

Technical Specification for
11 kV Ring Main Unit

1. SCOPE OF SUPPLY

- 1.1. This specification covers technical requirement of design, engineering, manufacturing, testing, packing, forwarding, supply and performance of 11KV Ring main unit for efficient and trouble-free operation in the distribution network.
- 1.2. The 11KV Non-extensible RMUs shall be supplied in following variants:
 - 1.2.1. 3 way non-extensible RMU (One circuit breaker and two load break switches)
 - 1.2.2. 3 way Load break switches
 - 1.2.3. 4 way non-extensible RMU (One circuit breaker and three load break switches)
 - 1.2.4. 4 way non-extensible RMU (Two circuit breakers and two load breakswitches)
 - 1.2.5. 5 way non-extensible RMU (Four load break switches and One circuit breaker)
 - 1.2.6. 5 way non-extensible RMU (Three load break switches and Two circuit breakers)
- 1.3. The offered equipments shall be complete with all parts and accessories which are necessary or usual for their efficient and satisfactory operation. 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 required quality of the product.
- 1.4. 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 & workmanship and shall be performed in continuous operation in a manner acceptable to the purchaser. The offered material shall be completed 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 the vendor of their responsibilities. 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.
- 1.5. 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. TECHNICAL SPECIFICATIONS OF THE EQUIPMENTS AND ACCESSORIES

The bidder shall offer 11KV switchgear as per this specification. The detailed technical specifications of major components are as under:

- 2.1. Specification for Numerical Relay : Annexure-1
- 2.2. Specification for Fault Passage Indicators : Annexure-2
- 2.3. Recommended Makes of Materials : Annexure-3

The bidder shall provide all the details of components not mentioned in the above list.

3. APPLICABLE STANDARDS

- 3.1. IS/IEC 62271 : High-Voltage Switchgear and Controlgear
- 3.2. IS/IEC 62271_Part 102 : High-Voltage Switchgear and Controlgear Part 102 Alternating Current Disconnectors And Earthing Switches
- 3.3. IS/IEC 62271_Part 100 : High-Voltage Switchgear and Controlgear Part 100 Alternating Current Circuit Breakers
- 3.4. IS 16227_Part 1 : Instrument Transformers Part 1 General Requirements
- 3.5. IS 16227_Part 2 : Instrument Transformers Part 2 Additional Requirements for Current Transformers
- 3.6. IS 2705_Part 1 : Current transformers: Part 1 General requirements
- 3.7. IS 13072-1991 : Specification of Technical Grade Sulphur Hexafluoride SF6 for Use in Electrical Equipment purposes
- 3.8. IS/IEC 60273 : Characteristic of Indoor and Outdoor Post Insulators for Systems with Nominal Voltages Greater than 1 000 V
- 3.9. IS/IEC 60137 : Insulated bushings for alternating voltages above 1000 Volts
- 3.10. IS/IEC 60947_Part 1 : Low-voltage switchgear and controlgear :Part 1 General rules
- 3.11. In addition to above, the RMU shall also comply with various relevant provisions of Central Electricity Authority Regulations and Indian Electricity Rules 1956.

3.12. 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. SERVICE CONDITION

The 11 KV SF6 gas insulated switchgear & its accessories to be supplied against this specification shall be required to operate satisfactorily and continuously under the following tropical conditions.

- | | | | |
|------|---|---|---------------|
| 4.1. | Maximum Ambient Air Temperature | : | 50° C |
| 4.2. | Minimum ambient air temperature | : | 2 ° C |
| 4.3. | Average daily ambient air temperature | : | 40 ° C |
| 4.4. | Maximum Relative Humidity | : | 80% |
| 4.5. | Maximum wind speed | : | 44 m/sec |
| 4.6. | Average Annual rainfall | : | 750mm |
| 4.7. | Seismic Zone | : | 3 |
| 4.8. | Maximum soil thermal resistivity | : | 150°C cm/watt |
| 4.9. | The overall climatic condition is moderately hot, humid, dusty and saline, conducive to rust and fungus growth. | | |

5. SYSTEM DESCRIPTION

The RMU shall be suitable for outdoor installation on 3-phase, 50 Hz, 11KV distribution network. The RMU shall be connected to 11KV Underground network and are subjected to frequent transient faults due to dense urbanization in Ahmedabad.

- | | | | |
|------|------------------------|---|-------|
| 5.1. | System voltage | : | 11 KV |
| 5.2. | Nominal system voltage | : | 12 KV |
| 5.3. | System frequency | : | 50 Hz |

- 5.4. System earthing : Non-effectively neutral Earthed system.

6. ALLOWABLE POWER SUPPLY VARIATIONS

- 6.1. Voltage : +10% and -10%
- 6.2. Frequency : $\pm 2\%$ (49 Hz to 51 Hz)
- 6.3. Power Factor : Zero (Lag) - Unity - Zero (Lead)

7. DESIGN

- 7.1. The 11 KV SF6 Gas insulated RMU shall be fully arc proof, metal enclosed, free standing, floor mounting, consisting of modules assembled into one unit. RMU shall be made of a cubicle sealed-for life with SF6 and contains all high voltage components sealed off from the environment.
- 7.2. SF6 tank of RMU shall be constructed from robotically welded Non Ferrite, Non Magnetic grade of stainless steel (SS-304) with 2.5 mm (min.) thickness to ensure a very high degree of precision in sealing of SF6 tank.
- 7.3. The SF6 tank of RMU shall have a pressure relief device. In case of an internal arc, high pressure hot gases are allowed to be exhausted out from the bottom/top of the RMU. A controlled direction of flow of the hot gas shall be achieved.
- 7.4. Load breaker switch, Circuit breaker and bus bar assembly shall be contained in a stainless steel tank filled with SF6 Gas. The tank shall be robotically welded to meet the sealed pressure system criterion in accordance with the IEC 62271- 200.
- 7.5. The design of RMU shall be such that there shall not be any requirement of refilling of gas throughout the expected operating life of 30 years. Sealed pressure system are completely assembled, filled and tested in the factory. The maximum leakage rate of SF6 gas shall be lower 0.1% of total initial mass of SF6 gas per annum. The filling pressure for the switchgear shall be just above the atmospheric pressure so as to reduce the tendency to leak. SF6 gas used for the filling of RMU shall be in accordance with IEC 60092-376.
- 7.6. The Ring Main Unit shall be of single bus bar SF6 gas insulated outdoor, tropicalized and metal enclosed type. The RMU shall be installed in hot, humid, saline tropical atmosphere. All equipment accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 7.7. The RMU shall be compact in construction and suitable for outdoor installation with / without any further covers/protection. In case additional covers are used for protection against outdoor use, the Internal Arc Test reports shall indicate that the tests have been carried out with additional cover.

- 7.8. The RMU shall be complete with all connection and copper bus bar with continuous current carrying capacity of 630A. The bus bar shall be fully encapsulated by SF6 gas inside the steel tank. There shall be continuity between the metallic parts of RMU and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The earth bus bar should be preferably enclosed in an enclosure to prevent theft/ tampering. The RMU body shall be earthed with 50 mm x 6 mm GI strips.
- 7.9. The enclosure shall be IP 54 and type tested for weather proof at recognized Test Laboratory.
- 7.10. The RMU shall be tested for Internal Arc as per IEC 622701 - 200 and to have the facility to have a safe evacuation of gases.
- 7.11. The base of the enclosure shall be made with material of adequate thickness and with proper surface treatment suitable for outdoor installation.
- 7.12. Suitable temperature rise test on the RMU with enclosure shall be carried out and test reports shall be submitted along with the offer.
- 7.13. All live parts except for the cable connection shall be insulated with SF6 gas.
- 7.14. The RMU shall be capable of continuous operation of rated output under the operating conditions of voltage and frequency variations as per statutory limits governed by relevant Indian Standard and its amendments in force.
- 7.15. The RMU shall conform to best engineering practice.
- 7.16. The design material construction shall be such that to secure reliability, economy, safe and convenient operation and shall include all specified or unspecified incidental items necessary for similar equipment for convenient working in every respect.
- 7.17. All materials used shall be of the best quality suitable for withstanding variations of temperatures and atmospheric conditions without undue deterioration or setting up of undue stresses anywhere. All mountings should be so designed as to avoid collection of water anywhere. All connections and contacts shall be of ample cross sections and surface for carrying specified currents continuously without undue heating and shall be secured by nut bolts, screws with adequate loading arrangement.
- 7.18. All measurable parameters like including Dimensions, Weight, Electrical Conductivity of Bus bars, Paint thickness etc. shall follow normal distribution curve with average of specified values
- 7.19. The RMU shall be designed to bring all potential free contact of Circuit Breaker, Load Break Switch, Relay, FPI, VPI, Manometer/Density meter and other auxiliary equipment to marshaling box. All necessary wiring for the same shall in scope of manufacturer.

- 7.20. The RMU shall have mechanism counter to record the operations of circuit breaker and load break switch.
- 7.21. 3 Way Non Ext. RMU (One circuit breaker and two load break switches) shall be of side cable entry for load break switch and rear cable entry for circuit breaker.
- 7.22. 3 Way motorized Load break switches shall have front side cable entry for all the three load break switches.
- 7.23. 4 Way and 5 Way Non Ext. RMU shall have front side cable entry for load break switch and circuit breaker.
- 7.24. Cable Box covers of Load break switch and circuit breaker shall have suitable locking and interlocking arrangement to prevent the theft of the covers. If theft proof design is not feasible, cable box covers shall be of FRP material with applicable type testing.

8. INTERLOCKS

- 8.1. The RMU shall be identified by an appropriate sized label which clearly indicates the functional units and their electrical characteristics. The RMU shall be designed to be temper proof so as to prevent access to all live parts during operation without the use of tools.
- 8.2. 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. The earth switch can only be operated when the main load breaker switch/circuit breaker is open. The earth switch shall be fitted with its own operating mechanism and manual closing shall be visible in the closed position through transparent covers. Mechanical interlocking system 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.
- 8.3. In addition to interlocking that prevents access into compartments, the following interlocking shall be provided.
 - 8.3.1. Operation of load break isolator/circuit breaker cannot be performed when the
 - a. Load Break Isolator /Circuit breaker is padlocked.
 - b. Earthing switch is in the closed position.
 - 8.3.2. Operation of an earthing switch cannot be performed when the Load Break Isolator/circuit breaker is in closed position.

8.3.3. Suitable interlocks shall also be provided for cables test terminals on the orifices will be accessible only in circuit “earth” position to prevent operation from “ON” position to “Earth” position or vice versa in a single operation.

8.4. All mechanical interlock of RMU shall be internal part of RMU enclosure so that it cannot be accessed or tampered from outside.

9. **REMOTE OPERATION OF THE RMU**

9.1. Remote operation of the RMUs line switches shall be possible using motors fitted to the operating mechanism for the both line-switches and branch circuit-breaker functions in future. It shall be possible to provide the motors to switches / breaker functions with RMU in service condition.

9.2. The doors of RMU compartments shall be provided in such a way that operation of RMU switches is not blocked with doors full open.

10. **SAFETY**

10.1. Extensive interlocking shall be provided to prevent inadvertent wrong operation.

10.2. Each of the switchgears shall be identified by an appropriately sized label, which clearly indicates the functional units and their electrical characteristics.

10.3. The Switchgear shall be so designed that the position of the different devices is visible to the operator.

10.4. In accordance with the standards in effect, the switchboard shall be designed so as to prevent access to all live parts during operation without the use of tools.

10.5. The SF6 tank of RMU shall have a pressure relief device. In the rare case of an internal arc, the high pressure caused by the arc will release it, and the hot gases are allowed to be exhausted out at the bottom/top of the RMU. A controlled direction of flow of the hot gas shall be achieved.

10.6. All manual/ electrical operations will be carried out from front of RMU.

11. **EARTHING**

11.1. The RMU shall have a common earth bar. The earth bar shall be bolted to the main frame and located so as to provide convenient facilities for earthing cable sheaths and / or for coupling earth bars of adjacent units. The system earthing shall be such that at least one of the neutral points of a three phase system is permanently solidly earthed. It shall not be possible to remove the earth bar during operation.

11.2. All panel and access covers or doors etc. rotating about hinges shall be earthed to the adjacent main frames by copper / hot dip galvanized flexible protective bonding conductors.

- 11.3. The frame of each switch shall be provided with reliable earthing terminal having a clamping screw of not less than 12 mm in diameter.
- 11.4. All the earthing terminals shall be inter-bonded for equal potential and brought to main earthing terminals.
- 11.5. The earthing conductor or strip mainly of copper/ hot dip galvanized steel shall be mechanically protected, anti corrosive and shall be of adequate size.
- 11.6. The supplier shall provide specific nut-bolt arrangement inside the cable compartment box for earthing of cable which is directly connected with the earthing strip of RMU.

12. **LOAD BREAK SWITCHES**

- 12.1. The technical particulars of the load break switches are as under:
 - 12.1.1. Construction per phase : SF6 - Single break
 - 12.1.2. Number of poles : Three
 - 12.1.3. Current capacity : 630A
 - 12.1.4. Short circuit current making capacity : 50 KA(peak)
 - 12.1.5. Breaking capacity normal load current : 630A @ 0.7 PF
 - 12.1.6. Short time rating : 21 KA for 3 Sec
 - 12.1.7. Short circuit breaking current : 20 KA
 - 12.1.8. Impulse withstand voltage to earth between poles : 95 KV Peak
 - 12.1.9. Power frequency withstand voltage to earth and between poles : 38 KV RMS
- 12.2. The Each load break Switch shall be of SF6 gas insulated type with gas both as insulating and interrupting medium.
- 12.3. Each load break Switch shall be of the triple pole, simultaneously operated, with quick break contacts and with integral earthing arrangement.
- 12.4. The mechanism of the Switch shall be quick-break and quick-make type, the speed of operation being independent of operation force with mechanically operated indicator.
- 12.5. Each load break Switch shall be fitted with a direct manually operated mechanism having three positions, "ON", "OFF" and "EARTH" provided with mechanical

indication and pad locking facility. All operating handles shall be located on the front panel of the ring main unit.

- 12.6. Each Load Break Switch shall have Interlocks between Load Break Switch to Earth Switch and Earth Switch to Cable Compartment door.
- 12.7. The operating mechanism shall be maintenance free without the need for any lubrication during its lifetime.
- 12.8. Load break switch shall be suitable to install motor for purpose of remote operation in future. However, manual operation of load break switch shall be possible locally.

13. CIRCUIT BREAKER

13.1. The technical particulars of the circuit breaker are as under:

- 13.1.1. Construction : Contact make & break should be in Vacuum Interrupter Bottle place in Hermitically sealed in SF6 Tank.
- 13.1.2. Current capacity : 630A
- 13.1.3. Rupturing capacity : 21 kA
- 13.1.4. Making capacity : 50 kA
- 13.1.5. Short time rating : 21 kA for 3 Sec
- 13.1.6. Impulse flashover withstand voltage : 95kV peak
- 13.1.7. Power frequency withstand voltage : 38kV (rms)
- 13.1.8. Current transformers : 03 Nos.
- 13.1.9. Class of accuracy for core : 5P10
- 13.1.10. CT ratio : 40-80/1A
- 13.1.11. VA burden : 2.5 VA

13.2. The breaker shall be provided with protection relay with series trip coil and shunt trip coil for protection of distribution transformer. Numerical relay shall be communicable over IEC 103 Modbus RTU protocol/ RS 485 for SCADA interface.

- 13.3. Relay shall have separate trip contacts for O/C and E/F. It shall have facility for Remote Reset through Modbus protocol.
- 13.4. The protection relay shall be of plug-in type.
- 13.5. The total breaking time for transient fault should not exceed 60-80 ms (CB + Relay+ trip coil).
- 13.6. Protection CT shall be preferably bushing mounted.
- 13.7. The circuit breakers Function shall be provided with interlocks between Disconnecter to Breaker, Disconnecter to Earth switch and Earth switch to Cable compartment door.

14. **CABLES AND CONNECTORS**

- 14.1. The cable termination shall be suitable for 3-core / 1-core XLPE cables having conductor sizes up to 300 mm². The cable termination shall be bolted type and the height of cable termination shall be 1070 mm.
- 14.2. The cable entry points of the cable termination chambers shall be provided with suitable water sealing arrangement. All additional holes shall be provide and covered with knockout arrangement to prevent the entry of any living creature.
- 14.3. The bidder shall provide adequate cable terminal protectors for cable termination suitable for 3-core / 1-core XLPE cables having conductor sizes up to 300 mm² along with each unit.
- 14.4. Cable gland base plate of Isolator and Circuit breaker shall be split type, comprise of two plates with one fix plate and the other removable plate. So that, Cable can be removed/Insert horizontally.

15. **OPERATING HANDLES**

- 15.1. An anti-reflex mechanism on the operating lever shall prevent any attempts to re-open immediately after closing of the switch or earthing switch.
- 15.2. All manual operations will be carried out on the front of the switchboard.
- 15.3. The effort exerted on the lever by the operator should not be more than 250 N for the switch and circuit breaker.
- 15.4. The overall dimensions of the RMU shall not be increased due to the use of the operating handle. The operating handle should have two workable positions 180° apart.
- 15.5. Mounting arrangement for operating handle of Ring main unit shall be in RMU compartment.

16. **FRONT PLATE COVER**

- 16.1. The front plate shall include a clear mimic diagram which indicates different functions of operation.

- 16.2. The position indicators shall give a true reflection of the position of the main contacts. They shall be clearly visible to the operator.
- 16.3. The lever operating direction shall be clearly indicated in the mimic diagram.
- 16.4. The manufacturer's plate shall include the switchboard's main electrical characteristics.
- 16.5. The slots & cutout provided on front plate cover for Load Break Switch and Breaker for insertion of operating handle as well as interlock lever mechanism, SF6 gas level indicator etc. shall be ensured for its proper alignment.
- 16.6. Proper Indication labels to be provide for each Function's equipments i.e. Earth Switch, Load break Switch, Breaker and Disconnecter (Off Load Switch).
- 16.7. Operation Instruction & Dos & Don'ts shall be provided in inner-side of the Front door of enclosure of RMU in Gujarati language.
- 16.8. Pocket type arrangement shall be provided for RMU keys

17. DANGER BOARD:

- 17.1. The danger Board plate as per relevant IS shall be riveted on the front plate of the RMU.
- 17.2. Indication marking of "LIVE" with symbol as shown below shall be provided on each cable box cover.



18. FAULT PASSAGE INDICATOR

- 18.1. Each combination of RMU shall have individual fault passage indicators for Load break switch with N-1 configuration (N: No. of Load break switches).

Sr.	Variants	Quantity of FPIs (Nos.)
1	3 way non-extensible RMU (One circuit breaker and two load break switches)	01 No.
2	3 way Load break switches	02 Nos.
3	4 way non-extensible RMU (One circuit breaker and three load break switches)	02 Nos.
4	4 way non-extensible RMU (Two circuit breakers and two load break switches)	01 Nos.

5	5 way non-extensible RMU (Four load break switches and One circuit breaker)	03 Nos.
6	5 way non-extensible RMU (Three load break switches and Two circuit breakers)	02 Nos.

- 18.2. These shall facilitate quick detection of faulty outgoing circuit. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply.
- 18.3. Fault passage indicator shall be plug-in type to enable quick replacement.
- 18.4. The FPIs shall be integral part of Load Break Switch of RMU. FPI shall be capable of displaying the fault. FPI shall have LCD display and manual reset facility. It shall also have potential free contacts for SCADA. FPIs should sense both short circuit fault and earth fault separately.
- 18.5. It shall have separate potential free contact for Short circuit, Earth fault indication and shall have remote reset facility by giving 24V DC pulse.
- 18.6. FPIs should have multiple ampere and time settings both for short circuit and earth fault in addition to multiple auto resetting time ranging from 2 hrs to 8 hrs.
- 18.7. Fault passage indicators shall be of any of the following approved makes:
- 18.7.1. EMG Make (Model : EKL8000NG)
 - 18.7.2. Siemens Make (Model : SICAM)
 - 18.7.3. C&S Make (Model : CSFPI (SC +EFPI))

19. TESTING OF CONNECTED CABLES

- 19.1. It shall be possible to carry out HV DC test on the connected cable at site, keeping only the corresponding Isolator / Circuit Breaker OFF but keeping bus bars /other circuits alive at the rated voltage.
- 19.2. The bushings in the cable boxes shall be easily accessible so that the aforementioned HV DC test can be carried on each phase separately without any hindrance.
- 19.3. RMU shall have test bushing facility for cable testing without opening cable box cover.

20. ENCLOSURES

- 20.1. Inner enclosure (SF6 gas tank)
- 20.1.1. The tank shall be robotically welded stainless steel sheet of minimum 3mm thickness. Any deviation shall be furnished with detailed technical justification and relevant type tests.

- 20.1.2. SS Tank shall be compatible for exposing in chemical polluted environment. If any additional external paint is to be applied on outer exposed surface then same shall be treated accordingly to ensure the compatibility with Chemical polluted environment.
- 20.1.3. The degree of protection of the inner enclosure shall be IP 67.
- 20.2. The tank shall be sealed and no handling of SF6 gas is required throughout its service life.
 - 20.2.1. SF6 gas
 - a. SF6 gas conforming to IEC 60376 should be used for the dielectric medium. The filling shall be sufficient for lifetime.
 - b. The SF6 shall be tested for purity, dew point, air hydrolysable fluorides and water content as per relevant IEC standards and test certificate shall be furnished along with the delivery of the equipments.
 - c. The switchgear shall be tested according to IEC recommendations. The recommended working pressure and the lowest possible pressure where the switchgear can be operated shall be stated.
 - d. The SF6 gas pressure inside the tank shall be constantly monitored by a temperature compensating gas pressure indicator offering a simple go, no-go indication. The gas pressure indicator shall be provided with green pressure and red pressure zones. There shall be one non-return valve to fill up the gas.
 - e. The manufacturer shall give guarantee for maximum leakage rate of SF6 gas will be lower than 0.1 % per year.
 - f. An absorption material such as activated alumina in the tank shall be provided to absorb the moisture from the SF6 gas to regenerate the SF6 gas following arc interruption.
 - g. Manometer/ Density meter shall be provide for monitoring the Gas pressure. Same shall be visible on front cover plate.
 - h. Manometer/ Density meter shall have the scale for pressure with green and red zone inbuilt Indication. The same shall be provided with potential free contact for SCADA integration.
 - i. In case of magnetic coupling type of SF6 gas level indicator, resetting of mechanical flag for gas level indicator shall be possible without opening the front cover plate.

- j. The supplier shall provide NRV (Non-Return Valve) on SF6 tank gas to fill the gas in case of low gas pressure found inside the SF6 tank which shall be accessible only after opening front plate cover.

20.3. Outer Enclosure

20.3.1. The RMU enclosure (Outer) shall be made up of CRCA of 3 mm thickness or galvanized of 1.6 mm thickness. The complete RMU enclosure shall be of degree of protection IP 54 (Main Door Close) and IP 41 (Main Door open).

20.3.2. The enclosure shall provide full insulation, making the switchgear insensitive to the environment like temporary flooding, high humidity etc. The active parts of the switchgear shall be maintenance-free and the unit shall be minimum-maintenance. The complete RMU unit shall be powder coated with Aztec Grey color. Each switchboard shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics.

20.4. Followings are the preferred makes of the paint:

20.4.1. Akzo Nobel (Product code : JP4G524N)

20.4.2. Asian paints (Material code : 2343RG45320, Shade code : PY940S)

20.4.3. Jotun (Product code : 1217808)

20.4.4. Berger

20.4.5. Nerolac

21. **VOLTAGE PRESENCE INDICATORS**

It shall be possible for each of the function of the RMU to be equipped with a permanent voltage indication as per relevant IEC to indicate whether or not there is voltage in the cables.

21.1. The VPIS shall be compatible for both 6.6 KV and 11 KV systems.

21.2. The VPIS shall be SCADA compatible, contacts of SCADA shall be integral part of VPIS

21.3. The VPIS shall be plug-in type.

22. **PADLOCKING ARRANGEMENT**

Provision shall be made for padlocking the load break isolator / Circuit Breaker and the Earthing switches in either open or closed position. Also padlocking arrangement shall be provided for the RMU panel.

23. **TERMINAL CONNECTORS**

- 23.1. Terminal connectors to be used for auxiliary and control wiring connections shall be of push in type.
- 23.2. The test terminal connectors shall be of high grade non-hygroscopic, low tracking property fire resistant, made of high grade engineering plastic have terminal holes and shall be of sufficient size to accommodate suitable size of solid copper conductor.
- 23.3. Terminal connectors shall be of following approved makes:
 - 23.3.1. Elemex
 - 23.3.2. Phoenix
 - 23.3.3. Wago
 - 23.3.4. Connectwell

24. AUXILARY AND CONTROL WIRING

- 24.1. The wiring shall be of high standard and shall be able to withstand the tropical weather conditions. The wiring cable must be standard single-core non-sheathed, Core marking (ferrules), stripped with non-notching tools and fitted with end sleeves, marked in accordance with the circuit diagram with printed adhesive marking strips.
- 24.2. The wiring shall be carried out using multi-strand copper conductor super flexible PVC insulated wires of 1100V Grade for AC Power, DC Control and CT circuits. Terminal should be suitably protected to eliminate sulphating. Connections and terminal should be able to withstand vibrations.
- 24.3. The position of PVC carrying trough and wires should not give any hindrance for fixing or removing relay casing, switches etc., Wire termination shall be made with solder less crimping type of tinned copper lugs. Core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted with both ends of each wire. Ferrules shall fit tightly on the wire when disconnected.
- 24.4. The wire number shown on the wiring shall be in accordance with the IS 375.
- 24.5. All auxiliary and control cables shall be of Flame retardant low smoke type confirming to IS 1554-1999.
- 24.6. All wires for identification of auxiliary and control wiring shall be as per following color codes

Sr.	Type of Wiring	Size of Wire	Color code
1	AC Circuit	1.5 Sq mm, 1.1KV, FRLS, PVC insulated cable	Black

2	DC circuit	1.5 sq mm, 1.1KV, FRLS, PVC insulated cable	Grey
3	Potential Free contacts	1 sq mm, 1.1KV, FRLS, PVC insulated cable	White

- 24.7. Wiring of Trip circuit shall identical and shall be provided with Red Sleeves at each ends.
- 24.8. The design of inter panel wiring/cablings between main RMU (3-Way) & extensible unit (1-Way) shall be done in such a way that it will not be disturbed during installation, commissioning, maintenance or replacement activity of Switchgear.

25. SPARES AND INSTALLATION TOOLS

- 25.1. The bidder shall furnish in his offer a list of recommended spares with unit rates for each set of equipments that may be necessary for satisfactory operation and maintenance of RMU for a period of 4 years.
- 25.2. The bidder shall submit a list and unit rates of all the special tools, equipment and instruments required for erection, testing, commissioning and maintenance of the equipment.
- 25.3. In each cable box, phase identification indicators for respective phase with color coding shall be provided.
- 25.4. The cable termination chart shall be provided in each cable box cover.
- 25.5. The cable clamps for each cable box shall be of HDPE suitable for 70 sq. mm to 300 sq. mm 11 KV 3 core XLPE insulated (UE) cable.
- 25.6. The supplier shall provide cable termination accessories like termination bolts and cable boots for RMU.
- 25.7. Each unit shall be supplied with copy of Operation & Maintenance Manual along with Schematic Diagram for Switchgears as well as relay with suitable provision for their housing inside the switchgear.
- 25.8. Each unit shall be supplied with the operating handle with suitable provision for their housing inside the switchgear.
- 25.9. The unit shall be supplied with channel based skid arrangement. The detailed drawing of hole centre of skid base arrangement shall be provided separately by the supplier.
- 25.10. The skid base arrangement of RMU shall be suitable for trench dimensions (610 mm) of substations.

26. FASTENERS

- 26.1. All bolts, studs, screw threads, pipe threads, bolt heads and nut bolts shall comply within the appropriate Indian standards for metric threads.

- 26.2. Bolts or studs shall not be less than 6mm in diameter except when used for small wiring terminals.
- 26.3. All nuts and pins shall be adequately locked. Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.
- 26.4. All ferrous bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion, by hot dip galvanizing, except high tensile steel bolts and spring washers which shall have electrolytic action between dissimilar metals.
- 26.5. Each bolt shall project at least one thread but more than three threads through the nut. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.
- 26.6. The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.
- 26.7. Taper washers shall be provided where necessary.
- 26.8. Protective washers of suitable material shall be provided on front and back of the securing screws.

27. SURFACE PREPARATION AND PAINTING

- 27.1. All surfaces of fabrication part shall undergo 7-tank chemical treatment process where the surface shall be degreased, de-rusting, pickled, phosphatized and passivated. The process of 7-tank treatment shall be as stated below.

- 27.1.1. Degreasing

- This is achieved by immersing the sheet metal in alkaline base solution degreasing bath. The dipping time is 10-15 minutes at room temperature. The pH value of the alkaline base solution shall be 10-10.5. It removes dirt, grease, oil, like deposits of the dipped parts.

- 27.1.2. Water Rinse

- Rinse the sheet metal in cold water. The water shall be clean, fresh and continuous overflowing. It removes all loose impurities from the surface.

- 27.1.3. De-rusting / Pickling

- This is achieved by immersing the item in diluted phosphoric base acid. It removes rust from the surface of the sheet metal. The dipping time is 15 to 25 minutes at room temperature. The pH value of phosphoric base acid shall be 2-3.

- 27.1.4. Water Rinse

Rinse the sheet metal in cold water. The water shall be clean, fresh and continuous overflowing. This enables to wash out all rust and acid from the surface of the sheet metal.

27.1.5. Phosphatizing

The sheet metal is immersed in zinc base Phosphatizing solution for about 20 minutes. The pH value of Phosphatizing solution shall be 2-4. The process shall be carried out at room temperature. The zinc base Phosphatizing solution forms shiny, smooth and crystalline zinc coating on the sheet. This accelerates the Phosphatizing process.

27.1.6. Water Rinse

Rinse the sheet metal in cold water. The water shall be clean, fresh and continuous overflowing. It removes excessive contamination of phosphatized parts.

27.1.7. Passivation

The phosphate coated surface is then sealed with diluted chromic acid base solution. The pH value of chromic acid base solution shall be 3-3.5. The dipping time is 5 to 10 seconds at room temperature.

27.2. The sheet metal is then dried using compressed air.

27.3. Alternatively, the cubicle shall be treated with shot blasting and thermal zinc (99.9% purity) spray followed by oven backed epoxy power coating followed over coating with polyurethane liquid paint.

27.4. After the paint pre-treatment, both the sides shall be painted by oven backed pure polyester powder coating followed over coating with polyurethane liquid paint. The paint shall be of Aztech grey color with structured finish.

27.5. Followings are the preferred make for Aztech Grey color:

27.5.1. Akzo-Nobel (Product code: JP4G524N)

27.5.2. Asian paints (Shade code: PY940S)

27.5.3. Jotun (Product code: 1217808)

27.5.4. Berger

27.5.5. Nerolac

27.6. Enclosure of RMU shall be dual coated and average thickness of paint coating film shall be 120 Microns.

28. CENTRE OF GRAVITY

The center of gravity of the assembled RMU shall be low and as near the vertical center line as possible. The RMU shall be stable. The location of center of gravity shall be shown

on the outlines drawing in all other views.

29. MATERIALS

- 29.1. All the materials used in manufacturing of RMU shall be of highest quality of their respective kind, obtainable in the market and shall confirm to relevant IEC and Indian Standards.
- 29.2. All iron parts having hot dip galvanized shall have minimum thickness of zinc not less than 610 grams per square meter and shall confirm to IS: 2633.
- 29.3. All the steel bolt and nuts exposed to atmosphere with suitable finishing like cadmium or zinc plate shall be used for diameter above 6 mm. All nuts, bolts and washer in contact with non-ferrous parts which may carry current shall be of phosphors bronze where transfer of current is through bolts.

30. TESTING FACILITIES

The bidder shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant IS/IEC.

31. QUALITY ASSURANCE

- 31.1. The manufacturer shall have a well-organized Quality Assurance Plan (QAP) based on ISO 9000 Series to assure that items and services comply with this specification.
- 31.2. 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 purchaser.
- 31.3. 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.
- 31.4. The Bidder shall invariably furnish following information along with his bid.
 - 31.4.1. 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.

- 31.4.2. List of tests normally carried out on raw materials in the presence of bidder's representative, copies of test certificates.
- 31.4.3. Information and copies of test certificates in respect of bought out accessories.
- 31.4.4. List of manufacturing facilities available.
- 31.4.5. Level of automation achieved and list of areas where manual processing exists.
- 31.4.6. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- 31.4.7. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. The manufacturer shall possess 0.1 class instruments for measurement of losses.

32. TYPE TESTS

- 32.1. All the tests as stipulated in relevant IEC and Indian Standards shall be carried out in order to determine whether the material and apparatus comply with the specification.
- 32.2. Type Tests
 - 32.2.1. The equipment offered in the tender should have been successfully type tested at NABL laboratories in India or equivalent international laboratories in line with the relevant standard and technical specification, within the last 3 (three) years from the date of offer. The bidder shall be required to submit complete set of the type test reports along with the offer.
 - 32.2.2. In case these type tests are conducted earlier than three years, all the type tests as per the relevant standard shall be carried out by the successful bidder at NABL in presence of purchaser's representative free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection.
- 32.3. The list of type tests is as follows:
 - 32.3.1. Short time current withstand test
 - 32.3.2. Peak current withstand test.
 - 32.3.3. Lightning ~Impulse voltage with-stand test
 - 32.3.4. Temperature rise test.

- 32.3.5. Short Circuit current making and breaking tests.
- 32.3.6. Power frequency voltage withstand test (dry).
- 32.3.7. Capacitive current switching test confirming to IEC.
- 32.3.8. Mechanical operation test.
- 32.3.9. Measurement of the resistance of the main circuit.
- 32.3.10. Degree of protection of main tank and outer enclosure
- 32.3.11. Making capacity for Switch, circuit breaker and earthing switch
- 32.3.12. Breaking capacity for Switch, circuit breaker.
- 32.3.13. Internal arc withstand test
- 32.3.14. Checking of partial discharge on complete unit

33. ROUTINE TESTS

- 33.1. All routine & acceptance tests shall be conducted on the RMU and all accessories in accordance with the latest versions of relevant Indian and international standards. Purchaser may also carry out additional tests as appropriate to ensure that the product is as per specification and suitable for intended purpose.
- 33.2. All the tests will be witnessed by purchaser or his authorized representative. Inspection of all bought out items shall be performed jointly with bidder and purchaser at OEM's work.
- 33.3. Following are the non exhaustive tests that shall be necessarily conducted on the complete assembled Ring Main Unit in addition to others specified in relevant IS/IEC during various stages of Inspection.
 - 33.3.1. Physical Inspection of RMU which shall contains
 - a. Verification of Bill of Materials, accessories & layout.
 - b. Dimensional check as per drawings.
 - c. Paint thickness Measurement.
 - d. Functional checks.
 - e. Fixing of Gasket
 - f. Paint shade Verification.
 - g. Dimensions and clearances
 - h. Door Alignment & operations
 - i. Earthing Verification
 - j. Verification of electrical wiring & Relay logic

- k. Verification of loose material as per order

33.3.2. Routine Inspection & Test

- a. Switch operation Test (Mechanical/Electrical)
 - i. Minimum 10 Operation of Earth switch
 - ii. Minimum 10 Operation of Load Break Switch
 - iii. Minimum 10 Operation of Disconnecter
 - iv. Minimum 10 Operation of Circuit Breaker
- b. Verification of Interlocks
 - i. Interlocks between earth switch & Load break Switch
 - ii. Interlocks between earth switch & Cable compartment door
 - iii. Interlocks between earth switch & Disconnecter
 - iv. Interlocks between Disconnecter & Circuit breaker.
 - v. Any other if provided.
- c. Test on auxiliary & control Circuit
 - i. Inspection of auxiliary & control circuit
 - ii. Functional tests of auxiliary equipment.
- d. Protection test by primary injection
 - i. Trip Test of Breaker Mechanism through Relay (Over Current, Erath fault and any other if provided)
 - ii. Operation of Fault passage Indicator (Short circuit & Earth fault)
 - iii. Operation of Voltage presence Indicator
- e. Measurement of Insulation resistance between phase to phase and phase to earth.
- f. Die-electric test (HV Test) between phase to phase and phase to earth.

34. **PROTOTYPE ACCEPTANCE TESTS**

Prototype Approval Test shall be conducted on Ring Main Unit for its design and compliance to this specification. The bidder shall provide estimated time required for manufacturing of prototype along with the offer. Mass production of Ring Main Units will be followed by approval of the prototype.

35. **PRE-DISPATCH INSPECTION**

- 35.1. All acceptance tests and inspection of Ring Main Unit shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the supplier and purchaser as agreed.
- 35.2. The supplier shall give ten days advance intimation to purchaser to organize pre dispatch inspection of Ring Main Unit.
- 35.3. The material shall not be shipped before the inspection has been carried out according to the approved quality assurance plan unless otherwise instructed by purchaser.
- 35.4. 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 Ring Main Unit or any part of the Ring Main Unit is found to be defective.
- 35.5. If Company intends to have inspection by competent/authorized body at manufacturer's premises during the manufacturing and testing process, the selection of the party will be at sole desecration of the company and manufacture will have to trust & provide all the facilities.
- 35.6. The manufacturer shall offer the inspector representing purchaser all the reasonable facilities free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification.
- 35.7. The Ring Main Unit shall be subject to inspection by a duly authorized representative of purchaser. Inspection may be made at any stage of manufacture at the option of purchaser and the equipment if found unsatisfactory as to workmanship or material is liable to rejection.
- 35.8. During the witnessing of testing of Ring Main Unit and its accessories at supplier's works, purchaser will also connect company's meters and supplier has to agree for the same.
- 35.9. The supplier shall grant free access to the places of manufacture to purchaser's representatives at all times when the work is in progress.
- 35.10. Inspection by purchaser or its authorized representatives shall not relieve the supplier of this obligation of furnishing equipments in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by purchaser.
- 35.11. The representative/Engineer attending the above testing will carry out testing on equipments and issue test certificate approval to the manufacturer and give clearance for dispatch.
- 35.12. Following documents shall be sent along with the Ring Main Unit.
 - 35.12.1. Test reports

- 35.12.2. Material Dispatch Clearance Certificate
- 35.12.3. Invoice in duplicate
- 35.12.4. Packing list
- 35.12.5. Drawings & catalogue
- 35.12.6. Guarantee / Warrantee card
- 35.12.7. Delivery Challan
- 35.12.8. Other Documents (as applicable)

36. PO MILESTONE

- 36.1. The supplier to provide the Purchase order execution plan within 7 days from the placement of PO covering followings:
 - 36.1.1. PO Details (No. and Date)
 - 36.1.2. Details of Supplier (Name, Vendor Code)
 - 36.1.3. Material details (code and description)
 - 36.1.4. PO Qty and lot wise bifurcation
 - 36.1.5. Documents submission and approval mechanisms
 - 36.1.6. SPOC for PO execution
 - 36.1.7. Escalation Mechanism
 - 36.1.8. Schedule of inspection at customer hold points and Pre-dispatch inspection
- 36.2. The supplier to provide post PO documentation (i.e., drawings / GTP) for approval within 10 days from the placement of the PO.
- 36.3. Purchaser shall review Documents and provide the comments else approval within 5 working days.
- 36.4. The supplier shall provide updated documents within 7 days from the receipt of comments from purchaser.
- 36.5. Purchaser shall review the final set of documents and provide approval within 5 working days after receipt of revised documents.
- 36.6. The supplier shall offer the inspection at least 7 days in advance for customer hold points as per approved QAP.
- 36.7. In case any Non-conformance observed during inspection, the supplier the re-offer the inspection within 7 days from inspection.
- 36.8. The supplier shall intimate respective store in-charge for the delivery in 7 days advance after receipt of MDCC.

- 36.9. 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

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

37. GUARANTEE

- 37.1. 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.
- 37.2. In the event any defect observed by purchaser within the period of 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract whichever is later.
- 37.3. 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 purchaser will be at liberty to get it replaced / rectified at bidder's risk and costs. The purchaser will recover all such expenses plus purchaser's own charges from the bidder's performance bank guarantee, as the case may be.
- 37.4. 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 purchaser.

38. PACKING & FORWARDING

- 38.1. The Ring Main Unit shall be dispatched with due care and in a packing as per manufacturer's standard practice. The supplier shall ensure that any of the equipment and part of the RMU shall not get damaged during transportation.
- 38.2. The Manufacturer shall be responsible for the shipping of RMU & its all accessories from their works to the destinations specified by purchaser.
- 38.3. The manufacturer shall be responsible for the transportation and shall take all reasonable steps for selecting routes and use appropriate vehicles for transporting so that the risk of damage to the equipments shall be eliminated.

- 38.4. The supplier shall provide Barcode (code-128 type) of 8 digit material code (to be provided by purchaser) on each Ring Main Unit.

39. SPARES, ACCESSORIES & SPECIAL TOOLS/GAUGES

- 39.1. The bidder shall provide a list of recommended spares with quantity and unit price for 5 year of operation after commissioning.
- 39.2. The 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 year minimum. However supplier shall give a minimum of 12 month notice in the event that the bidder or any sub vendor plans to discontinue manufacturing of any component used in RMU.
- 39.3. Any spare apparatuses, parts or tools shall be subjected to the same specification, tests, and conditions as similar material supplied under the contract. Parts shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the RMU and must be suitably marked and numbered for identifications.

40. TENDER AND CONTRACT DOCUMENTATION

- 40.1. The bidder shall furnish following along with the offer.
- 40.1.1. Drawings of all the equipments, relays, control wiring circuit, etc.
 - 40.1.2. Operation and Instruction manuals
 - 40.1.3. Catalogues of spares recommended with drawing to indicate each items of spares
 - 40.1.4. List of spares and special tools recommended by the supplier.
 - 40.1.5. Copies of Type Test Certificates as per latest IS/IEC.
 - 40.1.6. Complete filled in Guaranteed technical Particulars
 - 40.1.7. General description of the equipment and all components including brochures
 - 40.1.8. General arrangement for Ring Main Unit
 - 40.1.9. Power flow diagram
 - 40.1.10. Foundation plan
 - 40.1.11. Bill of material
- 40.2. The supplier shall submit following documents after placement of PO/LOI:
- 40.2.1. General arrangement drawing s of Ring Main Unit
 - 40.2.2. Foundation drawing
 - 40.2.3. Lifting arrangement

- 40.2.4. Name plate and rating plate drawing
 - 40.2.5. Individual drawing of Utility enclosure and its inside arrangement showing principal dimensions of major components and interconnection
 - 40.2.6. Single line diagram/Configuration drawing of the whole system
 - 40.2.7. Bill of material along with make and model/Product code
 - 40.2.8. Logic diagram
 - 40.2.9. Block diagram showing the proposed interconnection of all equipment.
- 40.3. Software & Protocols
- 40.3.1. The supplier shall submit all the software, protocols & accessories required to commission the system in Hard copy and one (3) No. of softcopy after commissioning. All these shall be in original and with licensed copy.
 - 40.3.2. Supplier has to provide license copy of updated version of the any software supplied for this package to the purchaser without any commercial implication

41. INFORMATION TO BE SUBMITTED BY THE BIDDER

The following shall be furnished with the offer

- 41.1. Brief background of the OEM
- 41.2. Manufacturing & Infrastructure facilities available
- 41.3. Technical Know-how and collaboration, if any
- 41.4. Catalogues describing the equipment and indicating the type and model number
- 41.5. Constructional features, materials used and relevant technical literature
- 41.6. Complete dimensional drawings
- 41.7. Complete filled in Guaranteed technical Particulars
- 41.8. General description of the equipment and all components including brochures
- 41.9. General arrangement for Ring Main Unit
- 41.10. Power flow diagram
- 41.11. Foundation plan for each variant of RMU
- 41.12. Bill of materials for each variant of RMU
- 41.13. Manufacturing Experience
- 41.14. The details of the information indicated on the Name Plate
- 41.15. Type Test Certificates from a recognized independent testing authority

41.16. Quality systems and Quality Assurance Plan

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

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

42. SUBMISSION OF DRAWINGS:

Schedule of submission of drawings for approval shall be as under

42.1. First submission within 10 days of PO/LOI

42.2. Purchaser's comments in 10 days from the receipt of drawings

42.3. Supplier to furnish final drawings within next 5 days of commented drawings

42.4. Purchaser to send back stamped approved copy within 10 days after receipt of correct drawing.

42.5. As built drawing to be submitted within 7 days of final inspection

43. NAMEPLATE AND MARKING

43.1. The RMU shall have a rating plate / name plate clearly visible and effectively secured against removal, indelibly and distinctly marked with all essential particulars as per relevant standards.

43.2. The aesthetics and layout of the rating plate shall be approved by the purchaser. The bidder shall submit AutoCAD/Corel Draw file of artwork of proposed rating plate immediately after placement of the order. The same will be standardized for all future supplies.

43.3. The supplier shall provide specific arrangement on RMU front plate to write/mention Load break switch and circuit breaker circuit names for feeder identification.

43.4. The supplier shall provide specific sticker on front plate with details of selected CT ratio. There shall also have the provision to mention the future changes of CT ratio on front plate of RMU.

43.5. The supplier shall provide sticker for specific instructions mentioning "Not to press the keys which may clear the fault data memory of relay".

43.6. The marking on every RMU shall include at-least the following.

43.6.1. Manufacturer's name and place of manufacturer

43.6.2. Model

43.6.3. Number of phases and wires

43.6.4. Alphanumeric serial number

- 43.6.5. Reference voltage & frequency
 - 43.6.6. Symmetrical breaking capacity
 - 43.6.7. Making capacity
 - 43.6.8. Short time current and its duration
 - 43.6.9. Purchase Order number and date
 - 43.6.10. Rated lightning impulse withstand voltage
 - 43.6.11. Month and Year of supply
 - 43.6.12. Logo of purchaser
 - 43.6.13. A text "Property of (Purchaser's name)"
 - 43.6.14. Serial number: 12 Digit Alphanumeric unique serial numbers will be provided by purchaser within a week of release of Purchase Order.
- 43.7. The bidder shall furnish detailed layout / drawings of the rating plate along with the offer.

44. DEVIATIONS:

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

11KV SWITCHGEARS

GUARANTEED TECHNICAL PARTICULARS

Descriptions	As Specified By Purchaser	To be furnished by Bidder
1. RMU Variant	3 Way / 4 Way/ 5 Way	
2. RMU Application	Indoor/Outdoor	
3. Dielectric Medium	SF6	
4. Interrupting Medium	SF6 / Vacuum	
5. System Frequency	50 Hz	
6. Rated voltage	12kV	
7. Service Voltage	11kV	
8. Rated Current-Line Switches	630A	
9. Rated Current –CB	630A	
10. Rated Short time Current Withstand (3 Sec)	21 kA	
11. Rated short circuit breaking current	20 kA	
12. Rated Short time Making Capacity	50 kA	
13. Rated Load Interrupting Line Current	630A	
14. No. Of Operations at rated Short Circuit Current on line Switches Earthing Switches and CB	5 close	
15. Mechanical endurance for Isolator & earth switch	Min 1000 Operations	
16. Electrical Operations of Isolator & Earth Switch at rated current	To be Provided By Bidder	
17. Max. Permissible Temperature	Maximum permissible temperature for bus bar shall be 90deg C at an ambient not exceeding 40 deg. C	
18. Supply of SF6 gas pressure indicator and phase comparator	1 per RMU	
19. Guaranteed SF6 leakage per annum	Less than 0.1 %	

Descriptions	As Specified By Purchaser	To be furnished by Bidder
20. Degree Of Protection for RMU		
When front door Open	IP41	
When front door Closed	IP54	
21. Internal arc test	21kA 1 Sec	
22. Lightning Impulse withstand Voltage	95kVp	
23. Power frequency withstand Voltage	38 KV rms	
24. Temp Rise above Ambient	50 Deg. C.	
25. Dimension of RMU (L x W x H) (mm x mm x mm)	To be provided by bidder	
26. Total weight	To be provided by Bidder	
27. Colour	To be provided by bidder	
28. Thickness of paint	120 microns	
29. Cable Termination for RMU		
Size of cable	Suitable for 3C x 70 Sq. mm to 300 sq. mm 11 KV cable	
Height of cable box above ground level	1070 mm	
Suitability for termination	Heat/cold shrinkable	
Flexible right angle boots with opening provision for testing of cables	3 Nos. per cable box suitable for indoor termination of 70 sq. mm to 300 sq. mm 3C 11 KV cable.	
30. Hermitically 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.	To be provided by bidder	
31. The pressure limiting device shall be installed in such a way that the gas shall be released from the rear side of the switchboard and shall be in upward direction.	To be provided by bidder	

Descriptions	As Specified By Purchaser	To be furnished by Bidder
32. Earth Bus Bar (Material and size)	To be provided by bidder	
33. Earthing of main CCT cables shall be earthed with earth switch with S/C making capacity as per IEC 129. Moving contacts of earthing switch shall be visible in closed position thru transparent covers AND closing shall be possible only when Isolator is open.	To be provided by Bidder	
34. Incomer load break switch shall be SF6 type with least maintenance and 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	
35. Circuit Breaker Preferably SF6 type 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.	To be provided by bidder	
36. Protection relay	Self-powered O/C+E/F IDMT characteristics with 0.05 Sec TMS.	
	Communicable over IEC 103 Modbus RTU protocol / RS 485 for SCADA interface	
37. Make of Relay	As per purchaser's Approval	
38. Flag indication on CB for trip on fault	To be Provided By bidder	
39. Testing of cable-without opening the doors. If doors are opened then earth switch shall be in closed position and cable test rod shall be provided which can be fixed on terminations for testing purpose AND if doors are opened it shall not be possible to operate ,Isolator, E/switch or CB	To be Provided By bidder	

Descriptions	As Specified By Purchaser	To be furnished by Bidder
40. Doors and cable covers	Design of RMU shall be tamper & arc proof and vandal screws shall be provided. Cable covers shall be pad lockable. All live parts/test bushing etc. shall be covered with antitheft covers. Hinged doors shall be provided with riveted hinges only such that they are not visible from outside and hence not removable	
41. Voltage indicator box shall be fixed type- This device shall be in compliance with IEC 61958 standard.	Capacitive dividers type which will supply low voltage to power the lamps and 3 inlets can be used to check phase sequence.	
42. Cable Clamps	HDPE	
43. Fault passage indicator (O/C & E/F)	One Per RMU with as a part of RMU	
44. Operating handle	To be provided by bidder as part of RMU	
45. MIMIC Diagram on Front of Panel	To be provided by Bidder	
46. Total breaking time	To be provided by bidder	
VCB Breaker opening time	To be provided by bidder	
Arcing time	To be provided by bidder	
47. Current Transformer	Shall be epoxy resin and are mounted around the cable outside SF6 gas compartment. The CTs around the cables shall be supported on the sheet steel bracket base sized for CTs. CTs shall not be kept hanging or put on base frame directly.	
47.1. Type of CT	Resin cast (Outdoor)	
47.2. Ratio	40-80/1 A	

Descriptions	As Specified By Purchaser	To be furnished by Bidder
47.3. Burden	2.5 VA	
47.4. Accuracy Class	5P10	
47.5. STC	21 KA for 3 Sec.	
47.6. BIL	3 KV rms	
48. SCADA Compatibility-Remote operation of RMU shall be possible by using motors fitted to operating mechanism of isolators & CB etc.	As per specification	
49. Availability of Spares	Assurance by bidder for 25 Years	

ANNEXURE-1

TECHNICAL SPECIFICATION FOR NUMERICAL RELAYS

1. SCOPE

- 1.1. This specification covers the design, engineering, manufacturing, assembly, inspection & supply of Self-Powered, non draw-out type, over current and Earth Fault Numerical Relay for protection of Distribution Transformer, to be installed in RMU, conforming to IS/IEC standards.
- 1.2. The scope of supply comprise of following:
 - 1.2.1. Numerical Relay as per this specification
 - 1.2.2. Computer Software for data downloading and analysis.
 - 1.2.3. Operational manuals of Relay and softwares
 - 1.2.4. Continued technical support
- 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 & workmanship and shall be performed in continuous operation in a manner acceptable to purchaser. The offered material shall be completed 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 the vendor of their responsibilities. 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. 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. SYSTEM DESCRIPTION

Numerical Protection Relay shall be installed with the breaker of RMU for protection of Distribution Transformer that is subjected to frequent faults on LV network connected to it due to dense urbanization. The system is effectively earthed as star point of the LV side of the transformer is solidly earthed.

3. SERVICE CONDITION

- 3.1. Relay to be supplied against this specification shall be required to operate satisfactorily and continuously under the following tropical conditions.

- 3.1.1. Maximum Ambient Temperature : 50 Degree Centigrade
- 3.1.2. Max Daily Average Ambient Temperature : 40 Degree Centigrade
- 3.1.3. Minimum Ambient Temperature : 10 Degree Centigrade
- 3.1.4. Maximum humidity : 95%
- 3.1.5. Average annual rainfall : 1000 mm
- 3.1.6. Average no. of rainy days per annum : 50 Days per Annum
- 3.1.7. Altitude above MSL not exceeding : 1000 Meters
- 3.1.8. Wind pressure : 150 Kg / Sqmm

3.2. The overall climatic condition is moderately hot, dusty, saline and humid, conducive to rust and fungus growth.

3.3. The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

4. ALLOWABLE POWER SUPPLY VARIATIONS

- 4.1. Voltage : -6% to +6% Vref
- 4.2. Frequency : $\pm 2\%$ (49 Hz to 51 Hz)
- 4.3. Power Factor : Zero (Lag) – Unity – Zero (Lead)

5. APPLICABLE STANDARDS

The relay shall conform (for design, construction, performance and testing thereof) in all respects to following IS and IEC Standards with their latest amendments.

- 5.1. IS/IEC 60255 Measuring Relays and Protection Equipment
- 5.2. IS/IEC 61850 Communication Networks and Systems for Power Utility Automation
- 5.3. IEC 61000-4-1 High frequency disturbance test
- 5.5. IEC 61000-4-4 Fast transient disturbance test
- 5.6. IEC 61000-4-2 Electrostatic discharge

- 5.7. IEC 61000-4-3 Impulse test
- 5.8. ANSI C37.90.2 Radio frequency interference
- 5.9. Unless otherwise specified elsewhere in this specification Relay shall conform to the latest version available of the standard as specified above.
- 5.10. 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.

6. BASIC ELECTRICAL PARAMETERS

- 6.1. Input CT current : 1 Amps
- 6.2. Number of CT inputs : 4 Nos.
- 6.3. Protection Requirement in single unit : O/C & E/F (Inst. + IDMTL)
- 6.4. Fault recording & fault History : Minimum Latest 10 faults
- 6.5. Communication interface Protocol : IEC 61850/ RS485
- 6.6. Special feature : Self-monitoring with live status indication
- 6.7. Minimum Numbers of binary input : 11 Nos.
- 6.8. Minimum Numbers of binary output : 06 Nos.
- 6.9. Minimum number of LEDs : 07 Nos.

7. GENERAL FUNCTIONAL REQUIREMENTS

- 7.1. Protection Functions
 - 7.1.1. Relay characteristics of IDMT elements shall be as per IEC. The inverse characteristic shall include normal inverse, very inverse, extremely inverse, and long inverse and shall be software selectable. Inverse elements shall have two or more stages for selection of required inverse characteristic to achieve close protection as required.

7.1.2. Over current protection

- a. Relay shall have phase wise element to provide over current protection, each element shall have independent settings for pickup current, time-multiplier and time-delays.
- b. Relay shall have built-in IEC or ANSI time current characteristics. It shall be possible to select IEC or ANSI time current characteristics. The IDMT curve shall have a user selectable reset characteristic.

7.1.3. Earth Fault protection

- a. Relay shall have two earth fault measurement modes. One mode shall directly measure the earth current from an independent CT and the second mode derives the residual current internally from the 3 line CTs. These elements shall provide over current protection, each with independent settings for pickup current, time-multiplier and time-delays.
- b. It shall be possible to select IEC or ANSI time current characteristics. The IDMT stage shall have a user programmable reset characteristic.

7.1.4. SOTF Function

- a. Relay shall have dedicated Switch-onto-Fault (SOTF) functionality to provide high speed tripping if a fault is still present on the feeder after the re-closure of the circuit breaker (Close-on-to-Fault) OR if earthing clamps are left connected after maintenance.
- b. SOTF function shall monitor the 3-phase current for 10 AC cycles from start-up of relay with CT power and trips when any fault is detected as per the user settings. After 10 AC cycle, SOTF shall not monitor current and does not operate.
- c. Sensitivity of Relay is the minimum phase current required for Relay to energize, detect a fault and issues a trip as per the configuration. The sensitivity of Self Powered Over current and Earth Fault Relay shall be 20% of nominal current in single phase and 13% of nominal current in three phases.
- d. The PROTECTION HEALTHY LED and TRIP READY LED shall be turned ON when Relay is TRIP ready at the above mentioned levels.
- e. It shall have trip circuit supervision feature.

7.2. Fault Diagnosis Functions:

Relays shall have the following tools for fault diagnostics

7.2.1. Fault record

Relay shall have the facility to store at least 5 last fault records with information on cause of trip, date, time, trip values of electrical parameters

7.2.2. Event record

Relay shall have the facility to store at least 10 stamped event records.

7.3. Pulse Output

7.3.1. Relay shall have one pulse output to interface directly with low energy circuit breaker tripping coil directly.

7.3.2. Pulse Output shall provide 24Volts, 0.1W pulses of 50 MS on and 500 ms off.

8. GENERAL TECHNICAL REQUIREMENTS

- 8.1. Relay shall be installed in hot, dusty, saline and humid tropical atmosphere. All components, accessories and wiring shall be provided with tropical finish to prevent rust and fungus growth.
- 8.2. Relay shall be capable to withstand surges and voltage spikes by providing necessary isolation and/or in-built suppression system.
- 8.3. The offered relay should be capable of withstanding 5 kV 1.2/50 micro-second impulse voltage immunity test in case of open circuit voltage and 8/20 micro second in case of short circuit current as per IEC: 60255-5 Standard.
- 8.4. The design, material and construction of Relay shall be such that to secure reliability, economy, safe and convenient operation and shall include all specified or unspecified incidental items necessary for similar equipment for convenient working in every respect.
- 8.5. Relay shall have sufficient number of input and output contacts to meet the functional requirements described in this specification. Any add-on external contact multiplier or other similar arrangement is not acceptable.
- 8.6. Relay shall have Modbus communication protocol through RS485 and shall be brought to utility compartment for SCADA integration.
- 8.7. All necessary wiring, connection and SCADA integration shall be in scope of supplier.

9. GENERAL MECHANICAL REQUIREMENTS

- 9.1. Relay shall be housed in a non-draw out case. The rear connection shall comprise user-friendly pluggable type terminals for Pulse output, binary inputs and binary outputs.
 - 9.2. The enclosure shall have high thermal stability and mechanical strength. The reference standard shall have a case made of unbreakable high grade, fire resistant high grade engineering plastic which can be sealed in such a way that the internal parts of Relay is protected from mechanical or electrical damage.
 - 9.3. The equipment shall be designed as that it can be used without requiring earthing.
 - 9.4. Relay shall be suitable for installation within a metal enclosure of the Ring Main Unit to be installed outdoor.
 - 9.5. Relay shall conform to degree of protection IP51 for protection against ingress of dust, moisture and vermin.
 - 9.6. All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.
 - 9.7. Relay should be compact and reliable in design, rugged for rough handling during transport.
 - 9.8. Relay shall have a case made of unbreakable high grade, fire resistant, reinforced polycarbonate or equivalent high grade engineering plastic or equivalent metal to prevent access to internal parts of Relay
 - 9.9. Relay shall be flush mounted having its enclosure degree of protection IP 5X.
 - 9.10. 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. Relay shall withstand solar radiation.
 - 9.11. All insulating material used in the construction of Relay shall be non-hygroscopic, non-aging and of tested quality.
 - 9.12. Relay 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
 - 9.12.1. Personnel safety against electric shock
 - 9.12.2. Personnel safety against effects of excessive temperature.
 - 9.12.3. Protection against spread of fire
 - 9.12.4. Protection against penetration of solid objects, dust and water.
10. **POWER**
- 10.1. Self-Powered Over current and Earth Fault relay shall be powered in the following modes and their priority is as follows:

- 10.1.1. CT Power
- 10.1.2. USB Power
- 10.1.3. Battery Power

10.2. CT Power shall be used for protection and tripping whereas USB power and Battery power shall be used for settings, viewing and downloading events, fault logs when relay is in CT power off condition.

11. RELAY SETTING

- 11.1. Relay shall have front key pad / keys to allow relay settings from relay by HMI.
- 11.2. All relays shall also have hand-reset button on relay front. Relay to be self-reset or hand reset shall be software selectable.
- 11.3. Relays shall also have facility to reset from remote command from SCADA through IEC 61850 & MODBUS protocols.
- 11.4. Relay settings shall be provided with adequate password protection. The password of Relay shall be of a minimum 4 characters upper case text to provide security to setting parameter.

12. KEYBOARD

- 12.1. A double function keypad shall be provided to configure Relay for configuration and testing.
- 12.2. The key board shall have following attributes.
 - 12.2.1. Any alphanumeric character shall be available with sequential operation of maximum three keys
 - 12.2.2. Long operational life of more than 10,000,00 operations
 - 12.2.3. Feedback for key press acknowledgement to user
 - 12.2.4. Legible and non-fading key pad imprints for all alpha numeric characters / symbols

13. REAL TIME CLOCK

- 13.1. Relay offered should have a real time clock based on a quartz crystal with a battery totally independent of power supply.
- 13.2. The time measurement should be independent of line frequency.
- 13.3. A lithium maintenance free battery of long life (minimum ten years) shall be provided for operation of time clock.
- 13.4. It should be possible to synchronize Real Time Clock (RTC) of Relay through explicit software command from any Laptop or mobile device. The bidder shall provide a software module with password protection specifically to reset RTC.

- 13.5. The drift in RTC shall not be more than 5 minutes in a year. The bidder shall submit the datasheets of RTC and crystal along with the offer.

14. MEMORY

- 14.1. Relay should have non-volatile memory, so that the registered parameters shall not be affected by loss of power.
- 14.2. The non-volatile memory should have a minimum retention time of 15 years.
- 14.3. The memory shall have sufficient capacity to store relay operation data and various electrical parameter data as per the relevant clauses of this specification

15. DISPLAY

- 15.1. Relay shall have a built-in Liquid Crystal Display (LCD) of adequate size for display of parameters and legends.
- 15.2. The LCD shall be transfective type industrial grade with extended temperature range. The LCD may be subjected to 65°C temperature for at least 72 Hours. The display shall be visible and readable after the test.
- 15.3. The display module shall be well protected from the external ultraviolet radiations.
- 15.4. The LCD shall be with backplane with LED illumination. The LCD shall be bright and with uniform backlit. The backlit shall be switched off automatically after 1 minutes of inactivity.

16. COMMUNICATION INTERFACES

- 16.1. The offered relay shall be SCADA enabled & shall be designed to integrate with open communication architecture. Relay protocol shall IEC- 61850 / Modbus RTU only. Relays with proprietary or any other protocol including protocol converter is not acceptable.
- 16.2. Relay shall have RS 485 communication port on rear side for SCADA Communication over IEC- 61850 or Modbus Protocol.
- 16.3. RS485 communication port (on rear side) for relay configuration, relay setting, monitoring, control, parameterization, disturbance record functionality etc.
- 16.4. RJ45 Ethernet Copper communication port or RS-232 or USB Port communication port (on front side) for Local configuration via Laptop related to relay setting tool for all type of functionality like relay configuration, relay setting, relay reset, monitoring, control, parameterization, disturbance record functionality etc.
- 16.5. The bidder shall provide License copy of relay setting software for Serial and LAN communication.
- 16.6. The bidder shall provide complete communication protocol in detail and interoperability list including IEC 61850 / Modbus protocol for offered relays.

17. CONNECTION DIAGRAM

- 17.1. Relay shall be indelibly marked with connection diagram showing the details of wiring and connections to external equipments.
- 17.2. In case of any specific precautions needs to be taken at the time of testing or installation of Relay, the same shall be indicated with the circuit diagram.
- 17.3. The bidder shall furnish drawings of the connection diagram along with the offer.

18. INSTALLATION CHECK

- 18.1. After installation, Relay shall have a facility to check the correctness of connections to Relay and their polarity.
- 18.2. Relay shall also capable of checking phase sequence of voltage and current as well as phase association between voltage and current.

19. TESTS

- 19.1. Relay shall be fully type tested by the bidder or his collaborator as per the relevant standards. The Bidder shall furnish the type test reports along with the offer.
- 19.2. The supplier shall carry out all routine tests as per IEC 60255 and its latest amendments.
- 19.3. Purchaser may also carry out additional tests as appropriate to ensure that the product is as per specification and suitable for intended purpose.

20. QUALITY ASSURANCE

- 20.1. The manufacturer shall have a well-organized Quality Assurance Plan (QAP) based on ISO 9000 Series to assure that items and services comply with this specification.
- 20.2. 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 purchaser.
- 20.3. 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.

- 20.4. The Bidder shall invariably furnish following information along with his bid.
 - 20.4.1. 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.
 - 20.4.2. List of tests normally carried out on raw materials in the presence of bidder's representative, copies of test certificates.
 - 20.4.3. Information and copies of test certificates in respect of bought out accessories.
 - 20.4.4. List of manufacturing facilities available.
 - 20.4.5. Level of automation achieved and list of areas where manual processing exists.
 - 20.4.6. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
 - 20.4.7. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid.

21. PRE-DISPATCH INSPECTION AT OEM 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 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. If company intends to have inspection by competent / authorized body at manufacturer's premises during the manufacturing and testing process, the selection of the party will be at sole desecration of the company and manufacture will have to trust & provide all the facilities.
- 21.5. The representative/engineer attending the above testing will carry out testing on equipments and issue test certificate approval to the manufacturer and give clearance for dispatch.

22. INFORMATION TO BE SUBMITTED BY THE BIDDER

The following shall be furnished with the offer:

- 22.1. Brief background of the OEM
- 22.2. Manufacturing & Infrastructure facilities available
- 22.3. Technical Know-how and collaboration, if any
- 22.4. Catalogues describing the equipment and indicating the type and model number
- 22.5. Constructional features, materials used and relevant technical literature
- 22.6. Complete dimensional drawings
- 22.7. User Manual / Instruction Manual of Relay software
- 22.8. Manufacturing Experience
- 22.9. Type Test Certificates from a recognized independent testing authority
- 22.10. Wiring diagram

23. DEVIATIONS:

The bidders are not allowed to deviate from the principal requirements of the specifications. However, the bidder is required to submit detailed list of all deviations without any ambiguity. Unless otherwise brought out separately by the bidder, Relay offered shall conform to the specification scrupulously. The discrepancies between the specification and the catalogues or literature submitted as part of the offer shall not be considered as valid deviations unless specifically brought in the statement of deviations.

ANNEXURE-2

TECHNICAL SPECIFICATION FOR FAULT PASSAGE INDICATOR

1. SCOPE

- 1.1. This specification covers the design, engineering, manufacturing, inspection & supply of Fault Passage Indicators for 11KV underground networks, to be installed in RMU, conforming to IS/IEC standards.
- 1.2. The scope of supply comprise of following:
 - 1.2.1. Fault Passage Indicators
 - 1.2.2. Fault passage indicators outside the enclosure
 - 1.2.3. 3 phase Split Core CTs (CBCT) with shielded/optical fiber cable
 - 1.2.4. Operational and maintenance manuals of hardwares and softwares
Battery Charger
 - 1.2.5. Power supply accessories
 - 1.2.6. Operational manuals of FPI and softwares including drawings
 - 1.2.7. Training to at least five people on all aspects of operation of FPI and software
 - 1.2.8. Continued technical support
- 1.3. The offered equipments shall be complete with all parts and accessories which are necessary or usual for their efficient and satisfactory operation. 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 required quality of the product.
- 1.4. 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 & workmanship and shall be performed in continuous operation in a manner acceptable to purchaser. The offered material shall be completed 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 the vendor of their responsibilities. 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.

- 1.5. 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. SYSTEM PARAMETERS

- 2.1. Nominal operation voltage : 11 KV
- 2.2. System Max Voltage : 12 KV
- 2.3. Frequency : 50 Hz
- 2.4. Number of phases : 3
- 2.5. Symmetrical Fault Current : 21 KA/3s and 25KA/170ms
- 2.6. Lightning Surge : 125 KV
- 2.7. Type of earthing : Solidly Earthed
- 2.8. Cable Size : 300 Sqmm/3c 11KV XLPE Armored Cable

3. SERVICE CONDITIONS

- 3.1. FPI to be supplied against this specification shall be required to operate satisfactorily and continuously under the following tropical conditions.

- 3.1.1. Maximum Ambient Temperature : 50 Deg. C
- 3.1.2. Max Daily Average Ambient Temperature : 40 Deg. C
- 3.1.3. Minimum Ambient Temperature : 10 Deg. C
- 3.1.4. Maximum humidity : 95%
- 3.1.5. Average annual rainfall : 1000 mm
- 3.1.6. Average no. of rainy days per annum : 50 Days
- 3.1.7. Rainy months : 4 Months
- 3.1.8. Altitude above MSL not exceeding : 1000 Meters

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

- 3.3. The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

4. ALLOWABLE POWER SUPPLY VARIATIONS

- 4.1. Voltage : -6% to +6% Vref
- 4.2. Frequency : $\pm 2\%$ (49 Hz to 51Hz)
- 4.3. Power Factor : Zero (Lag) – Unity – Zero (Lead)

5. APPLICABLE STANDARDS

5.1. The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest editions of the following standards / IEC and shall conform to the regulations of local statutory authorities.

- 5.1.1. IEC 68-2 : Environmental Testing – For vibrations and Solar Radiations
- 5.1.2. IEC 950 Information Technology Equipment-Safety
- 5.1.3. IEC 68-2-6 : For Vibrations and Shocks
- 5.1.4. IEC 68-2-29 : Electromagnetic compatibility for Low-frequency Conducted Disturbances and Signaling in Public Low Power Supply Systems
- 5.1.5. IEC 1000-4 : EMC -Testing & Measurement
- 5.1.6. IEC 1000-6 : EMC- Immunity for Residential, Commercial and Light Industrial Environments
- 5.1.7. IS 2705_Part 1 : Current Transformers: Part-I General Requirements

5.2. Unless otherwise specified elsewhere in this specification the materials shall conform to the latest version available of the standards as specified above.

5.3. 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.

6. GENERAL FUNCTIONAL REQUIREMENTS

- 6.1. The main functions of the system are:
 - 6.1.1. To detect phase-to-phase and phase-to-earth fault currents on the MV network
 - 6.1.2. To detect voltage presence interruptions
 - 6.1.3. To time stamp faults and Voltage dips and store them in memory
 - 6.1.4. To have SCADA compatibility to transmit information to the control center spontaneously via FRTU
 - 6.1.5. To provide a indication of fault which can be visible without opening the doors of the Ring Main Unit
 - 6.1.6. To measure load current on the line
 - 6.1.7. To provide operators with all useful information for fault finding and preventive maintenance.
 - 6.1.8. To be self-supplied at all times, including during outages.
- 6.2. FPI system shall allow the fast identification of the faulty section, by providing a light indication when they are located upstream of the fault, and by then actuating auxiliary output contacts;
- 6.3. It must return automatically in a stand-by position when the feeder of which they depend is (re)energized.
- 6.4. The Indicator shall be of the programmable type suitable for sensing;
 - 6.4.1. Short-circuit fault up to 21 KA
 - 6.4.2. Low earth leakage fault of maximum sensitivity of 4A or less with tripping level setting range up to 50A.
- 6.5. FPI shall be selective in action as indicated below;
 - 6.5.1. It shall not respond to any sudden variation (increase/decrease) in load current.
 - 6.5.2. It shall not respond to an over current condition not due to a fault.
 - 6.5.3. It shall not respond to high magnetizing inrush current.
- 6.6. Fault passage indicator shall have SCADA compatibility to send a signal to FRTU as soon as it detects disappearance or appearance of voltage on the cable.
- 6.7. Fault passage indicator shall continuously measure the phase currents and shall have compatible to send the minimum, maximum and average values measured.

- 6.8. The power supply for the operation of the equipment shall be from a lithium battery suitable for 10 years trouble free service.
- 6.9. Monitored information configurable as “alarming” shall include at least the following, consisting both of network diagnostic information and monitoring equipment internal faults for self-diagnostic purpose:
 - 6.9.1. Fault detection appearance with indication of Fault Passage Indicator reporting the fault and tripping criteria tripped.
 - 6.9.2. Fault detection disappearance with indication of Fault Passage Indicator reporting the fault and tripping criteria tripped.
 - 6.9.3. Voltage absence
 - 6.9.4. Voltage presence
 - 6.9.5. Change of state of a digital input
 - 6.9.6. Fault Passage Indicator absent
 - 6.9.7. Fault Passage Indicator battery low

7. GENERAL TECHNICAL REQUIREMENTS

- 7.1. The medium voltage Fault Current Indicators shall be of the outdoor type suitable for working in the tropical climate condition stipulated in the earlier clauses.
- 7.2. All the material and electronic power components used in the manufacture of FPI shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.
- 7.3. FPI should be compact and reliable in design, rugged for operating in polluted, dusty non-air-conditioned areas.
- 7.4. The equipment enclosure shall have high thermal stability and mechanical strength. The equipment shall have a case made of unbreakable high grade, fire resistant high grade engineering plastic which can be sealed in such a way that the internal parts of the instrument is protected from mechanical or electrical damage.
- 7.5. The components used in FPI shall be suitably protected from direct sunlight to prevent malfunctioning due to solar radiation. The maximum operating temperature shall not be less than 70°C.
- 7.6. The mounting bracket of FPI shall be made of Stainless steel or aluminum suitable for mounting in cable termination box.
- 7.7. 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.

- 7.8. FPI 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 personnel safety against electric shock.
- 7.9. All insulating material used in the construction of the equipment shall be non-hygroscopic, non-aging and of tested quality.
- 7.10. FPI CT secondary connecting cable shall be shielded/optical fiber type only.
- 7.11. FPI shall be powered up with auxiliary 24V DC supply and shall also work with inbuilt battery backup if auxiliary supply is not available.

8. BATTERY

- 8.1. The battery provided for FPI shall be Lithium Thyonil Sulphide (LiSOCl₂) with 10 years of self-life.
- 8.2. It is preferable that the battery is of cylindrical type with adequate capacity
- 8.3. The supplier shall provide the datasheet or/and the test certificates for the same.

9. FLASH INDICATOR

- 9.1. The flash indicator shall be installed inside or outside of the Ring Main Unit. However, the flash indication shall be visible from a distance without opening the enclosure.
- 9.2. The Indicators which are detecting the variation of the electromagnetic field due to fault current shall provide intermittent flash indication. The duration of flash indication shall be adjustable from 30 Minutes to 12 hours.
- 9.3. The flash indicator shall be of the neon/xenon type offering a good contrast against sunshine and an MTBF of the light emitting system at least 45000 Hours. The flash indication shall be visible for at least 100m in day time and 500 meters in night time. The flash indicator shall be so designed to allow a uniform 360° monitoring
- 9.4. A flashing indication shall also be provided to indicate the transient fault and permanent fault, and the duration shall be able to set at 24 hours.
- 9.5. The Indicator shall have the following Flash indication resetting facilities;
 - 9.5.1. To reset automatically after restoration of supply
 - 9.5.2. To reset after Programmed duration after occurring of fault
 - 9.5.3. To reset manually

10. NAMEPLATE AND MARKING

- 10.1. Each Fault Current Indicator shall carry a weather and corrosion proof Rating Plate indicating the following particulars.

- 10.1.1. Manufacturer's name / identification and place / country of manufacturer
 - 10.1.2. Model or type number (as per catalogue)
 - 10.1.3. Alphanumeric serial number
 - 10.1.4. Month and Year of manufacture
 - 10.1.5. Logo of purchaser
 - 10.1.6. A text "Property of (Purchaser's name)"
 - 10.1.7. Serial number of FPI: 12 Digit Alphanumeric serial numbers will be given by purchaser within a week of release of Purchase Order.
- 10.2. The name plate shall be clearly visible and effectively secured against removal, indelibly and distinctly marked with all essential particulars mentioned above.

11. **DEVIATIONS**

The Bidders are not allowed to deviate from the principal requirements of the specifications. However, the bidder is required to submit with his bid 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 specifications and no post-bid negotiations shall take place in this regard.

ANNEXURE-3
PREFERRED MAKES OF MATERIALS

Sr.	Bought out components	Make and model
1.	Numerical relays	Ashida- ADR241S-460 (Nano) C&S-CSDPR-V2-300 Siemens (7SR45)
2.	Fault passage indicator	EMG Make (Model : EKL8000NG) Siemens Make (Model : SICAM) C&S Make (Model : CSFPI (SC +EFPI))
3.	Control cables	Poly cab Finolex Havells RR Kabel
4.	MCB	L&T Havells Siemens Legrand Schneider Electric
5.	Paint	Akzo Nobel (Product code : JP4G524N) Asian paints (Product code : PY940S) Jotun (Product code : 1217808) Berger Nerolac
6.	Connectors	Phoenix Elemex
7.	Current Transformers	Narayan Power Tech- Vadodara Ashmor Electricals - Ahmedabad ECS-Vadodara

		Gilbert and Maxwell Pvt Ltd-Nashik Rishabh Instruments Pvt Ltd- Nashik
8.	MS Sheet/ Angle/ Channels	Posco Essar Tata Jindal
9.	Cable Boots	3M Raychem KD Joshi