Technical Specification for
Miniature Circuit Breaker

1. Scope

1.1. This specification covers design, manufacture, testing, supply and delivery of MCBs, to be used in place of service cut outs to provide over-current and short circuit protection.

1.2. Tolerances on all the dimensions shall be in accordance with provisions made in the relevant Indian standards and in these specifications. Otherwise, the same will be governed by good engineering practice in conformity with the required quality of the product. Prior approval for such dimensions shall be taken from utility.

1.3. It is not intended to specify completely herein all the details of the design and construction of material. However, the product shall conform in all respects to high standards of engineering, design, and workmanship and shall be performing in continuous commercial operation in a manner acceptable to the purchaser. The offered material shall be complete with all components necessary for their intended purpose. The design, manufacture, and performance of equipment shall comply with all currently applicable standards, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve vendor of this responsibility. Moreover, the design and components shall be deemed to be within the scope of vendor's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

1.4. All measurable parameters like Dimensions of plastic mould, Weight of resin and hardner compound, Electrical Conductivity of inline connectors etc. shall follow normal distribution curve with average of specified/Guaranteed values.

1.5. Any deviation from this specification to improve utility, performance and efficiency of the equipment or to secure overall economy shall be considered, if such deviations are mentioned by the bidder with full justification.

2. Climate Conditions of Installation:

The MCB shall be suitable for continuous satisfactory operation in following prevailing climatic conditions.

4.1.	Maximum Ambient Air Temperature	:	50° C
4.2.	Average Ambient Air Temperature	:	35° C
4.3.	Minimum ambient air temperature	:	2 ° C
4.4.	Maximum Relative Humidity	:	95%
4.5.	Maximum wind speed	:	44 m/sec

4.6.	Average Annual rainfall	:	1500 mm
4.7.	Average no. of rainy days per annum	:	50 Days per Annum
4.8.	Rainy months	:	4 Months
4.9.	Seismic Zone	:	III

The overall climatic condition is moderately hot and humid tropical climate, conducive to rust and fungus growth.

3. Applicable Standards

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

1.1.1.	IS/IEC 60898	:	Electrical Accessories – Circuit Breakers for over current protections for household and similar installations

3.2. Unless otherwise specified elsewhere in this specification, the MCBs shall conform to the latest version available of the standard as specified above.

3.3. The MCB supplied shall have Type Test certificates of laboratories approved by NABL such as ERDA, NPL, and CPRI etc.

3.4. Equipment conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would also, is acceptable. In case the bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Copy of such standards with authentic English Translations, shall be furnished along with the offer. In case of conflict the order of precedence shall be (i) IS (ii) IEC (iii) other standards. In case of any difference between provisions of these standards and provisions of this specification, the stringent provisions shall prevail.

4. SYSTEM DESCRIPTION:

4.1.	System of Supply	:	3 Phase 4 Wire
4.2.	Nominal System Voltage	:	3 x 240 Volts - Phase to Neutral
4.3.	System Highest Voltage	:	264 Volts
4.4.	System fault current rating	:	10000 Amps

5. TECHNICAL REQUIREMENTS

Sr.	Particulars	Requirements		
1	Rated Current "In"	16A, 25A, 40A, 50A & 63A	16A & 40A	16A, 40A & 63A
2	Type of Tripping characteristic	"C"	"C"	"C"
3	Rated voltage "Vn"	240 V for single phase	240 V for single phase	415 or 433 V for three phase
4	No of Poles	Single Pole	Two Pole	Four Pole
5	Rated impulse withstand voltage 1.2/50 µs	6 KV Peak		
6	Rated ultimate short circuit breaking capacity	10000 Amps		
7	Clearance Between live parts which are separated when the main contacts are in open condition	Minimum 4 mm		
8	Operational performance capability	10000 Nos. of operating cycles		

6. TRIPPING CHARACTERISTICS

Tripping characteristics of the MCB shall be as per the Table: 7 of the IEC: 60898-1:2002.

Sr.	Type of Tripping characteristic	Test Current	Limit of tripping or non-tripping time	Result to be obtained
1	C	1.13In	t ≤ 1 h (for In ≤ 63A) t ≤ 2 h (for In > 63A)	No Tripping
2	C	1.45In	t < 1 h (for In ≤ 63A) t < 2 h (for In > 63A)	Tripping
3	C	2.55In	1 s < t < 60 s (for In ≤ 32 A) 1 s < t < 120 s (for In > 32 A)	Tripping
4	C	5In	t ≤ 0.1 s	No Tripping
5	C	10In	t < 0.1 s	Tripping

7. DESIGN

7.1. The Miniature Circuit Breakers shall be a compact electro-mechanical device for making, breaking and disconnecting a circuit in normal conditions as well as in abnormal conditions such as those of over-current and short circuit.

7.2. The Miniature Circuit Breaker shall be of wire in, wire out type and basically comprise the following features.

6.2.1. Independent Manually operated latched switching mechanism with trip free release.

6.2.2. Arc-quenching chamber.

6.2.3. Overload protection (Thermally delayed Bi-metal type / Hydraulic-magnetic type Tripping facility). There shall be no thermal de-rating up to an operating temperature of 60°C.

6.2.4. Instantaneous Short circuit protection (Magnetic release type)

6.2.5. Safe Disconnection of load from the source.

7.3. All the material used in the manufacture of the MCB shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

7.4. All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions. The MCB shall be protected and shall have to withstand solar radiation.

7.5. All insulating material used in the construction of the MCB shall be non-hygroscopic, non-aging and of tested quality.

7.6. The MCB shall be designed and constructed in such a way as to avoid introducing any danger in use and under normal conditions so as to ensure specially.

6.6.1. Personnel safety against electric shock

6.6.2. Personnel safety against effects of excessive temperature.

6.6.3. Protection against spread of fire

6.6.4. Protection against penetration of solid objects, dust and water.

7.7. Single pole MCB shall be made of two different halves.

8. CONSTRUCTION

8.1. The insulated case of the MCB shall be made out of molded insulating material possessing high thermal stability and good mechanical strength to reasonably withstand rough usage without any fracture or permanent distortion.

8.2. The single phase MCB shall be in two halves and both halves shall be riveted.

8.3. The MCB shall be suitable for panel/surface mounting on standard DIN channel.

8.4. The material of the enclosure shall be UV protected and fire retardant. It shall be treated to withstand ultraviolet radiation to prevent the deterioration of the material due to direct sunlight and shall withstand a temperature of 950°C.

9. DOLLY

9.1. The color of the dolly shall be different for different rating of MCB.

9.2. Sealing arrangements shall be provided for MCB for unwanted operation of the MCB and should be suitable for application of polycarbonate seals with 0.6 mm seal wire.

10. TERMINALS

10.1. The MCB shall have provision for adequately accommodating and securely clamping the incoming and outgoing aluminum stranded / solid service wires up to 25 sq.mm minimum.

10.2. The manner of fixing the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. The bidder shall provide detailed drawing of the terminal arrangements.

10.3. One screw shall be provided in each terminal for effectively clamping the conductor or thimbles. The clamping screw shall engage at least 5 threads in the terminal.

10.4. The terminals and connections shall be suitable to carry up to 120% of I_{max} continuously.

10.5. All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.

10.6. Temperature rise for terminals and accessible parts shall conform of IEC 60898.

11. OPERATING MECHANISM

11.1. The Operating Mechanism of the MCB shall be of independent manual operation type (for closing and opening operation) and designed for automatic tripping on over-current and short circuit.

11.2. The operating mechanism shall be such that in the event of an overload / short circuit, the switch still trips, even if the externally operated lever is held in `ON' position (trip free mechanism).

11.3. Both the "On" and "Off" positions of the Circuit Breaker shall be clearly indicated. The indication shall be clearly visible to the operator when the Circuit Breaker is mounted in the normal manner.

12. CONTACTS

12.1. The contacts shall be of high current carrying capacity with good arc resistance property and shall be of silver alloy or silver coated copper.

12.2. The breaker shall be provided with arc chutes enclosing the contacts of pole or a similar device which should serve to quench the arc during breaking.

13. OVERLOAD RELEASE

13.1. A delayed thermal bi-metal/hydraulic - magnetic over-current release shall be fitted in each phase with inverse time lag over-current release.

14. SHORT CIRCUIT RELEASE

A magnetic type of instantaneous short circuit release shall be provided to trip the circuit breaker within 0.1 sec. during short circuit condition.

15. OPERATIONAL PERFORMANCE CAPABILITY

The operating performance of the Miniature Circuit Breaker shall not be less than 10,000 operating cycles conforming to IEC 947 and IEC 60898.

16. QUALITY ASSURANCE

16.1. The manufacturer shall have a well-organized Quality Assurance Plan (QAP) to assure that items and services comply with this specification.

16.2. The QA Plan shall identify the various stages of manufacture, quality checks to be performed at each stage and the customer hold points. The document shall also furnish details of method of checking, inspection and acceptance, standards / values and get the approval of purchaser or his representative before proceeding with manufacturing. However, purchaser or his representative shall have the right to review the inspection reports, quality checks and results of manufacturer's in-house inspection department which are not customer hold points and the manufacturer shall comply with the remarks made by purchaser or his representative on such reviews with regards to further testing, rectification or rejection etc. Manufacturer should submit the list of equipment for testing along with latest calibration certificates to the purchaser.

16.3. All design, manufacturing, processing, testing and inspection operations affecting the equipment or material shall be governed by Quality Assurance procedures in accordance with the directives of the ISO 9001 standards.

16.4. The manufacturer shall possess ISO 9001 Quality Assurance Certification for the manufacture of Miniature Circuit Breakers for the plant where the manufacture of MCB 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.

16.5. If the ISO 9001 Quality Assurance Certification was obtained from a parent company, then the name, address and the contact details of the parent company shall be furnished with the offer.

16.6. If the ISO 9001 certification was obtained from a representative of a parent company, then the name, address and the contact details of the said parent company shall also be furnished with the offer.

16.7. The Bidder shall invariably furnish following information along with his bid.

18.7.1. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested.

18.7.2. List of tests normally carried out on raw materials in the presence of bidder's representative.

18.7.3. Copies of test certificates for tests as mentioned in Clause 40.4.2.

18.7.4. Information and copies of test certificates in respect of bought out accessories.

18.7.5. List of manufacturing facilities available.

18.7.6. Level of automation achieved and list of areas where manual processing exists.

18.7.7. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.

18.7.8. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall posses 0.1 class instruments for measurement of losses.

17. MARKING

Each Miniature Circuit Breaker shall be marked in a durable manner with the following particulars conforming to IEC 60898 and located in a place such that they are visible and legible when the circuit-breaker is installed. Stickers are not acceptable. In addition to what is specified in the standards, the supplier shall provide following information on MCB.

17.1. Front Face

19.1.1. Rated current In

19.1.2. Indication of the open and closed position, with O and I respectively.

19.1.3. Manufacturer's name or Trademark

19.1.4. Type designation or serial number

19.1.5. Rated operational voltage.

19.1.6. Rated frequency

19.1.7. Rated Short-circuit capacity

17.2. On the sides of the MCBs

19.1.8. Manufacturer's identity

19.1.9. Rating of MCB

19.1.10. Manufacturing lot no. / batch no.

19.1.11. Month and Year of Manufacturing

19.1.12. Guarantee Period

19.1.13. Applicable Standard & Number

17.3. The aesthetics and layout of the marking shall be approved by the purchaser. The same will be standardized for all future supplies.

17.4. The supplier shall submit the artwork in AutoCAD or coral Draw within Seven days from the date of LOI/PO for approval.

17.5. The supplier shall submit 05Nos. of samples for approval within 15 days after approval of artwork. Manufacturing and supply of MCB shall be subject to approval of sample.

18. PACKING

18.1. Each MCB shall be enclosed in card box covers with the following details indelibly marked on it for easy identification purpose.

20.1.1. Rated Voltage kV

20.1.2. Rated continuous current (Amps)

20.1.3. Manufacturers identification code

20.1.4. Breaking capacity kA

20.1.4.1. Manufacturer’s identity

20.1.4.2. Rating of MCB

20.1.4.3. Month and Year of Manufacturing

20.1.4.4. Guarantee Period

18.2. Ten numbers of MCBs of the same current rating shall be packed in cardboard boxes and box shall be clearly marked with the following information.

20.2.1. Name of manufacturer

20.2.2. Country of manufacture

20.2.3. Rated continuous current A

20.2.4. Rated Voltage Volts

20.2.5. Manufacturer’s identification code or Catalogue No

20.2.6. Breaking capacity at rated voltage kA

20.2.7. Number of poles

20.2.8. Standard (IS / IEC) and year of standard

20.2.9. Year of manufacture

20.2.10. Quantity Numbers

20.2.10.1. Manufacturer's identity

20.2.10.2. Rating of MCB

20.2.10.3. Month and Year of Manufacturing

20.2.11. Guarantee Period

19. SAMPLE

The bidder shall submit 05 Nos. samples for each current rating along with the offer. While analyzing samples, the purchaser reserves the right to check dimensions, inspect workmanship and perform essential tests as prescribed in relevant standards.

20. TESTS

20.1. Type Tests

22.1.1. The bidder shall submit the type test reports of the following tests as per IEC 60898 along with the offer. The reports shall not be older than 5 years from 01-08-2017.

22.1.1.1. Indelibility of marking

22.1.1.2. Reliability of screws, current carrying parts and connections

22.1.1.3. Reliability of terminals for external connections

22.1.1.4. Protection against electric shock

22.1.1.5. Dielectric properties

22.1.1.6. Temperature rise

22.1.1.7. Tripping characteristics (As per table:7 of IS/IEC 60898-1: 2002)

22.1.1.8. Mechanical and electrical endurance

22.1.1.9. Short circuit tests

22.1.1.10. Resistance to mechanical shock and impact

22.1.1.11. Resistance to heat

22.1.1.12. Resistance to abnormal heat and to fire

22.1.1.13. Resistance to rusting

22.1.2. The type test certificate shall clearly indicate the following.

22.1.2.1. Name, address and country of the testing authority

22.1.2.2. Date of testing

22.1.2.3. Name of the equipment type tested

22.1.2.4. Number of pages of the type test certificate

22.1.2.5. Manufacturer's identity & Catalogue reference number

22.1.2.6. Basic technical parameters

22.1.2.7. The standard to which the equipment type tested

22.1.2.8. Comments and observations of the testing authority

20.2. Routine Tests

The routine tests shall be carried out on all MCB as per IEC 60898 and the routine test report shall be submitted to the company's representative at the time of inspection of the materials.

20.3. Acceptance Tests

The following tests shall be carried out by the representative of the company as per IEC 60898 during the pre-dispatch inspection of the material.

20.3.1. Indelibility of marking

20.3.2. Reliability of screws, current carrying parts and connections

20.3.3. Reliability of terminals for external connections

20.3.4. Dielectric properties

20.3.5. Tripping characteristics (As per table:7 of IS/IEC 60898-1: 2002)

21. PRE-DISPATCH INSPECTION AT MANUFACTURER'S WORKS

21.1. All acceptance tests and inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the supplier and purchaser at the time of purchases.

21.2. The material shall not be shipped before the inspection has been carried out according to the approved quality assurance plan unless otherwise instructed by the purchaser.

21.3. The acceptance of any material prior to shipment shall in no way relieve the supplier of any of his responsibilities for meeting all the requirements of the specification and shall not prevent subsequent rejection if such materials are found to be defective.

21.4. The representative/Engineer attending the above testing will carry out testing on equipment and issue test certificate approval to the manufacturer and give clearance for dispatch.

21.5. The supplier shall give 15 days' advance intimation to the purchaser to organize the pre-dispatch inspection of MCB.

22. PO Milestones

22.1. The supplier to provide the Purchase order execution plan within 7 days from the placement of PO covering followings:

22.1.1. PO Details (No. and Date)

22.1.2. Details of Supplier (Name, Vendor Code)

22.1.3. Material details (code and description)

22.1.4. PO Qty and lot wise bifurcation

22.1.5. Documents submission and approval mechanisms

22.1.6. SPOC for PO execution

22.1.7. Escalation Mechanism

22.1.8. Schedule of inspection at customer hold points and Pre-dispatch inspection

22.2. The supplier shall offer the inspection at least 7 days in advance for customer hold points as per approved QAP.

22.3. In case any Non-conformance observed during inspection, the supplier the re-offer the inspection within 7 days from inspection.

22.4. The supplier shall intimate respective store in-charge for the delivery in 7 days advance after receipt of MDCC.

22.5. In case any non-conformance observed post supply of the material, the supplier shall visit the site as per following matrix for preliminary assessment or immediate correction action:

Sr	Criticality	Days
1	High	Within 1 day
2	Medium	Within 3 Days
3	Low	Within 7 days

22.6. The supplier shall submit the Root cause analysis and CAPA report within 30 days from the report of non-conformance.

23. PROHIBITION OF ASBESTOS USAGE

There shall not be use of any asbestos content material directly or indirectly in manufacturing or packing of MCB.

24. INFORMATION TO BE SUBMITTED BY THE BIDDER

The following shall be furnished with the offer,

24.1. Catalogues describing the MCB and indicating the type and model number

24.2. Constructional features and material used for components, the standards to which the items are manufactured and relevant technical literature

24.3. Complete dimensional drawings

24.4. Copy of ISO 9001 Certification

24.5. Copies of Quality Manual and Quality Assurance Plan

24.6. Type Test Certificates from a recognized independent testing authority acceptable to the purchaser conforming to relevant Indian or International standard

24.7. Manufacturing Experience

24.8. A list of names and addresses of the utilities giving dates and quantities of deliveries made in the past three years

25. ADDITIONAL DOCUMENTATION:

In addition to what specifically mentioned in the specification, the bidders shall provide the following:

25.1. Brief background of your company.

25.2. Manufacturing & Infrastructure facilities available

25.3. Technical Know-how and collaboration, if any.

25.4. Any other specific qualifications, experiences and capabilities directly related to this enquiry.

26. GUARANTEE

26.1. The bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for the due and intended performance of the same, as an integrated product delivered under this contract.

26.2. In the event any defect observed by utility within the period of 12 months from the date of installation or 18 months from the date of last supplies made under the purchase order whichever is later.

26.3. The bidder shall be liable to undertake to replace/rectify such defects at their own cost within the mutually agreed time frame up to the satisfactory level, failing to which utility will be at liberty to get it replaced / rectified at bidder's risk and costs. Utility will recover all such expenses plus utility's own charges from the bidder's performance bank guarantee, as the case may be.

26.4. The bidder shall further be responsible for free replacement for another period of Three years from the end of the guarantee period for any Latent Defects if noticed and reported by utility.

27. DEVIATIONS

The bidders are not allowed to deviate from the principal requirements of the specifications. However, the bidder is required to submit schedule of particulars and a detailed list of all deviations without any ambiguity. In the absence of a deviation list, it is understood that such bid conforms to the bid specification and no post-bid negotiations shall take place in this regard.