



TECHNICAL SPECIFICATION COVER SHEET

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Prepared by	Reviewed by	Reviewed by	Reviewed by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
Devi Prasad Roy	Shailendra Kumar Jaiswal	KHAJAN BHARDWAJ	Yash Mane	SURYAKANTA MOHANTY	AMISHA PATTNAIK	SANJEEV ATRI	Shailendra Kumar Jaiswal	MR. ASHOK SARAF

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TECHNICAL SPECIFICATION

11kV Ring Main Unit (RMU)

Central Engineering Services

TPC-M/TPDDL/TPCODL/TPNODL/TPWODL/TPSODL/TPADL

Specification Title: 11kV Ring Main Unit (RMU)

REVISION HISTORY

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Central Engineering Services

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1. SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply (including unloading at site/store) and performance of 11kV Ring Main Units with all accessories and necessary training for trouble free & efficient performance.

It is not the intent to specify completely herein all the details of tech design and construction of material. However, the material shall conform to practices consistent with sound environmental management and local statues. It is also expected that equipment shall comply in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in manner acceptable to the User, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2. APPLICABLE STANDARDS:

Standards	Details
IEC 62271-200:2021	HV switchgear and control gear-AC Metal Enclosed switchgear and control gear for voltages above 1kV and up to and including 52Kv.
IEC 62271-100:2021/Cor2:2022	Alternating-current circuit-breakers
IS 513	Cold Rolled Low Carbon Steel Sheets and Strips.
IEC 62271-1:2017/AMD1:2021	High-voltage switchgear and control-gear - Part 1: Common specifications for alternating current switchgear and control-gear
IEC 62271-102:2022	HV switchgear and control gear-Alternating current disconnectors and earthing switches
IEC 62271-103:2021	High-voltage switchgear and control-gear - Part 103: Alternating current switches for rated voltages above 1 kV up to and including 52 kV
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against mechanical impacts (IK Code)
IEC 60060	High-voltage test techniques part-1 to 3
IEC 61439-1	Low-voltage switchgear and control-gear assemblies - Part 1: General rules
IEC 60255-3	Electrical relays – Part 3: Single input energizing quantity measuring relays with dependent or independent time.
IEC 61869-2 / IS 2705	Current Transformers
IEC 60376	Specification of technical grade Sulphur hexafluoride (SF6) for use in electrical equipment
IEC 62271-213:2021	High-voltage switchgear and control-gear - Part 213: Voltage detecting and indicating system
IEC 62271-215:2021	High-voltage switchgear and control-gear - Part 215: Phase comparator used with VDIS
IS 13573-2	Cable accessories for extruded power cable for Working Voltages from 3.3 kV up to and Including 33 kV.

Note- In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid.

3. CLIMATIC CONDITIONS OF THE INSTALLATION OF RMU:

1	Maximum ambient temperature	43 deg.C
2	Max. Daily average ambient temp	35 deg.C
3	Min Ambient Temperature	07 deg.C
4	Maximum Relative Humidity	100%
5	Minimum Relative Humidity	40%
6	Average No. of thunderstorm days	50 annum
7	Average Annual Rainfall	2380mm
8	Average No. of rainy days per annum	120 days max.
9	Rainy months	June to Oct.
10	Altitude above MSL not exceeding	1000 meters
11	Wind Pressure	Zone V (maximum recorded 300Kmph)
12	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
13	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed up to 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

Note: Climatic Condition will be considered as per respective TP DISCOM TPC-Mumbai/TPDDL/TPCODL/TPNODL/TPSODL/TPWODL.

4. GENERAL TECHNICAL REQUIREMENTS OF RMU:

Sr. no.	Description	Requirement
1	Application	11 kV, Three phase - Three wire
2	Rated Voltage	12kV
3	Service Voltage	11kV
4	System Frequency	50 Hz
5	Internal Arc rating	IAC AFL or better/ IAC AFLR or better for Outdoor RMU
6	Internal Arc test	20 kA for 1 Sec.
7	Lightning Impulse withstand Voltage	75 kV Peak
8	Power Frequency withstand voltage	28 kV rms
9	Rated current of incomer load break switch	630 A
10	Rated current of Circuit-breaker	630 A
11	Rated Short time current withstand	21 kA for 3 sec
12	Rated Short circuit making current	50 kA

13	Number of operations at rated short circuit current on line switches, earthing switches, CB	5 close
14	Opening time of breaker (max.) without relay time	2.5 cycle
15	Closing time of breaker (max.) without relay time	3 cycle
16	Breaker Duty Cycle	O – 3min - CO - 3min - CO
17	Rated cable charging interrupting current of incomer-- Load Break Switch	10 A
18	Rated cable charging breaking current of breaker	25 A
19	Insulating medium	SF6
20	Interrupting medium	Vacuum- for CB and SF6 for LBS and earth switch
21	Temperature Rise	Maximum permissible temperature rise for bus bar shall not be 65°C at an ambient temperature not exceeding 40°C, as per IEC 62271-1. However, the temperature rises for accessible enclosures and covers shall not exceed 30K and in case, they are not required to be touched during normal operation, the limit shall be raised by 10K.
22	Cable compartment	Front opening cable compartment for all feeders
23	Motorization	Normal RMU should have provision for Motor fixation in LBS compartment. Motorized and Smart RMU shall have Motorized LBS and CB compartment
24	Interlock	Electrical interlock for live cable presence indicator and operation of earth switch in RMU incomer cable compartment of LBS

4.1 RMU CONFIGURATIONS

RMU Category (Normal, Motorized or Smart)

1. Normal

1/2/3/4/5way

+Outdoor (Indoor for special case only)

+LBS (No to be specified on tender) +VCB (Nos to be specified in tender)

+FPI in each LBS

+Non-Extensible

2. Motorized

1/2/3/4/5way

+Outdoor (Indoor for special case only)

+LBS (No to be specified on tender) +VCB (Nos to be specified in tender)

+FPI in each LBS

+Non-Extensible

3. Smart

1/2/3/4/5way

+Outdoor (Indoor for special case only)

+LBS (No to be specified on tender) +VCB (Nos to be specified in tender)

+FPI in each LBS

+Non-Extensible

5. GENERAL CONSTRUCTION FOR RMU

5.1. MAIN TANK

- 5.1.1 The switchgear and bus bar shall be contained in a stainless-steel tank filled with SF6 gas and the outer body shall be made of GI high tensile steel/CRCA 2mm thick with thick gland plates as per IS 513.(Enclosure Material GI/CRCA to be finalized during detailed engineering)
- 5.1.2 The tank shall have SS sheet of 2.5 mm thickness minimum (or as per type tested design of bidder with undertaking on letter head) and meet the "sealed pressure system" criteria in accordance with the IEC 62271-200. This is a system for which no handling / refilling of gas shall be required throughout the expected operating life, i.e. 30 years. Sealed pressure systems are completely assembled, filled and tested in the factory.
- 5.1.2 The maximum leakage rate of SF6 gas shall be lower than 0.1% of the total initial mass of SF6 gas per annum from main tank. The filling pressure for the switchgear shall be just above the atmospheric pressure so as to prevent the tendency to leak. SF6 gas used for the filling of the RMU shall be in accordance with IEC 376.
- 5.1.3 It is mandatory to fit an absorption material in the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption. The degree of protection for RMU tank (Indoor/Outdoor) shall be IP 67.
- 5.1.4 The RMU shall be complete with all connection and all current carrying components shall be of copper inside tank. The copper bus bar shall have a continuous current carrying capacity of 630A. The bus bar shall be fully encapsulated by SF6 gas inside the steel tank.
- 5.1.5 The tank shall have separate SF6 refilling valve and the filling pressure must be mentioned near the valve. And the refilling valve should be marked properly.
- 5.1.6 If same valve is used for pressure indicator or remote communication, then the procedure to refill to be mentioned near the NRV from with permanent sticker.
- 5.1.7 The SF6 tank shall be completely enclosed in the enclosure such way that any rodent entry on top or side of tank is deterred.
- 5.1.8 All configurations should be in one tank without any coupling/joint on main Busbar.
- 5.1.9 Tank explosion vent shall be at the bottom.

5.2. GENERAL DETAILS

- 5.2.1 The mimic board shall be provided with IP2X/IP3X degree of protection for Indoor RMUs and protection for Outdoor RMUs shall be minimum IP 54(Main door closed). Cable compartment shall be IP54.
- 5.2.2 The RMU shall be suitable for mounting on plinth with trench below and shall have base frame on sides with mounting bolt accessibility from outside of RMU the mounting bolts provision shall be min. M12 bolts on all four sides. The mounting bolts and nuts shall be of hot dip galvanized to avoid rusting. The provision for cabling shall be through base plate from bottom of RMU through trench below. The RMU shall be designed so that the position of the different devices is visible to the operator on the front face plate with permanent type indicators.
- 5.2.3 The RMU shall be identified by visible font sized permanent painting **(UV resistant and durability to be maintained throughout the full operational life of the RMU)** which clearly indicates the functional units and their operation directions etc. The ON or OFF shall be marked as words and only I/O labelling shall not suffice.
- 5.2.4 The RMU shall be designed to be tamper proof to prevent access to all live parts during operation without the use of special tools.
- 5.2.5 The earth bus bar shall be covered if passing through the cable chamber and enclosed in an enclosure housing to prevent theft/tampering. Only extension outside enclosure shall open for

- access.
- 5.2.6 There shall be continuity between the metallic parts of the RMU and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The enclosure and cable compartment and tank shall be connected to common earthing.
 - 5.2.7 All parts of main circuit to which access is required or provided shall be capable of being earthed prior to becoming accessible. This does not apply to removable parts which become accessible after being separated from the switchgear and control gear. The cables shall be earthed by an earth switch with short-circuit making capacity in compliance with IEC 62271-102.
 - 5.2.8 The LBS /CB shall not be closed in case Earth Switch is closed. The earth switch shall be fitted with its own operating mechanism and manual closing shall be driven by a fast-acting mechanism, independent of operator action. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earth switch when the Load break switch is closed or when cable is charged.
 - 5.2.9 All panel covers shall be provided with anti-vandal screw bolts so that opening of panel covers is only possible with special tools, which shall be provided by the Bidder as mandatory spare/tool.
 - 5.2.10 The default design of cable compartment shall be 1run 3Cx400 sq. mm 11 kV or 1run 3 nos. 1Cx630 sq. mm 11kV UG or 1run 3 nos. 1Cx185 sq. mm 11kV UG, XLPE, armoured. However, actual size of cable to be decided during tendering/detailed Engineering.
 - 5.2.11 The circuit breakers, Load break switches and earthing switches shall have pad lock provision & can be locked in the open or closed position by 1 to 3 padlocks 6 to 8mm in diameter.
 - 5.2.12 Anticorrosive fasteners & components to be provided on switchgear.
 - 5.2.13 The main bus bar current density shall be less than 2.7A/sq.mm.
 - 5.2.14 The cable gland plate shall have split type design having two parts for removal of cable with termination. For Single core cable aluminum Gland to be used.
 - 5.2.15 The vacuum interrupter shall withstand 10-7 milli-bar Vacuum Pressure ensuring high quality vacuum for interruption and shall have Copper Chromium Arcing Contacts. The interrupter manufacturing unit shall have shall be single Shot brazing and have high First pass Yield. (Shall be part of Bidders own vendor evaluation criteria)
 - 5.2.16 For each terminals bolt should be provided with Cup or Belleville Washer and flat washers. (Note- The cut spring washers are not accepted)
 - 5.2.17 The CT secondary wires & Trip coil wires shall not have any joint in-between CT & TB or relay.

5.3. INTERNAL ARC TESTING

Any accidental over pressure inside the sealed chamber tank shall be limited by the opening of a pressure limiting device provided at the bottom part of the tank. Gas shall be released to the bottom without affecting cables and termination of the RMU with partition between cable chamber such way that gas releases away from the operator. Bidder shall provide type test report to prove compliance to the 'Internal fault IAC- A FL minimum for indoor and A-FLR for outdoor with bottom release' as per IEC 62271-200 on main tank and cable chambers.

An anti-reflex mechanism on the operating lever shall prevent any attempts to reopen immediately after closing of the switch or earth switch. All manual operations shall be carried out on the front of the RMU. In case of SF6 gas leakage from gas tank or any kind of repair should be done at site or replacement of complete RMU to be done free of cost within guarantee period.

5.4. INCOMER LOAD BREAK SWITCHES (LBS)

- 5.4.1 Load break switches shall be maintenance-free. The position of the contacts and earthing contacts shall be clearly visible on the front of the RMU. The position indicator shall provide positive contact indication in accordance with IEC 60265-1. In addition, manufacturer shall prove

reliability of indication in accordance with the standard. The switches shall be of the "increased operating frequency" in accordance with IEC 60265-1. There should be provision that the LBS earth switch operation should be independent of DC supply availability.

- 5.4.2 The LBS shall have at least 3 positions, open-disconnected, closed, and earth (with making capacity) and shall be constructed in such a way that natural interlocking prevents unauthorized operations.
- 5.4.3 The disconnecter should have the maximum 200 micro-ohm contact resistance.
- 5.4.4 Earthing of the cable shall be either through a three position switch of a separate snap action type or Earth Switch having fault making capacity.
- 5.4.5 The switches shall be fully mounted and inspected in the factory. For Normal RMU Provision for future motorization of LBS and CB should be kept in configuration while designing RMU. For Motorized and Smart RMU motor to be provided for LBS and CB operation.
- 5.4.6 The load break switch and earthing switch operating mechanism shall have mechanical endurance of at least 1000 (M0) operations. The type test reports to be submitted along with Bid.
- 5.4.7 Load break switch shall have mechanical switch operation counter and should be visible on front in horizontal alignment.
- 5.4.8 Load break switch shall have mechanical switch operation counter and should be visible on front in horizontal alignment.
- 5.4.9 The Load break switch should have minimum spare **3 NO+ 3 NC** auxiliary contacts, additionally for TPDDL, **4 NO + 4 NC** contacts are required for isolator as **spare**. Earth Switch shall have **1 NO + 1 NC** auxiliary contacts, additionally for TPDDL, **1 NO + 1 NC** contacts are required for Earth as **spare**.
- 5.4.10 The load break switch shall be compatible for manual & remote operation without any modification of the operating mechanism and without de- energizing the RMU, The LBS shall be fitted with an electrical operating mechanism and can remotely open-disconnected, closed and earthed from a reserved location.

5.5. CIRCUIT BREAKER FOR TRANSFORMER / LOCAL FEEDER CONTROL

- 5.5.1 The circuit breakers/ interrupter shall be of the maintenance free.
- 5.5.2 The circuit breakers shall have at least 2 positions: Open-disconnected and closed and shall be constructed in such a way that natural interlocks prevent all unauthorized operations.
- 5.5.3 In view of safety each VCB shall be assisted with disconnecter having 3 positions, open-disconnected, closed, and earth (having fault making capacity) and shall be constructed in such a way that natural interlocking prevents unauthorized operations.
- 5.5.4 They shall be fully mounted and inspected in the factory.
- 5.5.5 Breaker contact resistance should be ≤ 50 micro-ohms. The various circuit contact resistance should comply with provisions in IEC 62271-200.
- 5.5.6 The breaker should have minimum spare **4 NO + 4 NC** auxiliary contacts. Additionally, for TPDDL, **4 NO + 4 NC** contacts are required for breaker as **Spare**.
- 5.5.7 An operating mechanism can be used to manually close and open the circuit breaker with single push on push buttons. It shall be fitted with a local system for manual tripping by an integrated push button. There will be no mechanical automatic re- closing.
- 5.5.8 The circuit breaker compartment shall have three current transformers, an electronic self-powered relay, a Series & a Shunt trip coil for CB tripping.
- 5.5.9 CT shall be mounted on cables. The mounting arrangement shall be flexible to move to & fro, up and down based on site condition of cable terminations etc. The mounting arrangement shall ensure that the CT should not reach less than 300mm from live part of bushing. The CT mounting shall be fixed at position while dispatch such that the cable entry, the bushing terminal bolt, and CT core hole are co-axial.
- 5.5.10 Fixing bracket to be provided for fixing CT on particular position without touching termination cores. Bolting arrangement to be provided for fixing CT on the mounting bracket.
- 5.5.11 In any mounting the CT shall be mounted in such a way that the secondary connection shall be

- accessible and visible from front side after opening cable compartment door
- 5.5.12 Breaker shall have mechanical endurance of at least 10000 (M2) operations. Relevant type test reports to be submitted along with bid.
- 5.5.13 Breaker operation counter should be provided and should be visible on front in horizontal alignment.
- 5.5.14 In control cabinet the Terminal block shall have AC input wiring provision and MCB provision for incoming of LT AC supply.
- 5.5.15 The relay auxiliary power, communication ports and other required ports should be wired up on the TB. The breaker should have one series trip coil and one shunt trip coil.
- 5.5.16 The shunt trip coil shall be of 230V AC/24V DC along with charger and complete wiring up to trip coil through DC MCB and MCB arrangement for AC charger.
- 5.5.17 Protection relay:
- Electronic self-powered target latched by battery or capacitive unit.
 - There shall be Conformal Coating on relay PCB
 - The protection relaying shall have following features:
 - Phase Protection: With Definite time/ IDMT element having standard characteristics of Standard Inverse, Very inverse, Extremely Inverse (as per IEC 255-3) or Fuse Characteristics.
 - Earth Fault Protection: With Definite time or IDMT element having standard characteristics of Standard Inverse, Very inverse, Extremely Inverse as per IEC 255-3 standard.
 - The CTs of 2.5VA, 5P10 Class shall be employed. CT ratio shall be 60 to 400/1 (Further CT ratio (with at least two primary current rating) to be finalized during detailed engineering)
 - The preferable make of relay are ABB, Ashida, Schneider, Siemens make self-powered relay.
- 5.5.18 The terminal protectors to be supplied with the 11 KV RMU by the vendor along with the cable termination bolt for termination 185 Sq. mm 11kV 1C cable in breaker & 300 Sq. mm 11kV 3 C for isolator compartment.
- 5.5.19 The make of the vacuum bottle shall be same as that of the Type tested design.

5.6 BUSHINGS AND CABLE TERMINATIONS

- 5.6.1 Bushing should be of Epoxy resin. Each cable compartment shall be provided with three bushings of adequate sizes to terminate the incoming and outgoing cables. The termination bolt shall be stainless steel and M16 size.
- 5.6.2 The bushings shall be conveniently located for proper bend so as to allow easy working and termination of cables. The cable termination shall be done with Heat shrinkable /Push ON termination method so that adequate clearances are maintained between phases & cable shall be held by HDPE/Nylon (fire retardant) cleat. The Sizes of incoming and outgoing cable shall be as per clause no. 5.2.10.
- 5.6.3 Bidder should provide bimetallic washer for connection between Copper bushing stud and Aluminium Lug. Necessary spring and flat washers to be provided on each terminal. The bimetallic washer shall be suitable HDG M12 bolt for supply and 630A rating in all compartments with minimum thickness of 2mm and sufficiently cover the completely copper bushing stud. The bidder can alternately offer tinned copper surface of bushing then bimetallic washer not required.
- 5.6.4 The Terminal bolt shall have arrangement for fixing the cable test rod through cable boot opening. Cable boot should have opening for test rod insertion.
- 5.6.5 Cable boot shall be FR grade. Further, if clearance between bushing and body is less than 65 mm than touch free terminations may be specified. If Min. clearance in-between phase to phase bushings (center to center) < 95mm, **screened boots** shall be provided.
- 5.6.6 The bolt tightening pressure must be written inside each cable chamber with permanent sticker.
- 5.6.7 Cable boot for cable termination should be as per IS 13573-2. Boot should be easy to install.

- 5.6.8 The cable compartment must be without any holes or gaps and properly vermin proofed before inspection.
- 5.6.9 The cable compartment doors shall have interlocks such that doors can be opened only with earth switch in closed position.
- 5.6.10 Termination boots shall be as per type tested design. And should have a proper opening to facilitate the testing. The opening in boot shall be covered by means of removable protection cap.
- 5.6.11 All cable compartments shall have front door opening. The cable cover door shall be pad lockable and shall be Tamper and Arc proof. The circuit breaker and earth switch shall be lockable in the open or closed positions by 1 to 3 padlocks.
- 5.6.12 In outdoor RMU the door should have pad lock provision and cable door shall have interlock so that it shall not be opened by external forces. Also, it shall not be possible to operate the load break switch / isolator or breaker from outside once door closed. This is required to prevent pilferage.
- 5.6.13 Locking provision of cable compartment door to be provided in case of any switch/CB is at earth position to avoid pilferage.

5.7 EARTHING:

- 5.7.1 The RMU outdoor metal clad switchgear enclosure, load Break Switch, VCB, SF6 tank etc. shall be equipped with a copper earth bus throughout all compartments and securely fixed along the base of the RMU with cover.
- 5.7.2 The extension of this earth bus shall be taken out minimum 50mm outside the enclosure on both sides for fixing of the outside GI earth flat of 50mm width. The extension coming out of enclosure shall be properly sealed such a way to ensure vermin proofing of the cable compartment.
- 5.7.3 The size of tinned copper earth bus-bar should be Min.105 sq.mm inside the enclosure to withstand short time current carrying capacity as per IEC. Earth Bus Bar shall be tinned copper and thickness of tinning to be 10 μ m (minimum)
- 5.7.4 Two nos. body earthing bolts of M12X70 mm to be provide on the extended bus-bar.
- 5.7.5 The mother earth needs to be extended up to 250mm periphery of cable entry hole so that the cable termination earthing can be connected easily to the main mother earth with 12mm bolt and washers. This arrangement needs to be provided in each compartment of RMU.
- 5.7.6 The main tank must be connected to mother earth at least two positions with proper contact.
- 5.7.7 In outdoor type compact design bidders should ensure the earthing from mother earth is provided inside the cable compartment for earthing of the cable terminations.
- 5.7.8 Bidder to ensured that the earth bus shall be single conductor/bus suitable for taking specified fault current and both main earthing are interconnected by earth bus and not through tank or enclosure.
- 5.7.9 If bolts are provided as current carrying path then the bolt material shall be brass and size shall be suitable to carry specified fault current.
- 5.7.10 Two nos. body earthing bolts of M12X70 mm to be provide on the extended bus-bar. Bolts must be hot dipped galvanized.

5.8 VOLTAGE INDICATOR LAMPS AND PHASE COMPARATORS

- 5.8.1 Each compartment of RMU shall be equipped with a fixed type voltage indicator lamps having dip ports for insertion of phase comparators or line tester to check the phase sequence or presence of charge in cable. This is to be fixed on the front face plate to indicate presence of voltage in the cables. The capacitive dividers will supply low voltage power to the indicator lamps. Three inlets can be used to check the synchronization of phases with phase comparator or another device. These devices shall be following IEC 62271-206:2011 standard. The VPIS without dip ports are not accepted.
- 5.8.2 All the VIPS installed on compartments shall have auxiliary contacts wired up to the terminal block of respective compartment which shall be further used for remote status indication at SCADA.
- 5.8.3 There should be electrical interlock of cable presence indicator and operation of earth

switch in RMU incomer cable compartment of LBS.

5.8.4 In smart RMU this shall have to be programmed for SCADA communication.

5.8.5 This feedback should be used to operate the interlock for earth switch such that earth switch shall not operate when back end of cable is live.

5.9 FRONT COVER

5.9.1 The front cover shall provide a clear mimic diagram that indicates the different functions. This shall be permanent in nature throughout the useful life of the RMU.

5.9.2 The position indicators shall give a true reflection of the position of the main contacts. Position Indicators shall be clearly visible to the operator.

5.9.3 The lever operating direction shall be clearly indicated in the mimic diagram.

5.9.4 The bidder shall provide a operating sequence process on each compartment with permanent type arrangements. So that all data shall be self-explanatory.

5.9.5 The mimic plate or cover should be separate for each module/feeder of the RMU in view of safety. In case of any work to be done on mechanism of any one feeder then operation staff shall have only access to particular feeder via opening feeder mimic pate or cover plate.

5.9.6 The mimic shall have clear Words for "CLOSE/OPEN/EARTH" at each desired place.

5.9.7 All status indicators shall be marked visible font sized permanent painting (UV resistant and durability to be maintained throughout the full operational life of the RMU) as Earth ON/OFF, Disconnecter/LBS ON/OFF, CB ON/OFF.

5.9.8 All operating ports shall have marking like spring charging provision, three position disconnecter port and Shutter operator for interlocking, Operation allowed along with arrow indication and labeled as earth operation or disconnecter operation.

5.9.9 For better clarity of earthing related operations shutters and ports shall be painted in yellow background such way that the persons should get clear indication that if operating in yellow region means he is performing earthing related operation.

5.9.10 The Direction of operation shall be clock wise for any close operation and counter clock wise for any open operation of disconnecter /LBS and earth switch.

5.9.11 There shall be one label for SF6 gas pressure indicator and a clear message must be fixed near pressure indicator that region of safe operation and Alert message stating ' If GAS pressure not OK. Do not operate any switchgear and report to OEM (name) customer care/engineer in charge' this message should be clearly visible in front with suitable background and shall be with permanent marked.

5.9.12 For gas pressure indication a dial type manometer to be provided with will show actual pressure.

5.9.13 Gas pressure detector shall have SCADA compatible contacts and wired up on TB with labelling. This should give low gas pressure alarm to the SCADA.

5.9.14 IN case of smart RMU the FRTU should be programmed such that in case of low GAS pressure the remote switch operation should be blocked.

5.9.15 All the other accessories and boxes shall be properly labelled with permanent marking/printing such a way that the product is self-explanatory for user. Nomenclature to be provided along with symbols.

5.10 FAULT PASSAGE INDICATORS

5.10.1 Fault Passage Indicators shall be installed on the Ring Main Unit. Offered FPI shall give Fault Detection status with direction. These devices shall be electronic devices with dual energy source – with self-powered inbuilt battery and with provision of 24V DC aux supply. It must be connected to Single 3 phase Split Core CTs for O/C. These shall be provided with bright LED s / flag Indicators, which shall be clearly visible in the daytime. These shall have the following resetting facilities:

- a. Manual reset
- b. Resetting after a set time duration
- c. Electrically reset from remote with at least 2-spare potential free contacts.
- d. Resetting on restoration of LV

5.10.2 The unit shall have Short Circuit adjustable to different settings with separate Current transformer.

They shall be fully field-programmable and shall have at least and 5 settings for Phase fault or over current.

- 5.10.3 The preferred range is – O/C setting range 200-1000A.
- 5.10.4 The default setting shall be and 300A for overcurrent. This shall be ensured before inspection call in each RMU.
- 5.10.5 It shall be possible to Test these indicators at site thru “Test” push button. The Fault Passage Indicators shall also be provided with a SCADA output contact.
- 5.10.6 The process of fixing the FPI shall be fixed on the wall of the incomer LBS cable compartment along with pictorial view.
- 5.10.7 FPI connecting wires should be properly dressed and covered in insulated sleeve and tied to the side walls with help of cable ties. If sticking type arrangement is provide, then it must be with good quality permanent adhesive from reputed makes like 3M and should not come out with force of 10kN.
- 5.10.8 These shall confirm to the following standards:
- | | |
|------------------------------|---|
| IEC 60068-2-6, IEC 60068-2-9 | : Environmental testing – For Vibration, solar radiations |
| IEC 60950 | : Information Technology equipment – Safety |
| IEC 1000-2 | : Electromagnetic compatibility for low-frequency conducted disturbances and signaling in public low power supply systems |
| IEC 1000-4 | : EMC – Testing & Measurement |
| IEC 1000-6 | : EMC- Immunity for Residential, Commercial and light industrial environments. |

5.11 REMOTE CONTROL OF THE RMU:

LV Box at top (accessible from front side only)

A. For non-motorized RMU:

- Future provision for motorization to be kept on each feeder of each RMU.
- For future requirement of remote operation of the RMU line switches shall be possible using motors fitted to the operating mechanism for both line switch and circuit-breaker functions as and when required. All the necessary accessories shall be supplied separately to stores based on PO placed on quotation provided in this tender.
- The fitting of the motors to the mechanism must not in any way impede or interfere with the manual operation of the switches. An auxiliary contact to prevent motorized operation of the mechanism while the operating handle is inserted into the operating point shall also be provided

B. For motorized RMU-

The motors to be fitted in LBS and CB sections. The fitting of the motors to the mechanism must not in any way impede or interfere with the manual operation of the switches. An auxiliary contact to prevent motorized operation of the mechanism while the operating handle is inserted into the operating point shall also be provided. & shall have option to provide auxiliary PT having 1000VA burden for power supply to the FRTU, relay and DC battery charger.

- The On/Off Push button of LBS and VCB shall be Illuminated type with inbuilt LED indicating presence of electrical supply.
- Both the LBS should be wired up for auto changeover scheme. And CB to be wired up for Auto-recloser Scheme/feature.
- The CB mechanism should be suitable for auto reclosing after 10second dead time.
- 1 No. Surge Protection Device to be provided for the relay communication ports for protection from external surge.
- 1 No. Surge Protection Device to be provided for FRTU

Harting plug arrangement to be provided on each feeder of RMU. All the pins not used in harting plugs needs to be provided separately as spare. Preferred communication protocol for FRTU shall IEC-60870-5-104.

All Close-Open coils / signaling contacts shall be rated for 24 V DC. Following signaling contacts are essential for remote operation of RMU:

- Aux. contact for Line Isolator (Status)
- Aux. contact for all earthing switch (Status)
- Aux. contact for Breaker (Status)
- Aux. contact for FPI indication with direction
- Aux. contact for Protection trip (Breaker module)
- Aux. Contact for Low Gas Pressure
- Open/close status of the front cover of RMU, control panel and cable chamber door

4 Nos. spare relay tripping NO, NC contacts to be provided. Flag Indications on RMU when tripped should be on shunt trip. A provision for physical disconnection of motor supply (like fuse) of line isolator must be provided in RMU unit itself. (A flag is required for series and shunt coil actuation).

There should be harting plug arrangement for individual Isolator as well as breaker motor connections, which will be fitted on the RMU body itself. Also the PCB of motor should be covered by anti-tracking agent. There should be relay with timer instead of only relay, which is used in the latching circuit.

20% spare TB plug shall be required. All spare I/O points of FRTU should be wired up to harting TB plug.

Suitable unlatching system to be provided to prevent mal operation of motor in case of any latched command/ non-executed command at RMU (case like fuse failure etc.)

The separator between terminals to be provided to avoid any tracking etc.

One lamp with door open sensor to be provided in LT cabinet and 6/16 Amp switch and plug socket to be provided. The chamber shall have space heater at suitable location away from wires. The cable chamber shall have space heater at suitable locations.

Signal requirement for field RTU (which shall be mounted near RTU) is attached (refer Annexure-1).

C. For Smart RMU:

a) The smart RMU shall be motorized in LBS and CB also. This shall also have FRTU of the User approved make and approved models viz. Siemens, ABB/Hitachi, Schneider, Ashida etc. (updated list shall be shared during pre-bid meeting) & shall have auxiliary PT having 1000VA burden for power supply to the FRTU, relay and DC battery charger.

b) The On/Off Push button of LBS and VCB shall be Illuminated type with inbuilt LED indicating presence of electrical supply.

c) The FRTU shall be of approved make and model along with any license key (if required) for

programming and logic development at any site at any time.

d) The wiring diagram drawing should be fixed inside the compartment preferably at back side of door.

e) Any TB should not be mounded on base plate of RMU.

f) The battery terminal & other live terminals should be protected with insulating medium covering to avoid any direct accidental contact.

g) One Single pole MCB required for all DI signals and one single pole MCB required for DO positive supply.

h) 1 No. Surge Protection Device to be provided for the relay communication ports for protection from external surge. 1 No. Surge Protection Device to be provided for FRTU.

i) Provision for taking out antenna to be kept in FRTU cabinet and space for fixing modem(preferably 5G fallback to 2G) to be kept in cabinet.

j) Both the LBS should be wired up for auto changeover scheme. And CB to be wired up for Auto-recloser Scheme/feature.

k) The CB mechanism should be suitable for auto reclosing after 10second dead time.

l) Local/Remote switch & Auto/Manual Switch should be provided on the FRTU Chamber.

m) One lamp with door open sensor to be provided in FRTU cabinet and switch and socket to be provided.

n) The chamber shall have space heater in combination with thermostat at suitable location away from wires/Hygrostat is preferred for Aux PT chamber especially for coastal area.

o) Group marking & labeling to be done for all TB.

Harting plug arrangement to be provided on each feeder of RMU. All the pins not used in harting plugs needs to be provided separately as spare. Preferred communication protocol for FRTU shall IEC-60870-5-104.

All Close-Open coils / signaling contacts shall be rated for 24 V DC. Following signaling contacts are essential for remote operation of RMU:

- A) Aux. contact for Line Isolator (Status)
- B) Aux. contact for all earthing switch (Status)
- C) Aux. contact for Breaker (Status)
- D) Aux. contact for FPI indication with direction
- E) Aux. contact for Protection trip (Breaker module)
- F) Aux. Contact for Low Gas Pressure
- G) Open/close status of the front cover of RMU, control panel and cable chamber door

4 Nos. spare relay tripping NO, NC contacts to be provided. Flag Indications on RMU when tripped should be on shunt trip. A provision for physical disconnection of motor supply (like fuse) of line isolator must be provided in RMU unit itself. (A flag is required for series and shunt coil actuation).

There should be harting plug arrangement for individual Isolator as well as breaker motor connections, which will be fitted on the RMU body itself. Also the PCB of motor should be covered by anti-tracking agent. There should be relay with timer instead of only relay, which is used in the

latching circuit.

20% spare TB plug shall be required. All spare I/O points of FRTU should be wired up to harthing TB plug.

Suitable unlatching system to be provided to prevent mal operation of motor in case of any latched command/ non-executed command at RMU (case like fuse failure etc.)

The separator between terminals to be provided to avoid any tracking etc.

One lamp with door open sensor to be provided in LT cabinet and 6/16 Amp switch and plug socket to be provided. The chamber shall have space heater at suitable location away from wires. The cable chamber shall have space heater at suitable locations.

Signal requirement for field RTU (which shall be mounted near RTU) is attached (refer Annexure-1).

1. **Technical Details of motors** (For motorized and smart RMU only)
 - a. Operating Voltage 24 V DC
 - b. Max. power rating 240 Watts
 - c. Max current drawn 9 Amp ($\pm 10\%$)
 - d. Operating time 4-8 seconds
 - e. Power Supply Motor shall be suitable for 24 V DC
 - f. Motor Torque shall be higher than Mechanism Torque and be more than sufficient.
 - g. The motor shall be protected against overloading and abnormal temperature rise, with an indication mechanism in place.
2. **Technical details of Auxiliary PT (2 core)** For smart RMU only
 - a. Voltage ratio- 11000/3 $\square$ 240V, 3 $\square$ 240V
 - b. Power frequency withstand: 28kV
 - c. Impulse withstand: 75kVp
 - d. Voltage factor 1.2 continuous and 1.9 for 8hours
 - e. Burden- 1000VA each
 - f. Accuracy- 6P/6P
 - g. Type tested design (test report from OEM)
 - h. offered make
3. The FRTU offered model and make
Preferred make and model for the FRTU (**However it will be finalised during detailed engineering**)
 - a. ABB/Hitachi Make FRTU with Model No – RTU540, RTU 530
 - b. Siemens Make FRTU with Model No – A8021
 - c. Schneider Make FRTU with Model No – T 300
 - d. WAGO Make FRTU with Model no - 750-8212
 - e. For any other OEM – Please provide details during detailed engineering and subject to approval of concern DISCOM.
4. The busbar connecting to Aux. PT should have 11kV insulation sleeve.
5. THE HT compartment and FRTU compartment shall have separate door for safety
6. The Aux. PT shall have HT fuse protection (Bidder to mention make and rating of fuse offered)
7. The Aux. PT compartment cover shall have interlock so as to avoid opening when bus is charged for safety, applicable for the FRTU and PT placed having common enclosure.
8. Model of Modem for communication of data to be mentioned. Approved make of modem are ABB Viola & Robustel R2010.

* Any new model is required to undergo evaluation through a field trial for a minimum duration of 3 months.

9. In the scope of bidder testing, commissioning and integration of signals through FRTU up to ADMS is included Bidder to comply

5.12 FOR ALL TYPE OF RMU

1	Protection against theft	Design of RMU shall be tamper & arc proof. Anti-vandal screws shall be provided. Cable covers shall be pad lockable. All live parts and internal parts etc. shall be covered with antitheft covers.
2	Doors	Hinged doors shall be provided for outdoor type RMU. The hinges for the doors need to be riveted and shall not have any access from outside. Bolted hinges shall not be acceptable.
3	Voltage indicator box shall be fixed type-This device shall be following IEC 62271206:2011 standard only	Capacitive dividers type which will supply low voltage to power the lamps AND 3 inlets can be used to check phase sequence or presence of voltage in cable
4	Cable cleats (full circle)	Nylon (Fire Retardant)
5	Bushing suitability for cable termination types	Bushing should be suitable for Heat & Cold shrink terminations. The termination should RMU compatibility kit It will be finalized during detailed engineering
6	Cable compartment suitability shall be	Suitable for cable sizes a. 11kV 3CX630 sq.mm/3Cx400sqmm having dia of 100mm in all compartment and b. LBS suitable for 11kV 1CX630 sq.mm cable having diameter of 51mm if applicable as per requirement in tender. (Cable sizes to be confirmed during detailed engineering)
7	The cable compartment	All cable compartment shall be bottom entry and front opening type only
8	Size of bimetallic washer in all compartments	Must be suitable for M16 bolt and bushing sizes with min. 2mm thick, not applicable if tinned copper bushing provided.
9	Height of bushing terminal from base plate in each cable compartment. The cable compartment box length for easy termination of armored cables.	Minimum 800mm from base plate to bushing bolt center for proper termination space.
10	Fault passage indicator (SCADA compatible)	One FPI for each LBS.
11	Future motorization and SCADA Compatibility in non-motorized RMU	To be provided

12	List of Type test of product	To be attached for each model & type offered with test report number and date
13	Availability of spares	Assurance by bidder for 25 years, list of spares as mentioned in specification to be provide along with RMU lot.
14	VPIS electric interlock	The VPIS shall have electrical interlock with earth switch such that only earth when cable not charged.
15	VPIS with Aux. contact	In all compartments
16	Breaker operation counter	To be provided
17	LBS operation counter	To be provided
18	Direction of operation (Close - clock wise Open- counter clock wise) `	LBS – ON/off ES- Open/ close CB disconnecter- ON/off CB earth switch-Open/ close
19	Auxiliary contacts (total and spare)	a. LBS b. Earth Switch c. CB d. Series Disconnecter of CB - e. Earth switch of CB-
20	Control cable entry provision	To be provided
21	DC Shunt trip coil (24V)	To be provided along with series trip coil and specify DC power rating and charger/converter ratings offered
22	Double pole AC MCB of suitable rating to be considered in battery i/c and polarized DC MCB of suitable rating to be considered for individual LBS, CB Section as well as common DC output.	To be provided
22	MCB for LT AC incomer and TB connection of all CT, Aux switches and relay wiring in separate control cabinet.	To be provided in all RMU. Separate compartment to be provided for Terminal block of all auxiliary contacts wired up. MCB approved makes- ABB, Siemens, Scheider, EATON.

23	RMU Cable Boot/ terminal protector to be provided in each compartment for each phase.	Bidder to mention offered a. Make b. Model c. Material of boot d. Test report and data sheet showing suitability e. Confirmation from bidder that same boot was used during type testing of RMU. f. Impulse voltage rating of boot
24	On the extensible bushings of each phase the 11kV insulation to be provided.	Bidder to comply for the same.
25	Cable boot/ terminal protector should be suitable for 400sq.mm cables with flat lugs square end 400 sq.mm,	Bidder to comply for the same.
26	All auxiliary contact, relay LT Supply contact, relay DI/DO contact, provision for communication device in a control compartment.	Separate compartment to be provided for Terminal block of all auxiliary contacts wired up.
27	In each cable compartment each bushing shall have temperature sensors.	The temperature data should be shown on one common display unit and shall be communicated to SCADA in motorised and Smart RMU.
28	Total height of the indoor RMU should be <1900mm	Bidder to accommodate without compromising other requirements.
29	Terminal bolt material and bolt length & washers offered	The terminal bolt shall be M16 and of stainless steel. The offered length to be mentioned along with washer details.
30	Battery Capacity and Preferable battery make	26Ah at least for RMU part Only/ Battery capacity and type should be 2x 12V Maintenance free Preferable Make : Exide, Amara Raja, HBL etc.
31	SMPS make and Rating	Gogate /ALAN make(Preferable) , Output- 24V,10A
32	Battery Charger Isolation voltage and auto boost mode	In the range of 4000Volts (Preferable make : Adel syst

5.12 PAINT

All paint shall be applied on clean dry surfaces under suitable atmospheric conditions by seven tank process and powder coating. The overall paint thickness shall be 70 to 125 microns. (will be decided by user at the time of issuance of tender as per site requirement). The paint Type text here shall not scale off or crinkle or be removed by abrasion during normal handling. The enclosure of the RMU shall be painted with shade Dark Gray, i.e., BS381C or RAL 7032. Sufficient quantity of touch-up paint shall be furnished for application at site.

5.13 SLD AND CONFIGURATION

SLD to be provided by the bidder during bidding stage for reference

5.14 CONTROL CABINET

- 5.14.1 Control cabinet with a terminal block (TB) located at convenient accessible location so as to wire all inputs & outputs (IOs) up to the terminal block (TB). All the cable secondary wiring should be rooted through marshalling box separately for relay, CT etc.
- 5.14.2 The wiring of the relay to be done on the TB for its terminals along with communication terminals.
- 5.14.3 All terminals wires shall have proper identification ferrules and the identification marking provided on TB.
- 5.14.4 Control cabinet shall have control cable entry arrangement on both sides of the RMU top control cabinet with proper grommet such that the opening are sealed in normal installations when not used for our door extension box arrangement to be provided any other arrangement to be explained in drawing during tender.

6.0 NAME PLATE & MARKING: -

All the components and operating devices of the RMU shall be provided with durable and legible nameplates containing all technical parameters. Name plates shall be suitably embossed with " PO no. with date", "PROPERTY OF Tata Power-Mumbai/ TPDDL/ TPCODL /TPNODL /TPWODL /TPSODL' & "CODE NUMBER" along with the following information. A Danger plate of appropriate size shall also be provided on the enclosure.

- a) Manufacturer's Name
- b) Month and year of supply
- c) PO Number
- d) Type/Model
- e) Rated Voltage
- f) Rated current
- g) Service voltage
- h) System Frequency
- i) Rated Short time withstand current for 1 sec
- j) Rated Impulse withstand Voltage
- k) Degree of Protection
- l) Type Designation or Serial no.
- m) Year and month of manufacture.
- n) Applicable Rated values
- o) Mass of unit
- p) SF6 gas filling pressure.
- q) Warranty period

The sr. no. and year of manufacturing shall be painted in black color with yellow background ON SIDE.

7.0 TESTS FOR RMU

All the Routine and acceptance tests shall be carried out in accordance with the relevant IS/IEC standards. All routine/acceptance tests shall be witnessed by the purchaser/his authorized representative. All the components within the RMU enclosure shall have been tested for Routine/acceptance and Type tests as per the relevant standards. All Type tests as per latest IS / IEC shall have been carried out on the RMU as a whole as per relevant IS/IEC. Following tests shall be necessarily conducted on the equipment and its components as specified in IEC 62271-200:

Note- In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid.

7.1 TYPE TESTS

Sr. No.	Tests stipulated as per Tender Spec.	Applicable standard	Acceptance Clause as per IS / IEC
1	PF withstand voltage test & Lightning Impulse voltage withstand test for Switches	IEC62271-103	CI 6.2 of IEC62271- 103, CI 7.2.7.2 & 7.2.7.3 of IEC62271-1
2	PF withstand voltage test & Lightning Impulse voltage withstand test for CB	IEC 62271-200	CI 6.2.6.1 & 6.2.6.2- IEC 62271-200
3	Measurement of contact resistance & Temperature rise test LBS & CB combined unit (if individual then two separate reports required)	IEC 62271-200	CI 6.4 & CI 6.5 of IEC 62271-200
4	Short Time current and Peak current withstand tests Main Circuit	IEC 62271-200	CI 6.6 a & b -IEC 62271-200
5	Short Time current and Peak current withstand tests Earthing Circuit	IEC 62271-200	CI 6.6 a & b -IEC 62271-200
6	Short Circuit Breaking current tests LBS	IEC 62271-103	CI 6.101, Table 3 of IEC 62271-103
7	Short Circuit Making current test on LBS	IEC 62271-103	CI 6.101.1.2, Table3 of IEC 62271-103
8	Short Circuit Making test on Earth Switch	IEC 62271-102	CI 7.101 of IEC 62271-102
9	Short circuit making & Breaking tests on CB – three phase fault	IEC 62271-100	CI 6.112.1 of IEC 62271-100
10	Single Phase test on CB	IEC 62271-100	CI 6.108 of IEC 62271-100
11	Double Earth Fault test on CB	IEC 62271-100	CI 6.108 of IEC 62271-100
12	Mechanical operation tests on LBS	IEC 62271-200	CI 6.102.2 - IEC62271- 200
13	Mechanical operation tests on CB	IEC 62271-200	CI 6.102.2 - IEC62271- 200
14	Mechanical Endurance tests on LBS	IEC 62271-103	CI 6.102.2. - IEC 62271-103
15	Mechanical Endurance tests on CB	IEC 62271-100	CI 6.101.2.4 of IEC 62271-100
16	Mechanical Endurance tests on DS	IEC 62271-102	CI 7.102.3 of IEC 62271-102
17	Partial Discharge test on CB & LBS	IEC 62271-200	Annex BB , Procedure B of IEC 62271-200
18	Pressure withstand test of gas filled compartment/Tank	IEC 62271-200	CI 6.103.1 of IEC62271-200
19	IP67 of Gas compartment/Tank	IEC 62271-200	CI 6.7.1 of IEC62271- 200

20	IP54 for outdoor RMU	IEC 62271-200 & IEC- 60529	CI 6.7.1 of IEC62271- 200
21	IAC on Cable Compartment	IEC 62271-200	CI 6.106 IEC62271-200
22	IAC on Gas Compartment	IEC 62271-200	CI 6.106 IEC62271-200
23	Cable charging current breaking test	IEC 62271-100	CI 6.102, 6.105 of IEC 62271-100
24	Capacitive current switching test	IEC 62271-100	CI 6.111 of IEC 62271-100

Note: The bidder can submit the test report with combination of above listed tests. The test of CB & LBS to be done on combined unit. If bidder submits individual unit CB/LBS tests then both units test detailed test reports are to be submitted.

7.2 ROUTINE TESTS

Following routine tests are to be done on 100% of the lot quantity

1. Power Frequency Withstand Test.
2. Dimensional & Visual Checks
3. Operational & Interlock Tests of breaker & isolator switches.
4. Helium leakage detection test in vacuum chamber
5. Sf-6 leakage test.
6. HV withstand test across isolator distance.
7. HV withstand test of control and auxiliary circuits.
8. Voltage Indication Tests on VPIS
9. Breaker Contact Resistance Test
10. Total Trip Time Check Test through Current Injection in primary.
11. IR Value.

For other components, as per applicability, the RTC as per relevant IS/IEC from Original Equipment manufacturer (OEM) shall be required:

1. Cable Boots
2. Routine test report of the Relay
3. CT
4. Motor

7.3 ACCEPTANCE TESTS

The test mentioned in ITP attached as annexure-3 to this document shall be carried out as acceptance test on random samples. Minimum 10% units (or minimum 2 RMU if lot size is small) of the lot shall be selected for acceptance test shall be selected for testing from each offered lot.

Sr. No.	Tests details	Applicable standard	Acceptance Criteria
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1	PF withstand voltage test on LBS and CB combined with switches closed position	IEC62271-103 & IEC 62271-200	CI 6.2 Of IEC62271-103, CI 7.2.7.2 & 7.2.7.3 of IEC62271-1 CI 6.2.6.1 & 6.2.6.2-IEC 62271-200 Should withstand 28kV for 1minute
2	HV withstand test across isolator distance with opened contact of VCB	IEC 62271-200	Should withstand 28kV for 1minute
3	Voltage Indication Tests on VPIS	-	VPIS indication should lit up when voltage applied in all phases
4	Measurement of contact resistance on LBS & CB combined with all switches in closed condition	IEC 62271-200	CI 6.4 & CI 6.5 of IEC 62271-200 Total resistance limit shall be maximum 350micro ohm with busbar & switches closed.
5	Dimensional & Visual Checks	-	As per approved drawing and technical compliance document for tender
6	Operational & Interlock Tests of breaker & isolator switches	As per specification	All interlock shall operate without fail in any operation
7	Leak Detection Test at bushing terminals after RMU assembly	IEC 62271-1 clause 8.5	For gas-filled systems tested in factory, the probing test using a sniffing device to be done. The sensitivity of the sniffing device shall be at least 10 ⁻⁸ Pa × m ³ /s.
8	HV withstand test of control and auxiliary circuits of motorised and Smart RMU		Should withstand 2kV for one minute
9	Insulation resistance test		With open contacts and closed contacts of switches. Should be in Giga-ohms.
10	Other components, as per applicability, the RTC as per relevant IS/IEC from Original Equipment manufacturer (OEM) to be shared for cable boot Relay CT motor		OEM reports as per IS and IEC.
11	Relay testing- Relay testing should be done with primary injection kit on installed relay.		Total tripping time with relay & without relay (Without relay shall be done at trip coil directly) timing shall be within specified in specification.

Bidder should have all the requisite testing equipment's to carry out routine and acceptance test mentioned in ITP and following set up to be arranged for RMU relay testing:

- Facility for primary current injection up to 1000amp.
- Facility to check total trip timing of breaker along with breaker main contacts through primary

current injection.

8.0 TYPE TEST CERTIFICATE

The Bidder shall furnish the type test certificates of the 11kV RMU of same design as offered in bid for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA or reputed International Laboratory like PHELA, KEMA IPH, etc. as per the relevant standards of IS and IEC.

Type tests shall have been conducted in certified Test laboratories during the period not exceeding 10 years from the date of opening the bid. In case if type test conducted beyond 10 years then bidder to certify on letter head of parent OEM that no design change & no manufacturing plant change occurred from type tested product.

In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to the user.

9.0 PRE- DISPATCH INSPECTION

Equipment shall be subject to inspection by a duly authorized representative of the user. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment if found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to the respective user's representatives at all times when the work is in progress. Inspection by the User or it's authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by the User. Following documents shall be sent along with material

- a) Routine Test reports
- b) MDCC issued by the user
- c) Invoice in duplicate
- d) Packing list
- e) Drawings & catalogue
- f) Guarantee / Warrantee card
- g) Delivery Challan
- h) Installation and maintenance Manual soft copy for FPI, Relay, RMU
- i) Other Documents (as applicable)

10.0 INSPECTION AFTER RECEIPT AT STORE

The material received at the User defined store/location will be inspected for acceptance and shall be liable for rejection if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.

If any deviation or anomaly observed at this stage same need to be rectified by bidder at bidders own cost at earliest.

11.0 GUARANTEE

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Purchaser up to a period of at least 48 months from the date of commissioning or 60 months from the date of last supplies

made under the contract whichever is earlier, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the " Security cum Performance Deposit" as the case may be.

In case of GP failure, BA shall report at site within 48 hours from intimation and arrange for rectification of fault within a mutually agreed time. In case rectification at site is not possible then alternative arrangement (replacement) to be made by BA within 15 days of intimation of failure.

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 the Purchaser.

12. PACKING

Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit. The packing should be in such manner that during storage the RMU and its components should not be damaged.

No single use plastic to be used in packing material. Packing should be done with environment friendly recyclable materials.

13.0 TENDER SAMPLE

Not applicable. Bidders to mention offered model number or type in GTP along with GA drawing during tender for each variant.

14.0 TRAINING

The bidder shall arrange to provide the installation and operating training at our offices as and when required for better installation and usage of the product.

It is preferred that the service engineer present during installation shall arranged to provide the operation training of RMU to the staff during installation and inform about the critical points. In addition to this for new bidder, new product or change in design the bidder has to provide minimum one training sessions at each District office of Discom (for TPDDL and TPC -Mumbai) /one training sessions at concern circle office of Discom (for TPCODL/TPNODL/TPSODL/TPWODL) .

In addition to above bidder to share Digital /Video based training module for safe operation of RMU in pen drive.

15.0 QUALITY CONTROL

The bidder shall submit with the offer, assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's or its nominated representative engineer shall have free access to the manufacturer/sub- supplier's works to carry out inspections.

To ensure proper operation of RMU the bidder shall provide onsite training of the user teams as and when required. To ensure quality of installations bidder shall provide supervision support during impartation.

Bidder shall conduct root cause and defect analysis of the failed unit and submit the root cause analysis report within two months of reporting of failure.

16.0 TESTING FACILITIES

Bidder shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards

The bidder shall have in-house helium gas leakage detection system and all RMU main tank shall be checked for any leakages.

17.0 MANUFACTURING ACTIVITIES

CAT-A/CAT-B (Commented with manufacturing clearance) is necessary for the start of manufacturing activities of the equipment.

18.0 SPARES, ACCESSORIES & SPECIAL TOOLS/ GAUGES

Bidder shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment which shall be 25 years minimum. However, the User shall be intimated with a minimum of 12 months' notice in the event that the Bidder or any sub-vendor plans to discontinue manufacturing of any component used in this equipment.

Bidder shall provide following spares as commissioning spares along with RMU.

SL. No.	Name of Spare Parts	Required spares with above 80 No. of RMU	Required spares with above 20 No. up to 80 No. of RMU	Required spares up to 20 No. of RMU
1	Breaker Mechanism	4 No's	3 No's	1 No's
2	Isolator Mechanism	4 No's	3 No's	1 No's
3	Trip Coil	5 No's	3 No's	2 No's
4	CT (All types)	6 Sets (1 Set = 3 Nos.)	4 Set	2 Set (1 Set = 3 Nos.)
5	Bolt (For cable connection)	5 Sets (1 Set = 3 Nos.)	3 Set	2 Set (1 Set = 3 Nos.)
6	"L" Key (All Size)	2 Sets	1 Set	1 Set
7	VPIs	10	6	2
8	Manometer	8	6	2
9	24V DC Motor for Isolator	8	6	2
10	RMU PCB Card with Contactors	6	4	2
11	FPI CT	6 Set (1 Set = 3 Nos)	4 Set	2 Set
12	For Schneider FBX RMU: Control Card for Isolator Function Motorization	12	8	4

The mandatory items with each RMU are as below,

1. Operating Handle.
2. Cable bushing (if replaceable),
3. FPI,
4. Push button (On, Off both),
5. washer (SS),
6. anti-vandal screw, cable boot

7. Cable Connecting bolts with washers
8. cable boots for 11kV

19.0 DRAWINGS & DOCUMENTS

Following drawings and documents shall be prepared based on the user specifications and statutory requirements and shall be submitted with the bid:

- a) Completely filled in Technical Particulars
- b) Any deviation sheet or No deviation
- c) General description of the equipment and all components including brochures.
- d) General arrangement for RMU
- e) SLD of each feeder
- f) Arc path drawing of all variants offered
- g) Foundation plan
- h) Experience List
- i) All set of Type test certificates for offered design each variant

Drawings / documents to be submitted for approval after the award of the contract are as under:

Sl. No.	Description	For Approval	For Review/ Information	Final Submission
1	General Technical Particulars (GTP)	✓		✓
2	General Arrangement drawings	✓		✓
3	Schematic Diagram of MIMIC with ON/OFF and all front labelling	✓		✓
4	Bill of materials	✓		✓
5	Arc path drawing for each variant	✓	✓	✓
6	SLD of complete RMU and feeders	✓	✓	✓
7	Control wiring diagram and arrangement in control cubicle	✓	✓	✓
8	Cable compartment internal dimension drawing and one drawing stating standard boots arrangement and cable earthing arrangement with cable	✓	✓	✓
9	CT mounting arrangement drawing with details of fixing and frame movement etc.	✓		✓
10	Foundation Plan/Drawing	✓	✓	✓
11	Installation & Maintenance Instructions and manual			✓
12	QA & QC Plan	✓		✓
13	Test Certificates	✓	✓	✓

All the documents & drawings shall be in English language.

After the receipt of the order, the successful bidder will be required to furnish all detailed drawings of components for approval.

Instruction Manuals: Bidder shall furnish softcopies manuals of RMU, FPI, Relay (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices

20.0 GENERAL TECHNICAL PARTICULARS FOR RMU

S.N.	Description	As specified (Options defined in specs)	As furnished by Bidder
1.0	RMU Category	3Way - 1CB & 2 LBS or 3 LBS 4Way - 2CB & 2 LBS or 4 LBS 5Way - 3 CB & 2 LBS	
2.0	RMU application	Indoor or Outdoor as mentioned in tender	
3.0	Offered Model nos. and OEM type	3Way (NE, I/D or O/D) 4Way (NE, I/D or O/D) 5Way (NE, I/D or O/D)	
4.0	Dielectric medium	SF6	
5.0	Interrupting medium	Vacuum- for CB SF6 for LBS and earth switch	
6.0	System Frequency	50 Hz	
7.0	Rated Voltage	12 kV	
8.0	Service Voltage	11 kV	
9.0	Rated current -Line Switches	630 A	
10.0	Rated Current-CB and LBS	630 A for all type	
11.0	Rated Short time current withstand	21 kA for 3 s for 11 kV	
12.0	Rated Short time Making capacity	50 KA	
13.0	Rated cable charging interrupting current of incomer load break switch	10 A	
14.0	Rated load interrupting line current	630 A	
15.0	Rated cable charging breaking current of breaker	25 A	
16.0	No. of operations at rated short circuit current on line switches, earthing switches should be E2	LBS- 5 close ES- 5 close The ES in line with CB	
17.0	Opening time of breaker (max.) Without relay time	2.5 cycle	
18.0	Closing time of breaker (max.)	3 cycle	
19.0	Breaker Duty Cycle	O – 3min - CO - 3min - CO	
20.0	Mechanical endurance for Isolator & Earth Switch	Min 1000 (M0) Operations	
	Mechanical endurance for Circuit Breaker	Min 10000 (M2) Operations	
21.0	Electrical operations of at rated current LBS/Disconnecter Earth Switch	To be provided by bidder	

22.0	Temp rise above ambient of +40 deg.	+40 Deg C. (Type Tested as per IEC and complying to requirements)	
23.0	Min Gas pressure in bar	To be provided by bidder based on type tested design	
24.0	SF6 Gas pressure manometer with indicating bars/scale to measure the actual gas pressure (indirect method RFS etc. not accepted)	Dial type Manometer to be provided for gas pressure indication Contacts to be provided and wires up on the TB for SCADA communication of gas status	
25.0	Enclosure	The RMU metal parts shall be greater than 2mm thickness high tensile steel/CRCA. The overall paint thickness shall be not less than 70 microns.	
26.0	Guaranteed SF6 leakage per annum	Less than 0.1% from main tank	
27.0	Degree of protection	IP 67 for the tank and IP2X for the front cover / mimic board and IP 54 (Main door closed) for Outdoor RMUs. IP 54 for cable compartment	
28.0	Internal Arc rating	IAC AFL or better/IAC AFLR or better for Outdoor RMU	
29.0	Internal Arc test	20kA for 1 Sec for 11 kV	
30.0	Lightning Impulse withstand Voltage	75 kVp	
31.0	Power Frequency withstand voltage	28 kVrms	
32.0	SF6 Tank design	Hermetically/robotically sealed unpainted stainless-steel enclosure with SF6 Gas. Sealed pressure system by Laser welding so that no refilling of gas is required for 30 years. No gas work at site. Complete body shall be tamperproof to prevent access to live parts. No gaskets shall be used. No bolts shall be provided.	
32.1	Tank material and grade of SS 304 and welding	Should be of SS 304 and non- corrosive, offered grade of SS to be mentioned. The welding shall be such that there shall be no corrosion of welding for useful life of equipment.	
33.0	Earth bus bars	In enclosure to prevent tampering.	
34.0	Material & size of earth bus bar	Copper earth bus-bar should be Min.105 sq.mm	
35.0	Earthing of main CCT Cables shall be earthed with earth switch with S/C making capacity as per IEC 129. closing shall be possible only when Isolator is open	To be provided by bidder	

36.0	Incomer Load Break switch: Shall be SF6 insulated with least maintenance. Shall have at least 3 positions, Open, Close & earth with natural interlocks. Fitting of motor at site shall be possible & shall have mechanical interlock	To be provided by bidder	
37.0	Circuit Breakers: With VCB interrupter and SF6 insulated bus with minimum maintenance and shall have at least 2 positions I.e. Open & Close, Manual operation & fitting of motor at site shall be possible if required. In view of safety each VCB shall be assisted with disconnecter having 3 positions, open-disconnected, closed, and earth (having fault making capacity) and shall be constructed in such a way that natural interlocking prevents unauthorized operations.	To be provided by bidder as per specs.	
38.0	Electrical interlock for live cable presence indicator and operation of earth switch in RMU incomer cable compartment of LBS	To be provided by bidder	
39.0	Make of self-powered Relay & offered model	Ashida make, 241S-AM-760-09-01-28-01-00-10	
40.0	Paint thickness	Minimum 70 microns	
41.0	The cable compartment doors shall have interlocks such that doors can be opened only with earth switch in closed position	To be provided by bidder	
42.0	Protection against theft	Design of RMU shall be tamper & arc proof. Anti vandal screws shall be provided. Cable covers shall be pad lockable. All live parts and internal parts etc. shall be covered with antitheft covers.	
43.0	Doors	Hinged Main doors shall be provided for outdoor type RMU. The hinges for the doors need to be riveted and shall not have any access from outside. Bolted shall not be acceptable.	

44.0	Voltage indicator box shall be fixed type-This device shall be in compliance with IEC 62271-206:2011 standard only	Capacitive dividers type which will supply low voltage to power the lamps AND 3 inlets can be used to check phase sequence or presence of voltage in cable	
45.0	Cable cleats (full circle)	HDPE/Nylon (Fire Retardant)	
46.0	Cable compartment suitability shall be	Suitable for cable sizes as per tender document In the isolators compartment 11kV, 3C X 630sq. mm/400Sqmm/300mm and in breaker compartment 11kV, 1CX185 sq. mm,/ 3C X 300 Sq. mm. (To be finalized during detailed engineering)	
47.0	The cable compartment	All cable compartments shall be bottom entry and front opening type only	
48.0	Size of bimetallic washer in all compartments	Must be suitable for M12 for TPC bolt and bushing sizes with min. 2mm thick.	
49.0	Height of bushing terminal from base plate	Minimum 900mm for proper termination space for 11 KV	
50.0	Fault passage indicator	One per RMU in all LBS compartments	
51.0	Operating handle	To be provided by bidder as a part of RMU with each RMU and to be placed on front or on door	
52.0	Non removable MIMIC Diagram on Front of panel	To be provided by bidder with detailed descriptions as mentioned in specs. And earth switch marking background shall be Green for TPC, Mumbai background. As per annexure-2	
53.0	Main Bus bar Material	Copper	
53.1	Bus bar Cross Section	Copper earth bus-bar should be Min.105 sq.mm	
54.0	Opening & Closing times with relay	125 ms maximum	
55.0	Current Transformer for CB compartment	Shall be epoxy resin casted and mounted on cables. The CTs around the cables shall be supported on the sheet steel bracket and should be fixed with bolts. The mounting frame should be moveable up and down or to and fro but shall be fixed at co- axial position with base plat holes and bushing terminal bolts. 200/1, 5P10	
56.0	Motorization and SCADA Compatibility	To be provided	
57.0	Guarantee	As per specification	
58.0	Dimension (LxWxH) (mm x mm x mm)	To be provided by bidder	
59.0	Total weight	To be provided by bidder	

60.0	Paint	Light Gray shade RAL 7032	
61.0	Type test of product	To be provided by bidder as per specification	
62.0	Availability of spares	Assurance by bidder for 25 years, list of spares as mentioned in specification to be provide along with RMU lot.	
63.0	VPIS auxiliary contact	The VPIS shall have auxiliary contact such that it can be configured with SCADA for remote status indication of cable charged. The auxiliary contact to be wired up in TB.	
63.1	VPIS	In all compartments	
64.0	Breaker operation counter	To be provided by bidder	
65.0	LBS operation counter	To be provided by bidder	
66.0	Moisture absorption material in SF6 tank	Bidder should provide the detail of the moisture absorption material.	
68.0	Making of earthing operations	All earth operation to be marked with green back ground and permanent in nature.	
69.0	Auxiliary contacts (total numbers and spare numbers)	LBS Earth Switch CB CB Disconnecter - CB earth switch-	
70.0	Control cable entry provision	To be provided	
71.0	Shunt trip coil 24V DC/ 230V AC	230V AC/24V DC shunt trip coil to be provided. Trip coils to be wired up on TB.	
72.0	MCB for LT AC incomer and TB connection of all CT, Aux switches and relay wiring	To be provided	
74.0	RMU Cable Boot/ terminal protector for 11 KV RMU		
a	Terminal protector	Insulating Boots	
b	System voltage	12 kV	
c	AC High voltage	28kV For 1 min	
d	Impulse withstand voltage	75kV	
e	Bushing Diameter	To be provided by bidder	
f	Bushing Types	To be mentioned by bidder	
g	Cable cross section suitability	Bidder to provide complying to specs.	
h	Dimensions of cable protector	Suitable for cables & bushing in specs. (offered size to be provided by bidder)	
i	Material of the component	To be specified by bidder	
75	Type test reports	Bidders to provide detailed list of tests conducted at lab name, conducted dates, report number along with full reports.	

For motorized RMU			
1	SCADA Compatibility-Remote operation of RMU shall be possible by using motors fitted to operating mechanism of isolators & CB etc.	To be provided	
2	Harting Plug arrangement for individual isolator as well as breaker motor connections, which will be fitted on RMU body itself.	To be provided	
3	Details of I/O	As per Annexure-IO list of this specs	
4	System to prevent mal operation in case of latch command	Bidder to provide inbuilt system to prevent any mal operation in case of latch command at RMU in case of any fuse failure or DC fail situation	
5	Technical Details of motors		
a	Operating Voltage	24 V DC	
b	Max. power rating	240 Watts	
c	Max current drawn	9 Amp ($\pm 10\%$)	
d	Operating time	4-8 seconds	
e	There shall be provision of 230 V AC (maximum 5 Amp current) & 24 V DC		

21.0 SCHEDULE OF DEVIATIONS

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

S.No.	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Designation Signature

ANNEXURE-1

SIGNAL LIST FOR AUTOMATION

Description	Analog Inputs (AI)					Status (DI)		
Type	Amp. Loading- R ph	Amp. Loading- Y ph	Amp. Loading- B ph	Phase Voltage	Power Factor	Switch Close	Switch Open	Reset Element
RMU Switch	0	0	0	0	0	1	1	
*								
Breakers	1	1	1	1	0	0	0	
*								
FPI	0	0	0	0	0		1	1
Pressure Gauge (manometer)	0	0	0	0	0		1	
VPIS	0	0	0	0	0	1	1	

FRTU SIGNAL LIST

Description	Analog Inputs (AI)				
Type	Amp. Loading- R ph	Amp. Loading- Y ph	Amp. Loading- B ph	Phase Voltage	Power Factor
RMU Switch	0	0	0	0	0
*					
Breakers	1	1	1	1	0
*					
FPI	0	0	0	0	0
*					

Description	Status(DI)		
Type	Switch close	Switch Open	Reset Element
RMU Switch	1	1	
Breakers	0	0	
FPI		1	1
Pressure Gauge (manometer)		1	
VPIS	1	1	

Note: 0 indicates functionality not required for that element, 1 indicates functionality required for that element

* Denotes the nos of switches/Breakers in RMU based on the type of RMU (3 W, 4 W)

Additional IOs

RMU switch Control Command
Earth Sw. 1 Status Input

Earth Sw. 2 Status Input
FPI Reset
FRTU Local/Remote Position

FRTU Door Open
FRTU Battery Charger Faulty
FRTU Battery Faulty
FRTU Switchgear Supply Off
FRTU Aux Supply Off
FRTU Fault
Relay operation
CB OFF status
CB ON status
CB ON/OFF Command

ANNEXTURE-2

The reference sample MIMIC used for earthing color identifications.



ANNEXTURE-3

Inspection Test Plan

Sr. No.	Tests stipulated as per Tender Spec.	Applicable standard	Acceptance Clause as per IS / IEC
1	PF withstand voltage test on LBS and CB combined with switches closed position	IEC62271-103 & IEC 62271-200	CI 6.2 of IEC62271-103, CI 7.2.7.2 & 7.2.7.3 of IEC62271-1 CI 6.2.6.1 & 6.2.6.2-IEC 62271-200 Should withstand 28kV for 1minute
2	HV withstand test across isolator distance with opened contact of VCB	IEC 62271-200	Should withstand 28kV for 1minute
3	Voltage Indication Tests on VPIS	-	VPIS indication should lit up when voltage applied
4	Measurement of contact resistance on LBS & CB combined with closed switch condition	IEC 62271-200	CI 6.4 & CI 6.5 of IEC 62271-200
5	Dimensional & Visual Checks	-	As per approved drawing and technical compliance document for tender
6	Operational & Interlock Tests of breaker & isolator switches	As per specification	All interlock shall operate without fail in any one operation
7	Leak Detection Test at bushing terminals after RMU assembly	IEC 62271-1 clause 8.5	For gas-filled systems tested in factory, the probing test using a sniffing device to be done. The sensitivity of the sniffing device shall be at least 10 ⁻⁸ Pa × m ³ /s.
8	HV withstand test of control and auxiliary circuits.		Should withstand 2kV for one minute
9	Insulation resistance test		With open contacts and closed contacts of switches. With be in Giga-ohms.
10	Other components, as per applicability, the RTC as per relevant IS/IEC from Original Equipment manufacturer (OEM) to be shared for cable boot Relay CT motor		OEM reports as per IS and IEC.
11	Relay testing- Relay testing should be done with primary injection kit on installed relay.		Total tripping time with relay & without relay (Without relay shall be done at trip coil directly) timing shall be within specified in specification.