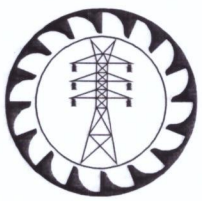
013: 2021

CEB

SPECIFICATION

MOULDED CASE CIRCUIT BREAKERS FOR LOW VOLTAGE NETWORKS



CEYLON ELECTRICITY BOARD

SRI LANKA

Telephone: +94 11 232 8051

Fax: +94 11 232 5387

Contents

SPECIFICATION FOR MOULDED CASE CIRCUIT BREAKERS FOR LOW VOLTAGE NETWORKS

1.0 SCOPE

This specification covers the manufacture and testing of following types of Moulded Case Circuit Breakers (MCCB) used in the Low Voltage Distribution system of the CEB to provide overload and short circuit protection for Distribution lines up to Customer Distribution Panel.

(i). MCCB of rated current 30 A, fixed current settings, with selectivity category A

(ii). MCCB of rated current 60 A, fixed current settings, with selectivity category A

(iii). MCCB of rated current 100 A, fixed current settings, with selectivity category A with/without locking arrangement.

(iv). MCCB of rated current 125 A, adjustable current settings, with selectivity category A with/without locking arrangement.

(v). MCCB of rated current 160 A, adjustable current settings, with selectivity category A with/without locking arrangement.

(vi). MCCB of rated current 250 A, adjustable current settings, with selectivity category A with/without locking arrangement.

(vii). MCCB of rated current 400 A, adjustable current settings, with selectivity category B with/without locking arrangement.

(viii). MCCB of rated current 630 A, adjustable current settings, with selectivity category B with/without locking arrangement.

(ix). MCCB of rated current 800 A, adjustable current settings, with selectivity category B with/without locking arrangement.

(x). MCCB of rated current 1000 A, adjustable current settings, with selectivity category B with/without locking arrangement.

(xi). MCCB of rated current 1250 A, adjustable current settings, with selectivity category B with/without locking arrangement.

(xii). MCCB of rated current 1600 A, adjustable current settings, with selectivity category B with/without locking arrangement.

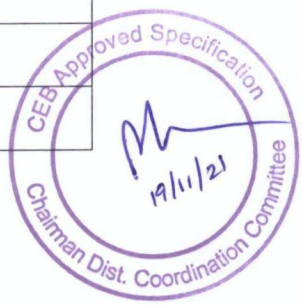
Procurement entity shall prescribe the required category/ies in the price schedule indicating any other extra options if needed. Number of poles of MCCBs shall be 3 unless otherwise specified in the price schedule. It should be noted that adjustable current settings mean thermal adjustable settings.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage (U)	400/230 V
(b)	System highest voltage (U_m)	440/250 V
(c)	System frequency	50 Hz
(d)	Method of earthing	Solidly earthed neutral at substations
(e)	System faults level	25 kA
(f)	Fault duration	1s

3.0 SERVICE CONDITIONS

(i).	Annual average ambient temperature	30 °C
(ii).	Maximum ambient temperature	40 °C
(iii).	Maximum relative humidity	90%
(iv).	Solar Radiation	4.5 kWh/m^2/day
(v).	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(vi).	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(vii).	Isokeraunic (Thunder days) level	100 days



4.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	IEC 60947 – 1: 2020	Low-voltage switchgear and control gear Part1: General rules
(b)	IEC 60947 – 2: 2016 +A1:2019	Low-voltage switchgear and control gear Part2: Circuit Breakers

Material conforming to other International Standards which are not less stringent than the Standards stipulated above may be offered. When such alternative Standards are used, reference to such Standards shall be quoted and English language copies of such Standards shall be provided with the offer.

However, in the event of discrepancy, details given in this CEB specification supersede above standards.

5.0 BASIC FEATURES

5.1 Design

The circuit breakers shall be of three poles unless otherwise specified in the price schedule, with moulded case design, suitable for operation at the service conditions specified in clause 3.0. This circuit breakers are generally used for mixed resistive and inductive load applications.

The case shall be moulded from insulated material possessing high thermal stability and good mechanical strength, able to withstand robust use without fracture or permanent distortion.

The Moulded Case Circuit Breaker shall be of surface mounting type and shall be suitable for mounting in an enclosure for outdoor application. It shall be possible to reverse feed the breaker without any reduction in performance. A padlocking arrangement shall be available in open position of the circuit breaker if requested in the price schedule.

The maximum permissible temperature rise of various components of the breaker shall not exceed the values stipulated in IEC 60947 - 1.

5.2 Construction

5.2.1 Operating Mechanism

The circuit breaker shall be provided with trip free features for manual ON-OFF operation.

The operating mechanism shall be quick make and break type, with the speed of operation independent of the operator, and mechanically trip free from the operating handle so as to prevent the contacts from being held closed against short circuit and overload conditions.

The operating mechanism shall be constructed to operate all poles of the breaker simultaneously during, opening, closing and tripping conditions. The breaker shall be operated by a toggle, which shall clearly indicate the 3 positions ON, OFF and TRIPPED and these 3 positions shall be clearly identifiable visually.

5.2.2 Contacts

The MCCB shall be of the uninterrupted duty type and the contacts shall be of Silver alloy or Silver faced Copper having high current carrying capacity with good arc resistance property.

5.2.3 Operation

(a) Overload Release

Each pole of the MCCB shall be provided with bimetallic Thermal Element or Hydraulic Magnetic or Solid State (electronic) type of overload protection with the tripping time decreasing with increasing tripping current characteristic (inverse time delay). The operating value of overload release shall be independent of ambient air temperature within the limits of 4 0C to 40 0C.

(b) Short Circuit Release

An electromagnetic element type or solid state (electronic) instantaneous short circuit protection shall be fitted in each pole assembly affecting immediate tripping of the circuit breaker if the current exceeds the breaking ratings given Clause 5.3.

(c) Solid state type trip unit

The solid state trip unit shall be suitable for operation in tropical climate stipulated in Clause 3 above.

It shall be a proven design to provide trouble free operation during the life span of the MCCB.

The solid state type trip unit could not be energized by internally mounted current transformers. It shall not require any external power supply to operate the tripping mechanism.

5.2.4 Terminals

The terminals of the breaker shall be suitable for front connection of cables Alluminium/Copper rated for respective breaker capacity and insulated phase barriers shall be provided for all poles.

(a) Breakers of capacities below 400A:

Cables are to be fixed to the breaker using palm type lugs with nut and bolt. Allen key head bolts are not acceptable.

Breaker Capacity (A)	No. of Cables per phase
30	1 x 16 mm^2
60	1 x 35 mm^2
100	1 x 35 mm^2
125	1 x 50 mm^2
160	1 x 70 mm^2
250	1 x 120 mm^2

(b) Breakers of capacities 400A and above:

To terminate oversize and multiple cables for circuit breakers of capacities of 400A and above,

suitable tinned copper extenders or spreaders and insulated phase barriers which has sufficient working clearance shall be provided. Sufficient number of holes shall be provided in the terminal extenders to accommodate cables as indicated below for different capacities of circuit breakers.

Breaker Capacity (A)	No of cables per phase at cable side*
400	1 x 240mm^2 or 2 x 70mm^2
630	2 x 150mm^2
800	2 x 240 mm^2
1000	3 x 185 mm^2
1250	3 x 240 mm^2
1600	3 x 300 mm^2

*Each hole is meant for a cable connection with a palm type lug. However back-to-back cable arrangements can accommodate two cables per one hole.

The shape of the extender and number of extenders required shall be agreed with the purchaser (CEB). A schematic of the general arrangement of extenders fixed to MCCB is indicated in drawing no. DS&S/2021/013 (Annex A).

5.2.5 Mounting Bolts

Mounting bolts, required for mounting of the Moulded Case Circuit Breakers to Wooden Boards of thickness not less than 30mm shall be provided.

5.2.6 Rated Short Time Withstand Current

The rated short time withstand current for MCCB above 630A shall be 12In for 1 Sec. MCCB up to 630A, rated short time withstand current shall be 5kA for 1 Sec.

5.3 Technical Requirements

(a)	No. of Poles	3 unless otherwise specified in the price schedule
(b)	Rated insulation voltage	600V
(c)	Rated frequency	50Hz
(d)	Rated insulation level:	
	(i) Impulse withstand voltage (1.2/50 us peak)	6 kV
	(ii) Power frequency Dielectric Test Voltage (rms)	2500V
(e)	Rated duty	Uninterrupted
(f)	Creepage distance suitable for	Pollution degree 3 and suitable for isolation

(g) Circuit breaker ratings:

Circuit Breaker Current (A) Rated (I_n)	Service Short Circuit Breaking Capacity kA Rated (min) (I_{cs} at 415V)	Selectivity Category
30	7.5	A
60	7.5	A
100	13	A
125(Adjustable)*	13	A
160(Adjustable)*	13	A
250 (Adjustable)*	13	A
400(Adjustable)*	18	B
630(Adjustable)*	25	B
800(Adjustable)*	25	B
1000(Adjustable)*	25	B
1250(Adjustable)*	25	B
1600(Adjustable)*	25	B

* Adjustable moulded case circuit breaker shall be at least in the operating range 70-100% of rated current (adjustable thermal settings).

6.0 REQUIREMENTS FOR SELECTION

6.1 Quality Assurance

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification for the manufacture of Moulded Case Circuit Breakers for the plant where the manufacture of MCCB is done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.

6.2 Manufacturing Experience

Manufacturer should have a minimum of ten (10) years experience for manufacturing of MCCB. The manufacturer should submit proof documents such as supply records, the name of the purchasers, quantity sold, and the year of sale to prove that they have supplied the MCCB to minimum of five customers internationally during last five years.

6.3 Test Certificates

The following Type Test Certificates conforming to relevant standard stipulated in clause 4.0 or any other international standard which is not less stringent, issued by:

Either

(a) an accredited independent testing laboratory acceptable to the CEB or

(b) an accredited or independent testing laboratory acceptable to the CEB where the type tests have been witnessed by CEB or a reputed independent body acceptable to CEB

shall be furnished with the offer. Type Test Certificates shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters. In case if the submitted type tests are according to any other international standard which is not less stringent than the specified, then the copy of the used standard in English shall be submitted with offer.

Proof of accreditation and accredited scope by a national/ international authority shall be forwarded with the offer. Test certificates shall be complete including all the pages as issued by the testing authority. Type test certificates shall be in English language. Parts of test certificates shall not be acceptable. Test Certificates, Performance Curves and Tables etc., of the Type Test performed shall conform to the standard specified, at a reference frequency of 50 Hz where applicable.

a) Temperature-rise
b) Tripping limits and characteristics
c) Dielectric properties
d) Operational performance capability
e) Overload performance (where applicable)
f) Short-circuit breaking capacities
g) Short time withstand current (where applicable)
h) Performance of integrally fused circuit-breakers

7.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

(a) Catalogues describing the equipment and indicating the model number and the literature describing the operational features of the equipment.

(b) Constructional features, materials used for components and relevant technical literature and complete dimensional drawings.

(c) Completed Schedule of Guaranteed Technical Particulars. (Annex-B)

(d) Quality Assurance Certificate conforming to ISO 9001:2015 or latest as stipulated in the Clause No. 6.1.

(e) A list of names and addresses of ten leading purchasers outside the country of manufacture to whom the manufacturer has supplied the MCCB of similar type and design quoted. Give

dates and details of such sales made during the last 05 years.

(f) The Characteristics

(i). The tripping time-current characteristics curves covering both thermal and magnetic current settings for each type of circuit breaker offered.

(ii). If over-current and instantaneous releases are of static type, then the manufacture shall furnish evidence that the components used are tropicalised, (suitable for the climatic conditions stipulated in Clause 3.0 above) and the field tests on the equipment have been satisfactory.

(iii). Discriminating table indicating proper coordinating shall be submitted.

(g) Type test certificates in accordance with clause 6.3.

Not furnishing above documents and details may result in offer being rejected.

8.0 PERFORMANCE GUARANTEES AND WARRANTY

Manufacturer should provide CEB a warranty ensuring that MCCBs supplied meet the specification and any defected cable shall be replaced without extra cost during the first year after the final delivery to CEB stores.

9.0 SAMPLES

One sample shall be furnished for MCCB offered in the range up to 630 Amp.

In case of 800 Amps and above, sample shall be furnished within one month of notification.

10.0 SPARES

Not applicable.

11.0 PACKING AND LABELING/MARKING

11.1 Packing

The MCCB shall be suitably packed in biodegradable material (cardboard boxes) to prevent damage during transport, handling and storing.

11.2 Rating Plate Markings

The case should be stamped with the letters "CEB" for the purpose of identification.

Each Circuit Breaker shall be marked in a durable manner with the following data as stipulated in IEC 60947-2 and shall be visible and legible when the circuit breaker is installed.

(a) Rated current
(b) Suitability for isolation, with symbol
(c) Indication of the open and closed positions

Ultimate breaking capacity (I_{cu}) for various values of the rated operational voltage (U_e) shall be recorded on the device.

The following data should be marked externally on the breaker and they need not to be visible from the front when the breaker is installed.

(a) Manufacturer's identification (Name or Trade Mark);
(b) Type designation or serial number;
(c) Number and Year of the standard adopted;
(d) Selectivity category
(e) Rated operational Voltage and Frequency;
(f) Rated service short-circuit breaking capacity
(g) Rated ultimate short-circuit breaking capacity
(h) Rated short-time withstand current/duration

11.3 Storing

The moulded case circuit breakers of different current ratings shall be stored according to the serial number and rating in batches of 100 separately so as to select breakers for acceptance inspection and testing as per Clause 12.3 by random sampling method.

12.0 INSPECTION, SAMPLING AND TESTING

12.1 Routine Tests

The following routine tests as per IEC 60947-2 shall be carried out on all the MCCB and routine test report shall be made available for the observation of the inspector at the time of inspection.

(a) Mechanical operation tests
(b) Dielectric Tests
(c) Verification of the calibration of releases

12.2 Inspection

The successful bidder shall make necessary arrangements for inspection by an Engineer appointed

by the CEB and also to carry out in his presence necessary acceptance tests on equipment and material. CEB may waive off the inspection with the condition of witnessing the acceptance tests by an independent testing authority acceptable to CEB. In such a situation a notice of waive off will be issued in advance to the supplier.

12.3 Selection of Test Samples

The number of moulded case circuit breakers to be selected by random sampling method for acceptance inspection and testing shall be as indicated below.

	No. of units	No. of Batches	No of Samples to be selected from total quantity
(a)	Less than 100	1	3
(b)	100-500	1-5	4
(c)	500-1000	5-10	6
(d)	1000-1500	10-15	8
(e)	Above 1500	Above 15	10

12.4 Acceptance/Sample Tests

The following Tests as per IEC 60947 shall be witnessed by the inspecting Engineers.

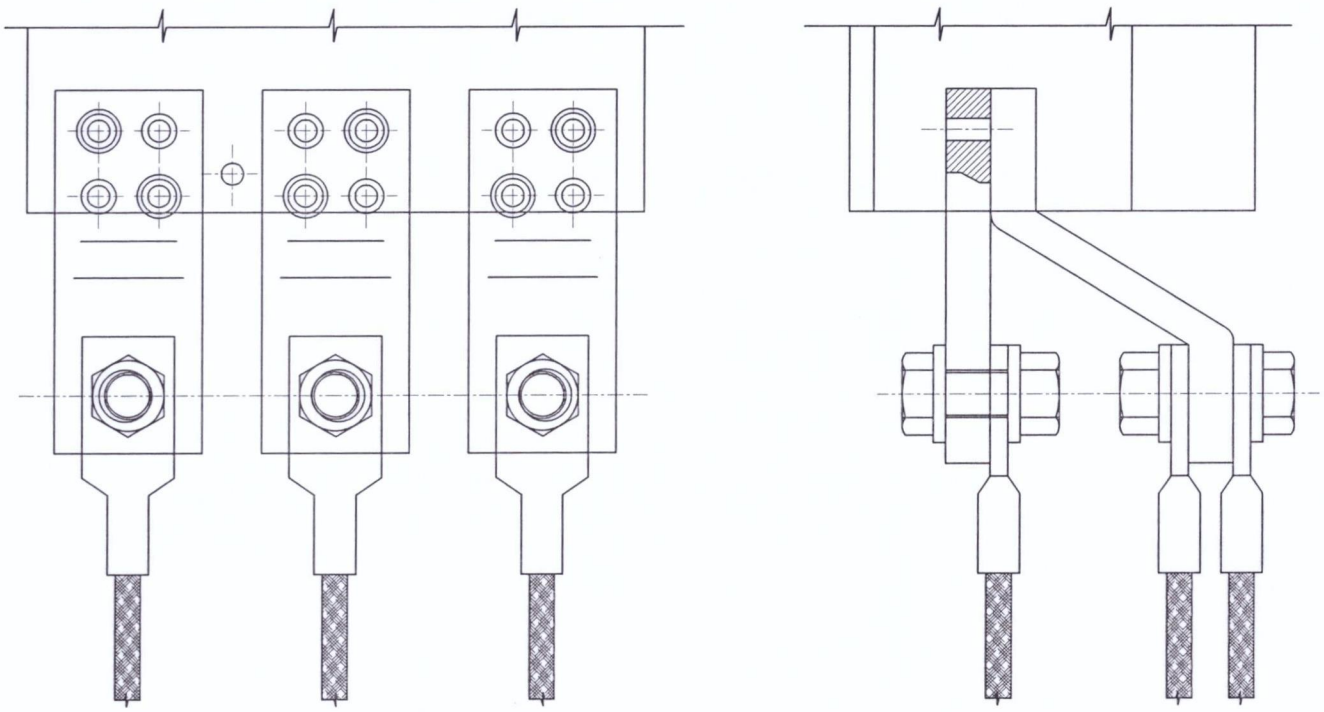
(a) Mechanical Operation tests
(b) Calibration of releases
(c) Temperature rise tests
(d) Dielectric tests

13.0 TECHNICAL LITERATURE AND DRAWINGS

All relevant drawings, technical literature, product catalogue, hand-books etc. required for installation, operation and maintenance of the equipment shall be supplied with the equipment. Routine test report shall also be supplied with the equipment.

14.0 ANNEXES

Annex – A: Schematic of the terminal arrangement
Annex – B: Schedule of Guaranteed Technical Particulars
Annex – C: Non - Compliance Schedule



CEB Approved Specification
19/21/21
Chairman Dist. Coordination Committee

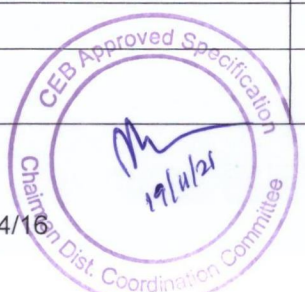
ALL DIMENSIONS ARE IN MILLIMETRES

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATIONS	SCALE : NOT TO SCALE
	MOULDED CASE CIRCUIT BREAKER TERMINAL ARRANGEMENT	DRAWN : LALANI / EDITED : HARSHA
		DATE : JUN - 2021
	DESIGNED BY / APPROVED BY	DRG. NO : DS&S/2018/005
DISTRIBUTION COORDINATION BRANCH	EE (DC) / CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :

Annex B - SCHEDULE OF GURANTEED TECHNICAL PARTICULARS

(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the manufacturer)

			CEB Requirement	Offered
1.	Name of manufacturer			
2.	Country of origin			
3.	No. of poles		As per clause 5.3/ Price schedule	
4.	Rated frequency	Hz	As per clause 5.3	
5.	Rated insulation voltage	V	As per clause 5.3	
6.	Rated continuous operating current	A	As per the price schedule	
7.	Type:			
	(a) Selectivity category A or B		As per clause 1.0	
	(b) Standard or Current limiting type			
	(c) Duty		As per clause 5.0	
8.	Rated short circuit making capacity	kA	As per the applicable standard	
9.	Ultimate Short Circuit breaking capacity at specified power factor, 415V AC	kA	As per the applicable standard	
10.	Service Short Circuit breaking capacity at specified power factor, 415V AC	kA	As per clause 5.3	
11.	Rated short time withstand current for 1 Sec.	kA		
12.	Total fault clearing time	ms	As per the applicable standard	
13.	Type of overcurrent release		As per clause 5.0	
14.	Type of short circuit release		As per clause 5.0	
15.	Current setting range of short circuit release	kA	As per the applicable standard	
16.	Whether the operating value of the overload release is independent of the ambient air temperature within the limits of 4 0C to 40 0C	Yes/No	Yes	
17.	Whether the solid state trip unit is of the tropicalised type	Yes/No	Yes	
18.	Rated insulation level:			
	(a) Impulse withstand voltage (1.2/50 peak)	kV	As per clause 5.3	
	(b) Impulse withstand voltage across the contacts (1.2/50 peak)	kV	As per clause 5.3	
	(c) Power frequency withstand voltage across the open contacts	kV	As per clause 5.3	
19.	Material of contacts			
20.	Clearance between open contacts	mm	As per applicable standard	
21.	Usable as an isolator	Yes/No	Yes	
22.	Creepage distance	mm	As per clause 5.0	
23.	Type of Moulded insulating material			
24.	Clearance between phases		As per applicable standard	



25.	Overall dimensions:			
	(a) Height	mm		
	(b) Length	mm		
	(c) Width	mm		
26.	Mean service life			
	(a) No. Of operations at rated current			
	(b) No. Of operations at rated short circuit current			
27.	Bolts provided with the terminals/extended bar for clamping incoming and outgoing cable sockets	Yes/No		
28.	No of bolts provided (with the terminal bars)			
29.	Whether the extenders or spreaders are provided for breakers above 400 Amps rating	Yes/No	Yes	
30.	Whether the insulated phase barriers are provided	Yes/No	Yes	
31.	Whether the operating toggle clearly indicates the following			
	(a) ON Position	Yes/No	Yes	
	(b) OFF Position	Yes/No	Yes	
	(c) TRIPPED Position	Yes/No	Yes	
32.	Whether the operating mechanism is of:			
	(a) Independent manual type	Yes/No		
	(b) Trip free type	Yes/No		
33.	Whether padlocking arrangement in open position provided?	Yes/No	Yes	
34.	Whether the Quality Assurance Certification conforming to ISO 9001:2015 or latest is furnished	Yes/No	Yes	
35.	Whether all information requested in clause 7.0 provided with the offer?	Yes/No	Yes	
36.	Net weight	kg		

.....
Signature of the Manufacturer and seal

.....
Date

I/We certify that the above data are true and correct

.....
Signature of the Bidder and seal

.....
Date

Annex C - NON-COMPLIANCE SCHEDULE

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

.....
Signature of the Manufacturer

.....
Date

I/We certify that the above data are true and correct

.....
Signature of the Bidder and seal

.....
Date

CEB Approved Specification
Chairman Dist. Co... Committee
19/11/21