating handle of the MCCB to lock the mechanism in an "OFF" position. The lock shall only be operated by SEC approved Ronis Standard Key. The lock positions shall marked as “LOCKED” and “UNLOCKED”.

5.5.5 Each MCCB shall have a “Push-to-Trip” button.

5.6. BREAKER CONTACTS

5.6.1 The contacts of the MCCBs shall be fitted with arc suppression devices, and shall be constructed such that all the poles will simultaneously close, trip, and open for a fault on any pole.

5.7. MOUNTING SCREWS

5.7.1 Each MCCB shall be supplied with corrosion-proof steel cap screws of sufficient length for mounting the breaker on unthreaded 3mm thick steel sheets or polyester sheets or steel rails. The size of bolts shall be M4 for MCCBs rated up to 300A. For MCCBs rated 400A and above, the size of screws shall be M6.

5.8. RELEASES (OVER-CURRENT RELEASES)

5.8.1 All MCCBs shall be equipped with fixed-setting thermal and magnetic releases, with inverse time-delay characteristics.

5.9. MAINTENANCE

5.9.1 All MCCBs shall not be openable and do not require any routine maintenance.

5.10. DIMENSIONS

5.10.1 The maximum overall dimensions of the MCCBs are given in the table below:

Table 2: Maximum allowable dimensions of MCCBs

MCCB Ratings	Width, mm	Length, mm		Depth, mm
		w/o Terminal Cover	w/ Terminal Cover	
20A to 250A	110	165	210	140
300A & 400A	140	260	400	140
500A & 600A	210	300	500	175
800A & 1000A	210	330	500	205

6. ELECTRICAL REQUIREMENTS

6.1. ELECTRICAL PERFORMANCE RATING

The MCCBs shall conform to the following minimum requirements:

6.2.1 Rated Operational Voltage, *Ue* = 230V and/or 400V (3-Pole)

6.2.2 Rated Operational Current at 55°C, *Ie*

20A, 30A, 40A, 50A, 70A, 100A, 125A, 150A, 200A, 250A, 300A, 400A, 500A, 600A, 800A, and 1000A.

6.2.3 Rated Duty = Uninterrupted Duty

6.2.4 Rated Insulation Voltage, *Ui* = 1000V

6.2.5 Rated Impulse Withstand Voltage, *Uimp* = 8kV

6.2.6 Rated Frequency, *f* = 60Hz

6.2.7 Rated Short-Circuit Breaking Capacity, *Icn*

a. At 230V (3-Pole) rated voltage:

- 25kA for MCCBs rated 20A up to 400A
- 65kA for MCCBs rated 500A up to 1000A

b. At 400V (3-Pole) rated voltage:

- 20kA for MCCBs rated 20A up to 400A
- 40kA for MCCBs rated 500A up to 1000A

7. MARKING

The rated current shall be marked using indelible ink or engraved on the operating handle or suitable location that can be viewed readily from the front and through the MCCB window of the meterboxes.

Each MCCB shall have a clear nameplate engraved or laser printed on the left-side of the front cover. The nameplate shall bear the following information:

a. Manufacturer and Model/Type
b. MCCB Electrical Requirements per Clause 6 above, as applicable
c. Conformance Standard, i.e. IEC 60947-2
d. Serial Number
e. Year of Manufacture
f. Origin
g. SEC Issued PO Number
h. Vendor Name
i. Reference SEC Specification
j. SEC Monogram

The front cover shall be laser printed showing the hex-socket size and the maximum torque of the terminal screws.

The operating handle shall have position indicators in “OPEN” and “CLOSE” position. This can be achieved either by making indelible markings or using strong printed adhesive stickers. The “CLOSE” position shall be marked using bold black font typed “ON” in red background, and the “OPEN” position shall be marked using black bold font typed “OFF” in green background.

8. TESTING AND INSPECTION

The MCCBs shall be tested in conformance with the applicable requirements of the latest version of IEC 60947-2.

SEC reserves the right to optionally carryout testing either through its own in-house laboratory or in 3rd-party laboratories to verify the performance of the supplied MCCBs. This shall be performed by randomly selecting 10% samples of any batch delivered to each SEC warehouses. The batch shall be assumed rejected should more than three (3) MCCBs are found faulty.

8.1. ROUTINE TESTS

Routine tests in conformance with the applicable clauses of IEC 60947-2 shall be performed on all MCCBs. Electronic copies of the test reports shall be submitted to SEC in USB thumb drive for each batch to be delivered prior to issuance of the releases.

8.2. TYPE TESTS

Type test shall be performed in complete conformance with the applicable clauses of IEC 60947-2. It shall be performed at SEC approved laboratories.

SEC reserves the right to attend and witness the tests.

SEC reserves the right to request the supplier/manufacturer to repeat the type test every five (5) years, or as needed should the supplied MCCBs have frequent faults and failures.

8.3. SAMPLE INSPECTION

Samples together with actual CAD drawings and routine test reports shall be submitted for inspection/evaluation prior to issuance of approval for mass production. The following attributes shall be checked:

a. Dimensional verification
b. Engraved or laser print markings
c. Compliance of Lock and Keys
d. Operation
e. Torque requirements of the terminal screws, as applicable
f. Finishing
g. Packaging

9. PACKING AND SHIPPING

Packing and shipping requirement shall generally be as per latest revision of SEC General Requirements for Equipment/Materials, 01-SDMS-01 or as per purchase order requirements.

Each MCCB with all its accessories shall be packed in a box as a complete unit/assembly and shall be delivered ready for use. Keys should be supplied collectively in a separate box and must not be included in each MCCB box. A minimum of one (1) key should be provided for every 50 units of MCCB supplied.

Packing shall protect the MCCBs against damage during shipment and site handling.

Each MCCB shall be packed to ensure that no dust, dirt, or foreign matter will enter in the MCCB mechanisms.

Suppliers should coordinate with SEC Warehousing Department for additional packing, handling, and or shipping instructions, as applicable.

Each box shall be printed with the following information:

a. Purchase Order Number / Tender Number
b. MCCB Rated Current
c. Manufacturer's Name and Model/Type
d. Year of Manufacture
e. SEC Item Code

10. GUARANTEE

The supplier/manufacturer shall guarantee the products against all defects arising out of faulty design or manufacturing defects or defective materials for a period of five (5) years from the date of delivery.

The supplier shall guarantee the uniformity of the products delivered with the approved samples.

11. SUBMITTALS

11.1. SUBMITTALS REQUIRED WITH TENDER/INQUIRY

10.1.1 Summary in table form with the following information: list of items offered, manufacturer, origin, catalogue number, and quantity

10.1.2 Clause-by-clause compliance with the latest revision of SEC specification 37-SDMS-01.

10.1.3 Manufacturer's Catalogue

10.1.4 Certificate stating that the raw material has been sampled, tested and inspected in accordance with relevant standard specifications.

10.1.5 Product type test reports and certificates carried out from SEC approved laboratories

10.1.6 Filled-up technical data schedule on each of the items offered

10.1.7 Manufacturer CAD drawings for each of the items offered

10.1.8 USB Flash Drive containing e-copy of all the documents mentioned above

11.2. SUBMITTALS REQUIRED FOLLOWING AWARD OF CONTRACT

10.2.1 Samples in compliance with Clause 8.3 of this specification

10.2.2 Quality assurance tests

10.2.3 Manufacturing and routine test schedules

10.2.4 Special tests, if applicable

12. TECHNICAL DATA SCHEDULE

Table 5: Technical Data Schedule

SEC Inquiry No: Item No:

No	Description	SEC Specified Values (*)	Vendor Proposed Values (**)
1	**General**		
	MCCB Rated Operational Current at 55°C, *Ie*	*	
	Rated Operational Voltage, *Ue* (3-Pole)	230V ±5% 400V ±5%	
	Rated Duty	Uninterrupted	
	Rated Insulation Voltage, *Ui*	1000V	
	Rated Impulse Withstand Voltage, *Uimp*	*	
	Rated Frequency, *f*	*	
	Rated Short-Circuit Breaking Capacity, *Icn*	*	
2	**Casing**		
	Case is sealed and not openable	Yes	
	Material	Resin	
	Temperature Index	75°C	
3	**Incoming Terminals**		
	MCCBs Rated 20A up to 150A (Box-Type Terminals)	Suitable for direct-connection of 35mm² cable	
	MCCBs Rated 200A up to 250A (Box-Type Terminals)	Suitable for direct-connection of 120mm² cable	
	MCCBs Rated 300A up to 1000A	Suitable for connection of cables up to 300mm² with cable lugs	
	Material (MCCB Main Terminal)	Tinned Copper	
	Terminal Covers Provided	Yes / No	

4	**Outgoing Terminals**		
	MCCBs Rated 20A up to 150A (Box-Type Terminals)	Suitable for direct-connection of 35mm² cable	
	MCCBs Rated 200A up to 250A (Box-Type Terminals)	Suitable for direct-connection of 120mm² cable	
	MCCBs Rated 300A up to 400A (Box-Type Terminals)	Suitable for direct-connection of 185 mm² or 240mm² cable	
	MCCBs Rated 500A up to 1000A	Suitable for bolted-type connection of tinned copper busbar	
	Material (MCCB Main Terminal)	Tinned Copper	
	Terminal Covers Provided	Yes / No	
	Terminal Spreader Provided	Yes / No	
	Bolts for Terminal Spreader Provided	Yes	
	Phase Barrier Provided	Yes	
5	**Releases**		
	Type of Releases	Fixed-Setting Thermal and Magnetic	
	Tripping Time Setting Characteristics	Inverse Time-Delay	
6	**Dimensions, mm**	L x W x D	
7	**Testing**		
	Product is Type Tested	Yes	
	SEC Approved Laboratory	**	
	Date Tested	**	
	Manufacturer	**	
	Model/Type	**	
	Country of Origin	**	
	Submittals Required with Tender/Inquiry Included or Not?	**	

Molded-Case Circuit Breaker (MCCB)

SEC Inquiry No: Item No:

- Additional Technical Information or Features Specified by SEC

- Additional Supplementary Data or Features Proposed by Bidder/Vendor/Supplier.

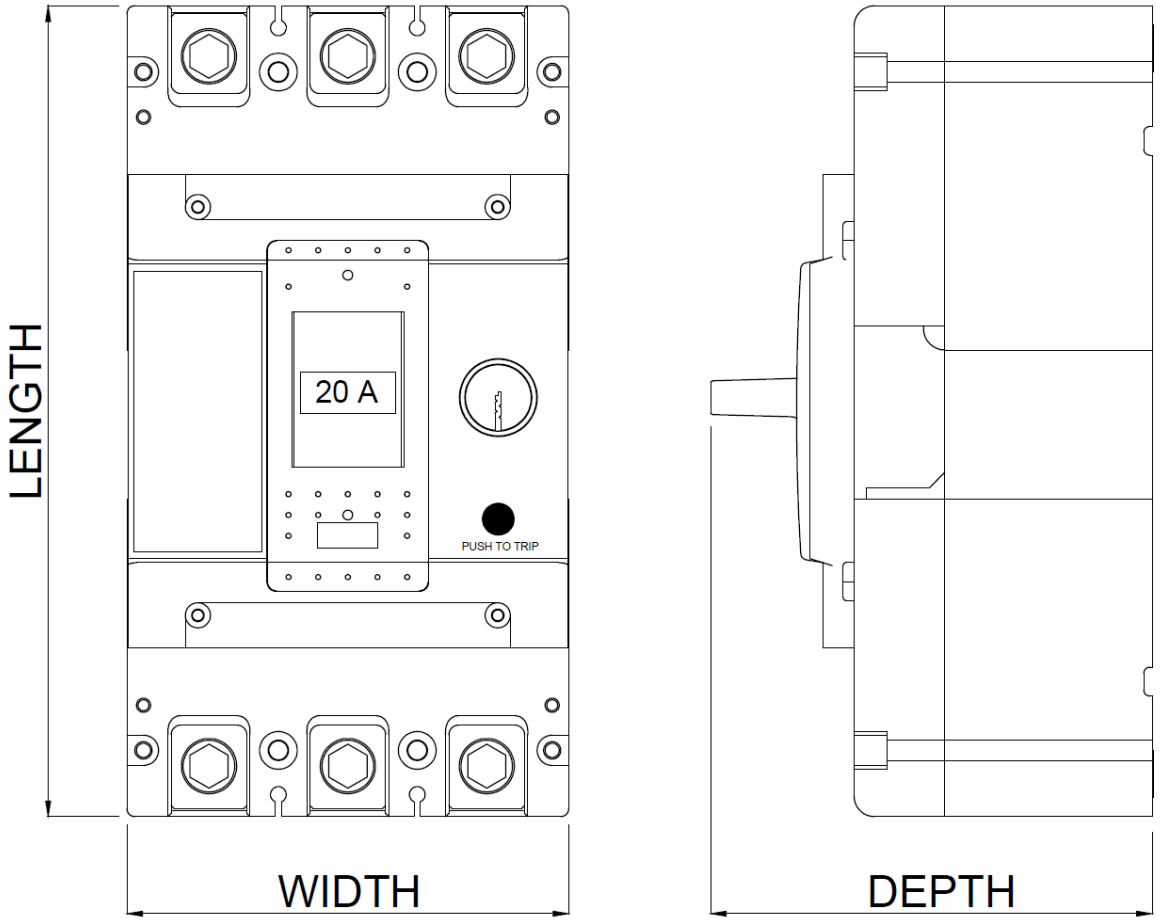
- Other Particulars to be filled-up by the Bidder/Vendor/Supplier.

- List of Deviations and Clauses to which exception is taken by the Bidder/Vendor/Supplier. (Use separate sheet, if necessary).

Description	Manufacturer of Material/Equipment	Vendor/Supplier
Name of Company		
Location and Office Address		
Name and Signature of Authorized Representative with Date		
Official Seal / Stamp		

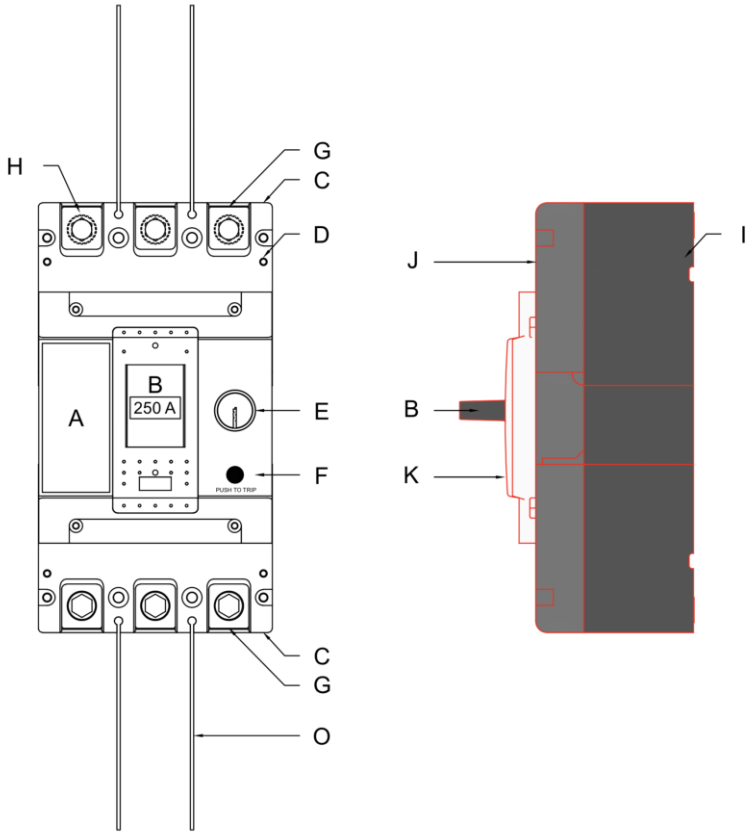
13. DRAWINGS

Figure 1: Maximum allowable dimensions of MCCB



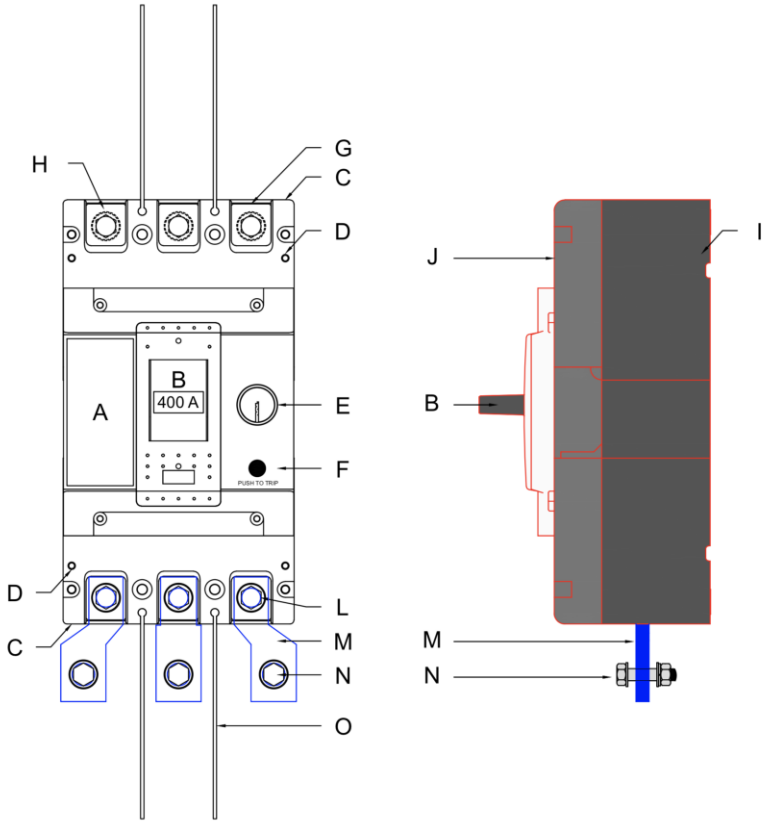
MCCB Ratings	Width, mm	Length, mm		Depth, mm
		w/o Terminal Cover	w/ Terminal Cover	
20A to 250A	110	165	210	140
300A & 400A	140	260	400	140
500A & 600A	210	300	500	175
800A & 1000A	210	330	500	205

Figure 2: Illustrative example of the general parts and components of MCCBs rated 20A up to 250A



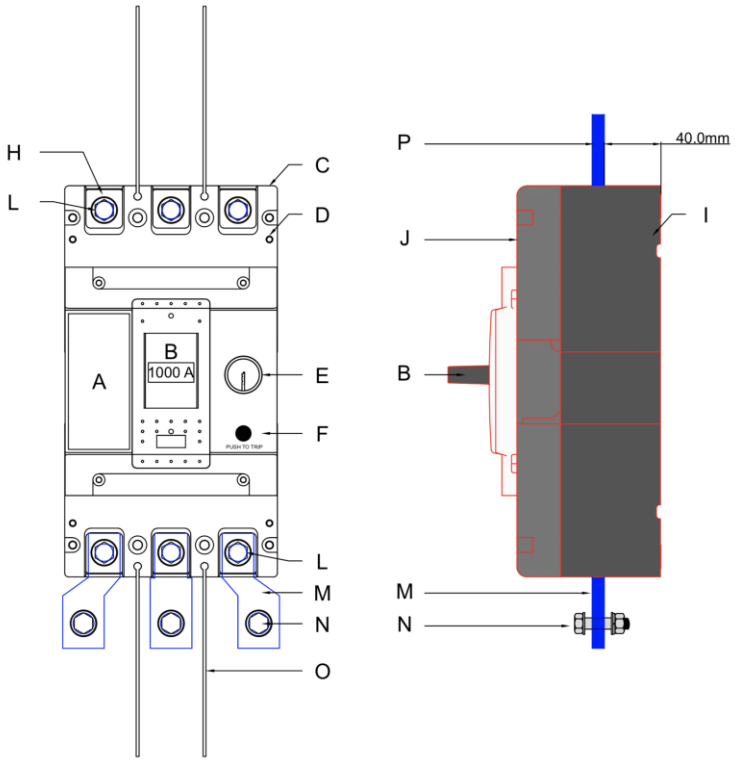
Legend	Description
A	Nameplate
B	Handle
C	Terminal Cover
D	Sealing Provision for Terminal Cover
E	Lock & Key System
F	Trip Button
G	Box-Type Terminal with Hex-Socket Screws
H	Terminals
I	Base Frame
J	Mechanism Cover
K	Face (Front Cover)
O	Phase Barriers

Figure 3: Illustrative example of the general parts and components of MCCBs rated 300A up to 400A



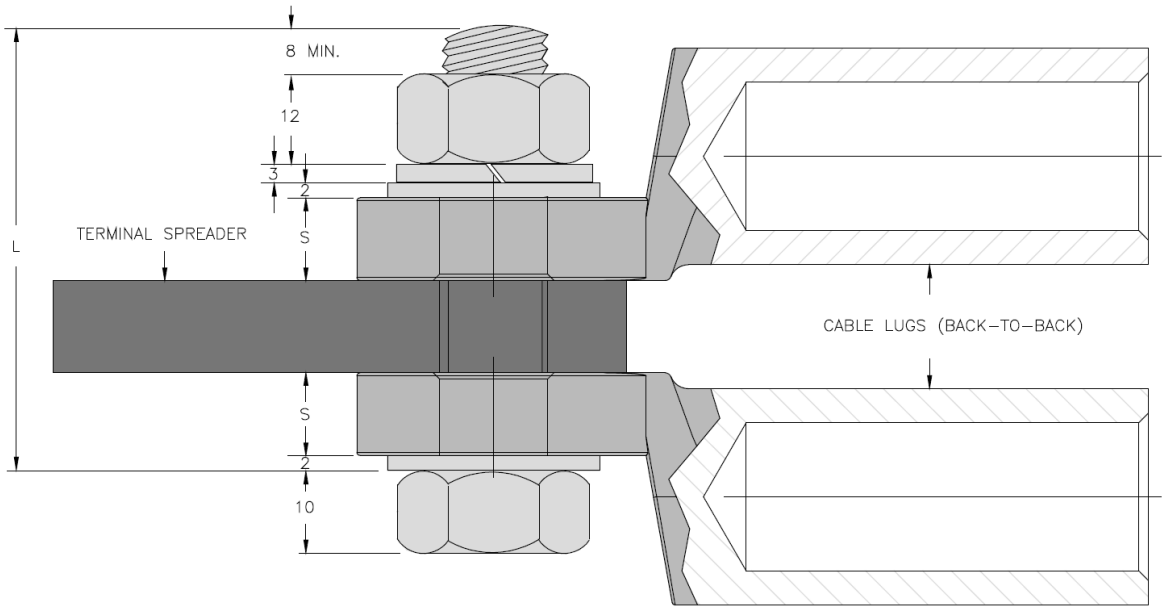
Legend	Description
A	Nameplate
B	Handle
C	Terminal Cover
D	Sealing Provision for Terminal Cover
E	Lock & Key System
F	Trip Button
G	Box-Type Terminal with Hex-Socket Screws
H	Terminals
I	Base Frame
J	Mechanism Cover
K	Face (Front Cover)
L	Hex-Head or Hex-Socket Bolts
M	Terminal Spreaders
N	Bolt w/ 2-Flat Washers, 1-Spring Washer & 1-Nut, M12
O	Phase Barriers

Figure 4: Illustrative example of the general parts and components of MCCBs rated 500A up to 1000A



Legend	Description
A	Nameplate
B	Handle
C	Terminal Cover
D	Sealing Provision for Terminal Cover
E	Lock & Key System
F	Trip Button
G	Box-Type Terminal with Hex-Socket Screws
H	Terminals
I	Base Frame
J	Mechanism Cover
K	Face (Front Cover)
L	Hex-Head or Hex-Socket Bolts
M	Terminal Spreaders
N	Bolt w/ 2-Flat Washers, 1-Spring Washer & 1-Nut, M12
O	Phase Barriers
P	Direct Bolted-Type Connection to Tinned Copper Busbar

Figure 5: Calculation of minimum length of bolts for the spreader terminals



NOTE:

S - Palm thickness of cable lugs (see Figure-1 and Figure-2 per latest revision of 12-SDMS-02 for copper and aluminum lugs, respectively).