

**TECHNICAL SPECIFICATION FOR MAINTENANCE FREE OUTDOOR 11 KV  
RING MAIN UNIT SWITCHGEAR**

**26.1 GENERAL:**

- 26.1.1. All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standard.
- 26.1.2. Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted.
- 26.1.3. The electrical installation shall meet the requirement of Indian Electricity Rules-1956 as amended up to date; relevant IS code of practice and Indian Electricity Act-1910. In addition other rules and regulations applicable to the work shall be followed. In case any discrepancy the most stringent and restrictive one shall be binding.
- 26.1.4. The high-tension switchgear offered shall in general comply with the latest issues including amendments of the following standards but not restricted to them.

**26.2.1. Configurations (Non Extensible / Extensible):-**

The Ring Main Unit shall be installed at 11 KV junction points to have continuous supply by isolating faulty sections. The RMU shall be non extensible / extensible type and consists of the following combinations of load break switches and Circuit breakers for a nominal voltage of 12 KV using SF6 gas as insulating and Vacuum as arc quenching medium.

1	Installation, Testing & Commissioning of 11kV RMU with <b>0+3</b> (0 Nos of VCB + 3 Nos of Load Break Switch) Non Extensible
2	Installation, Testing & Commissioning of 11kV RMU with 0+4 (0 Nos of VCB + 4 Nos of Load Break Switch) Non Extensible
3	Installation, Testing & Commissioning of 11kV RMU with 1+4 (1 Nos of VCB + 4 Nos of Load Break Switch) Non Extensible
4	Installation, Testing & Commissioning of 11kV RMU with 1+3 (1 Nos of VCB + 3 Nos of Load Break Switch) Non Extensible
5	Installation, Testing & Commissioning of 11kV RMU with 2+3 (2 Nos of VCB + 3 Nos of Load Break Switch) Non Extensible
6	Installation, Testing & Commissioning of 11kV RMU with 3+3 (3 Nos of VCB + 3 Nos of Load Break Switch) Non Extensible
7	Installation, Testing & Commissioning of 11kV RMU with 2+4 (2 Nos of VCB + 4 Nos of Load Break Switch) Non Extensible
8	Installation, Testing & Commissioning of 11kV RMU with 0+5 (0 Nos of VCB + 5 Nos of Load Break Switch) Non Extensible
9	Installation, Testing & Commissioning of 11kV RMU with 1+5 (1 Nos of VCB + 5 Nos of Load Break Switch) Non Extensible
10	Installation, Testing & Commissioning of 11kV RMU with 2+5 (2 Nos of VCB + 5 Nos of Load Break Switch) Non Extensible
11	Installation, Testing & Commissioning of 11kV RMU with 0+3 (0 Nos of VCB + 3 Nos of Load Break Switch) Non Extensible for feeder interconnections

12	Installation, Testing & Commissioning of 11kV RMU with 0+3 (0 Nos of VCB + 3 Nos of Load Break Switch) <b>Extensible</b>
13	Installation, Testing & Commissioning of 11kV RMU with 1+3 (1 Nos of VCB + 3 Nos of Load Break Switch) <b>Extensible</b>
14	Installation, Testing & Commissioning of Single VCB unit <b>both side extensible</b>
15	Installation, Testing & Commissioning of Single Load Break Switch unit <b>both side extensible</b>

11KV Gas (SF6) Insulated RMU with 630A load break switch and SF6 insulated VCB of 200A rating.

- This Specification provides for design, manufacture, inspection and testing before despatch, packing and delivery F.O.R.(Destination) of SF6 insulated RMUs with necessary take *off* terminal units for future automations, other accessories and auxiliaries equipments and mandatory spares, described herein and required for their satisfactory operation.
- RMUs should be compact, maintenance free, independent of climate, easy installation, operational reliability, Safe and easy to operate, minimum construction cost, minimum site work and minimum space requirement.
- The RMUs shall conform in all respects to high standards Of Engineering design, workmanship and latest revisions of relevant standards at the time of *offer*.
- The type of the 11 KV circuit breaker shall be VCB and insulating medium for load break isolators, Earth switch, 11 KV Buses and other associated equipments should be SF6 gas.

### 26.3. GENERAL

- 26.3.1. The RMU and combination shall be tropicalised and outdoor metal enclosed type. The RMU metal parts shall be of high thickness, high tensile steel which must be grit/short blasted, thermally sprayed with Zinc alloy, phosphate or should follow the 7 tank pre-treatment process and be subsequently painted with polyurethane based powder paint. The overall paint layer thickness shall be not less than 80 microns.
- 26.3.2. Relevant IE rules for clearances, safety and operation inside the enclosure shall be applicable. The enclosure shall be IP 54 and type tested for weather proof at EREDA/CPRI.
- 26.3.3. All live parts except for the cable connections in the cable compartments shall be insulated with SF6 gas. The SF6 gas tank shall be made of TIG or MIG or Laser welded stainless steel, to have the best weld quality or It shall be metallised resin cast construction. The gas cubicle shall be metal enclosed with stainless steel of minimum 2 mm thickness and should be provided with a pressure relief arrangement away from operator.
- 26.3.4. Both the load break switches and the tee *off* circuit breaker should be motorized.
- 26.3.5. The cable box of isolators and circuit breakers both should be of front/side/rear access type as per site requirement.
- 26.3.6. Any accidental over pressure inside the sealed chamber shall be limited by the opening of a pressure-limiting device in the top or rear-bottom part of the tank or enclosure. Gas will be release to the rear of the switchboard away from the operator and should be directed towards the bottom, into the trench to ensure safety of the operating

- personnel and the pedestrians / civilians. All the manual operations should be carried out on the front of the switchboard.
- 26.3.7. The Entire units of RMU shall be enclosed in a single compact metal clad, outdoor enclosure suitable for all weather conditions. The switchgear/steel gas tank shall be filled with SF6 as per IEC/IS Standards relative pressure to ensure the insulation and breaking functions. The steel gas tank must be sealed for life and shall meet the "sealed pressure system" criteria in accordance with the IEC 298 standard. The RMU must be a system for which no handling of gas is required throughout the 20 years of service life.
- 26.3.8. The RMU shall have a design such that in the event of an internal arc fault, the operator shall be safe. This should be in accordance with IEC 298 and relevant Test certificates shall be submitted with the Tender.
- 26.3.9. The RMU shall be tested for an internal arc rating of 20 kA for 1 Sec.
- 26.3.10. Suitable temperature rise test on the RMU shall be carried out & test reports shall be submitted with tender for technical bid evaluation.
- 26.3.11. Each switchboard shall be identified by an appropriately sized label, which clearly indicates the functional units and their electrical characteristics.
- 26.3.12. The switchgear and switchboard shall be designed so that the position of the different devices is visible to the operator on the front of the switchboard and operations are visible as well.
- 26.3.13. The entire system shall be totally encapsulated. There shall be no access to exposed conductors. In accordance with the standards in effect, the switchboards shall be designed so as to prevent access to all live parts during operation without the use of tools.
- 26.3.14. The entire 11 KV RMU are insulated by inert gas (SF6) suitable for operating voltage up to 12 KV respectively. The 11 KV circuit breakers must be VCB breaker. It is necessary to fit an absorption material in the tank to absorb the moisture from the SF6 gas. The SF6 insulating medium shall be constantly monitored via a temperature compensating gas pressure indicator offering a indication at different temperature ranges, having distinctive RED and GREEN zones for safe operation.
- 26.3.15. All the RMUs must be routine tested for the following at factory in India:-
- o Micro-ohm test for the assembly inside the tank.
  - o Circuit breaker analyzer test so as to ensure the simultaneous closing of all poles for VCB.
  - o SF6 gas leak test.
  - o Partial Discharge test on the complete gas tank so as to be assure of the proper insulation level and high product life.
  - o High voltage withstand.
  - o Secondary test to ensure the proper functioning of the live line indicators, fault passage indicators and relays.
- 26.3.16. Sulphur Hex fluoride Gas (SF6 GAS)
- The SF6 gas shall comply with IEC 376,376A,and 376B and shall be suitable in all respects for use in 11 KV RMUs under the operating conditions. The SF6 shall be tested for purity, dew point air hydrolysable fluorides and water content as per IEC 376,376A and 376B and test certificate shall be furnished to the owner indicating all the tests as per IEC 376 for each Lot of SF6 Gas.

#### 26.4. STANDARDS

Unless otherwise specified elsewhere in this Specification, the RMU, Switchboard (Switchgear), Load break isolators, Instrument Transformers and other associated accessories shall conform to the latest revisions and amendments thereof to the following standards.

- 26.4.1. IEC 60 298/IEC 62 271-200/IS 12729:1988- General requirement for Metal Enclosed Switchgear
- 26.4.2. IEC60129/IEC62271-102/IS 9921 - Alternating current disconnectors (Load break isolators) and earthing switch
- 26.4.3. IEC 62 271-100 & 200/IEC 60 056/IS 13118:1991- Specification for alternating current circuit breaker
- 26.4.4. IEC 62 271-1/IEC 60694 - Panel design, SF6/Vacuum Circuit Breakers
- 26.4.5. IEC 60044-1/IEC 60185/IS 2705:1992 - Current Transformer
- 26.4.6. IEC 60265/IS 9920:1981- High voltage switches.
- 26.4.7. IEC 376 - Filling of SF6 gas in RMU.
- 26.4.8. IEC 60273/IS :2099 - Dimension of Indoor & Outdoor post insulators i. with voltage > 1000 Volts.
- 26.4.9. IEC 60529/IS 13947(Part-1) -Degree of protection provided by
  - i. enclosures for low voltage switchgear and
  - ii. control gear.
- 26.4.10. Indian Electricity Rules/IS Code

Equipment meeting with the requirements of any other authoritative standards, which ensures equal or better quality than the standard mentioned above shall also be acceptable. If the equipments, offered by the Bidder conform to other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. In case of any difference between provisions of these standards and provisions of this specification, the provisions contained in this specification shall prevail. One copy

of such standards with authentic English Translations shall be furnished along with the offer.(Hard copy)

26.S. THE STANDARDS MENTIONED ABOVE ARE AVAILABLE FROM:

**IEC-** (INTERNATIONAL ELECTRO-TECHNICAL COMMISSION, BUREAU CENTRAL DE LA COMMISSION, ELECTROTECHNIQUE INTERNATIONALE, 1, RUE DE VEREMBE, GENEVA, SWITZERLAND.)

**ISO-** INTERNATIONAL STANDARD ORGANISATION

26.6. SPECIFIC REQUIREMENTS IN RMU:-

26.6.1. CLIMATE CONDITIONS

The climatic conditions under which the equipment should operate satisfactorily are as under:

- Maximum ambient temperature : 50 °C
- Maximum ambient temperature in shade : 45 °C
- Relative Humidity : 10 to 95%
- Maximum annual rainfall : 1450 mm
- Maximum wind pressure : 150 Kg/m. sq
- Maximum altitude above mean sea level : 1000 meters
- Isoceraunic level : 50 days/year
- Seismic level (Horizontal acceleration) : 0.3g
- Moderately hot and humid tropical climate

26.7. RMU OUTDOOR METAL CLAD ENCLOSURE.

The RMU enclosure must be a metallic, it shall follow an industrialized process of manufacturing. The RMU and combination shall be tropicalised and outdoor metal enclosed type. The RMU metal parts shall be of high thickness, high tensile steel which must be grit/short blasted, thermally sprayed with Zinc alloy, phosphate or should follow the 7 tank pre-treatment process and be subsequently painted with polyurethane based powder paint. The overall paint layer thickness shall be not less than 80 microns.

The rating of enclosure shall be suitable for operation on three phase, three wire, 11KV, 50 cycles, A.C. System with short-time current rating of 20KA for 3 seconds with RMU Panels.

The enclosure should have two access doors one for the operation and relay monitoring and other for the cable access. Both the doors should have the locking facility to prevent the access to operating mechanism to avoid unauthorized operating of RMU and relay.

26.8. TAKE OFF TERMINAL UNITS FOR AUTOMATION:

The RMU should be provided with necessary take off terminal units for automations, located in the front recesses / LV cubical of the RMU. The connectivity to the FRTU for SCADA purpose shall be provided

## 26.9. ISOLATORS (LOAD BREAK TYPE)

The load break isolators for Incoming and Outgoing supply must be provided. These should be fully insulated by SF6 gas. The load break isolators shall consist of 630 Amp fault making/load breaking spring assisted ring switches, each with integral fault making earth switches. The switch shall be naturally interlocked to prevent the main and earth switch being switched 'ON' at the same time. The selection of the main and earth switch is made by a lever on the facia, which is allowed to move only if the main or earth switch is in the *off* position. The load break isolators should have the facility for future remote operation. Each load break switch shall be of the triple pole, simultaneously operated, non automatic type with quick break contacts and with integral earthing arrangement.

The isolating distance between the OFF and the ON position in the isolator should be sufficient to withstand dielectric test as per IS/IEC, so as to have enough isolating distance for ensuring safety during DC injection for Cable testing.

## 26.10. EARTHING OF ISOLATORS AND BREAKERS (EARTH SWITCH)

Necessary arrangements are provided at Load break isolators Breaker for selecting Earth position. Mechanical interlocking systems shall prevent the RMU function from being operated from the 'ON' to 'Earth On' position without going through the 'OFF' position.

## 26.11. DISTRIBUTION TRANSFORMER/FEEDER BREAKER (VACUUM)

The VCB breaker for the controlling of DT/Feeder Breaker must be provided inside welded stainless steel SF6 gas tank with the outdoor metal clad enclosure.

The VCB circuit breaker must be a spring assisted three positions with integral fault making earth switch. The selection of the main/earth switch lever on the facia, which is allowed to move only if the main or earth switches is in the *off* position.

The manual operation of the circuit breaker shall not have an *effect* on the trip spring. This should only be discharged under a fault (electrical) trip; the following manual reset operation should recharge the trip spring and reset the circuit breaker mechanism in the main *off* position.

The circuit breaker shall be fitted with a mechanical flag, which shall operate in the event of a fault (electrical) trip occurring. The 'tripped' flag should be an unambiguous colour differing from any other flag or mimic.

Both the circuit breaker and ring switches are operated by the same unidirectional handle.

The protection on the circuit breaker shall comprise of the following components:-

- 3 class X protection CT's,

- a low burden trip coil and

- a self powered (No external DC or AC source required) IDMT protection relays (Numeric/Micro processor based) 3 x over current

and earth fault element shall be Definite Time type relay . The protection system should be suitable for protecting transformers of rated power from 250 KVA on wards. The relay should be housed within a pilot cable box accessible.

#### 26.12. BUSHINGS

The units are fitted with the standardized bushings that comply with IEC standards. All the bushings are the same height from the ground and are protected by a cable cover.

#### 26.13. CABLE BOXES

All the cable boxes shall be air insulated suitable for dry type cable terminations and should have front / rear/side access. The cable boxes at each of the two ring switches should be suitable for accepting HV cables of sizes 3c x 300/3c x95 sq.mm and circuit breaker cable suitable up to 3c x 95 sq.mm. The cable boxes for an isolator in it's standard design should have sufficient space for connecting two cables per phase. Necessary Right angle Boot should be supplied to the cable terminations. The type of the Right angle Boot should be cold applied insulating Boot.

#### 26.14. CABLE TESTING FACILITY

It shall be possible to test the cable after opening the cable boxes. The cable boxes should open only after operation of the earth switch. Thus ensuring the earthing of the cables prior to performing the cable testing with DC injection.

#### 26.15. VOLTAGE INDICATOR LAMPS AND PHASE COMPARATORS

The RMU shall be equipped with a voltage indication to indicate whether or not there is voltage on the cable. There should be a facility to check the synchronization of phases with the use of external device. It shall be possible for the each of the function of the RMU to be equipped with a permanent voltage indication as per IEC 601958 to indicate whether or not there is voltage on the cables.

#### 26.16. EXTENSIBLE

As per clause no. 26.2.1 configurations 12&13 of RMUs shall have the provision for extension by load break isolators / breakers in future, with suitable accessories and necessary Bus Bar. The equipment shall be well designed to provide any kind of extension / trunking chamber for connecting and housing extensible Busbars. Extensible isolators and circuit breakers shall be individually housed in separate SF6 gas enclosures. Multiple devices inside single gas tank / enclosure will not be acceptable. In case of extensible circuit breakers, the Breaker should be capable of necessary short circuit operations as per IEC at 20 KA, and the Breaker should have a rated current carrying capacity of 200 A.

#### 26.17. WIRING & TERMINALS:

26.17.1. The wiring should be of high standard and should be able to withstand the tropical weather conditions. All the wiring and terminals (including take off terminals for future automation, DC, Control wiring), Spare terminals shall be provided by the

contractor. 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.

- 26.17.2. The wiring should be of high standard and should be able to withstand the tropical weather conditions. All wiring shall be provided with single core multi-strand copper conductor wires with P.V.C insulation.
- 26.17.3. The wiring shall be carried out using multi-strand copper conductor super flexible PVC insulated wires of 650/1100V Grade for AC Power, DC Control and CT circuits. Suitable colored wires shall be used for phase identification and interlocking type ferrules shall be provided at both ends of the wires for wire identification. Terminal should be suitably protected to eliminate sulphating. Connections and terminal should be able to withstand vibrations. The terminal blocks should be stud type for controls and disconnecting link type terminals for CT leads with suitable spring washer and lock nuts.
- 26.17.4. Flexible wires shall be used for wiring of devices on moving parts such as swinging Panels (Switch Gear) or panel doors. Panel wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals, terminal blocks and wiring gutters. The cables shall be uniformly bunched and tied by means of PVC belts and carried in a PVC carrying trough.
- 26.17.5. 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. The wire number shown on the wiring shall be in accordance with the IS.375.
- 26.17.6. All wires directly connected to trip circuits of breaker or devices shall be distinguished by addition of a red color unlettered ferrule.
- 26.17.7. Inter-connections to adjacent Panels (Switch Gear) shall be brought out to a separate set of Terminal blocks located near the slots or holes to be provided at the top portion of the panel. Arrangements shall be made for easy connections to adjacent Panels (Switch Gear) at site and wires for this purpose shall be provided and bunched inside the panel. The bus wire shall run at the top of the panel. Terminal block with isolating links should be provided for bus wire. At least 10% of total terminals shall be provided as spare for further connections. Wiring shall be done for all the contacts available in the relay and other equipment and brought out to the terminal blocks for spare contacts. Color code for wiring is preferable in the following colours.

Voltage supply	Red, Yellow, Blue for phase and Black for Neutral
CT circuits	imilar to the above
DC circuits	Grey for both positive and negative
250V AC circuits	Black for both phase and neutral
Earthing	Green

- 26.17.8. The wiring shall be in accordance to the wiring diagram for proper functioning of the connected equipment. Terminal blocks shall not be less than 650V grade and shall be piece-molded type with insulation barriers.

- 26.17.9. The terminal shall hold the wires in the tight position by bolts and nuts with lock washers. The terminal blocks shall be arranged in vertical formation at an inclined angle with sufficient space between terminal blocks for easy wiring.
- 26.17.10. The terminals are to be marked with the terminal number in accordance with the circuit diagram and terminal diagram. The terminals should not have any function designation and are of the tension spring and plug-in type.
- 26.17.11. External box in RMU shall be provided for installing FRTU. The Aux supply will be taken through the PT provided for metering in RMU. The PT must have sufficient burden for meeting the aforesaid requirement also for battery charging.

#### 26.18. EARTHING

- 26.18.1. The RMU outdoor metal clad, Switch Gear, Load break isolators, Vacuum circuit breakers shall be equipped with an earth bus securely fixed along the base of the RMU.
- 26.18.2. The size of the earth bus shall be made of IEC/IS standards with tinned copper flat for RMU and M.S. Flat for Distribution Transformer, earth spike and neutral earthing. Necessary terminal clamps and connectors shall be included in the scope of supply.
- 26.18.3. All metal parts of the switchgear which do not belong to main circuit and which can collect electric charges causing dangerous *effect* shall be connected to the earthing conductor made of copper having CS area of minimum 75 mm<sup>2</sup>. Each end of conductor shall be terminated by M12/equivalent quality and type of terminal for connection to earth system installation. Earth conductor location shall not obstruct access to cable terminations.
- 26.18.4. The following items are to be connected to the main earth conductor by rigid or copper conductors having a minimum cross section of 75 mm<sup>2</sup>
- (a) Earthing switches
  - (b) Cable sheath or screen
  - (c) Capacitors used in voltage control devices, if any.
- 26.18.5. The metallic cases of the relays, instruments and other panel mounted Equipment's shall be connected to the earth bus by independent copper wires of size shall be made of IEC/IS standards. The colour code of earthing wire shall be green. Earthing wires shall be connected on the terminals with suitable clamp connectors and soldering shall not be permitted.

#### 26.19. ACCESSORIES & SPARES:

The following spares and accessories shall be supplied along with the main equipments at free of costs. This shall not be included in the price schedule.

1. Charging lever for operating load break isolators & circuit breaker of each RMU.
2. The pressure gauges indications – 1 numbers

Provision shall be made for padlocking the load break switches/ Circuit breaker, and the earthing switches in either open or closed position with lock & master key.

## 26.20. TESTING OF EQUIPMENT & ACCESSORIES:

Provision for testing CTs,PTs,Relays,Breakers and Cables shall be made available. Procedure and schedule for Periodical & annual testing of equipments, relays, etc. shall be provided by the supplier.

### 26.20.1. TYPE TEST

The Tenderer should, along with the tender documents, submit copies of all Type test certificate of their make in full shape as confirming to relevant ISS/IEC of latest issue obtained from a International/National Govt. Lab/Recognized laboratory.

The above type test certificates should accompany the drawings for the materials duly signed by the institution who has type test certificate. The details of type test certificate as per Schedule F.

### 26.20.2. ACCEPTANCE AND ROUTINE TESTS

All acceptance and routine tests as stipulated in the latest IEC- shall be carried out by the supplier in the presence of Board's representative. The supplier shall give at least 7 days advance intimation to the Board to enable them to depute their representative for witnessing the tests. The partial discharge shall be carried out as routine test on each and every completely assembled RMU gas tank and not on a sample basis. As this test checks and guarantees for the high insulation level and thus the complete life of switchgear.

### 26.20.3. ADDITIONAL TESTS

The Board reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/laboratory or at any other recognized laboratory/research institute in addition to the above mentioned type, acceptance and routine tests at the cost of the Board to satisfy that the material complies with the intent of this specification.

### 26.20.4. PRE-COMMISSIONING TESTS

All the pre-commissioning tests will be carried out in the presence of the Board testing engineer and necessary drawing manual and periodical test tools shall be arranged to be supplied.

During the above tests the contractor's representative should be present till the RMUs are put in to service.

## 26.21. INSPECTION:

The inspection may be carried out by the Board at any stage of manufacture. The supplier shall grant free access to Board's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the Board shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

The supplier shall keep the Board informed in advance, about the manufacturing programme so that arrangement can be made for inspection. The Board reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The Board has rights to inspect the supplier's premises for each and every consignment for type & routine test.

No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested / unless the same is waived by the Board in writing.

26.21.1. QUANTITY ASSURANCE PLAN:

The bidder shall invariably furnish following information along with his offer /in case of event of order.

I. Statement giving list of important raw materials including but not limited to

- a) Contact material
- b) Insulation
- c) Sealing material
- d) Contactor, limit switches, etc. in control cabinet.

Name of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

II. Information and copies of test certificates as in (i) above in respect of bought out accessories.

III. List of areas in manufacturing process, where stage inspections are

IV. normally carried out for quality control and details of such tests and inspections.

V. Special features provided in the equipment to make it maintenance free.

VI. List of testing equipment available with the Bidder for final testing of RMUs and associated combinations vis-a-vis the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in the relevant schedule i.e. schedule of deviations from specified test requirements. The supplier shall, within 15 days from the date of receipt of Purchase Order submit following information to the Board.

- a) List of raw materials as well bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
- b) Necessary test certificates of the raw material and bought out accessories.
- c) Quality Assurance Plan (QAP) with hold points for Board's inspection.

The quality assurance plan and hold points shall be discussed between the Board and supplier before the QAP is finalized.

The supplier shall submit the routine test certificates of bought out items and raw material, at the time of routine testing of the fully assembled breaker.

26.22. TRAINING:

The supplier shall give rigorous training to the engineers & *staff* for 2 days in attending trouble shooting and maintenance .

26.23. SCADA CONNECTIVITY:

Provision shall be made in all the RMUs with necessary take *off* terminal units for automations and connectivity with FRTU. Space for motorization wherever required for SCADA operation should be provided

26.24. DOCUMENTATION and DRAWINGS

All drawings shall conform to relevant International Standards Organization (ISO) Specification. All drawings shall be in ink and suitable for microfilming.

The tenderer shall submit along with his tender dimensional general arrangement drawings of the equipments, illustrative and descriptive literature in triplicate for various items in the RMUs which are all essentially required for future automation.

- I. Schematic diagram of the RMU panel
- II. Instruction manuals
- III. Catalogues of spares recommended with drawing to indicate each items of spares
- IV. List of spares and special tools recommended by the supplier.
- V. Copies of Type Test Certificates as per latest IS/IEC.
- VI. Drawings of equipments, relays, control wiring circuit, etc.
- VII. Foundation drawings of RMU and D.T. Structure.
- VIII. Dimensional drawings of each material used for item Vii.
- IX. Actual single line diagram of RMU/RMUs with or without Extra combinations shall be made displayed on the front portion of the RMU so as to carry out the operations easily.

The following should be supplied to each consignee circle/town along with the initial supply of the equipments ordered.

- a. Copies of printed and bound volumes of operation, maintenance and erection manuals in English along with the copies of approved drawings and type test reports etc.
- b. Sets of the manuals as above shall be supplied to the Chief Engineer (RE) / Engineer In-Charge. A soft copy of the all Technical and Drawing furnished in a CD

26.25. NAME PLATE:

Each RMU and its associated equipments shall be provided with a nameplate legible and indelibly marked with at least the following information.

- a. Name of manufacturer
- b. Type, design and serial number
- c. Rated voltage and current
- d. Rated frequency
- e. Rated symmetrical breaking capacity
- f. Rated making capacity
- g. Rated short time current and its duration
- h. Purchase Order number and date
- i. Month and Year of supply
- j. Rated lightning impulse withstand voltage
- k. Feeder name(Incoming and Outgoing),DTs Structure name,11000Volts Dangers etc.

26.26. FAULT PASSAGE INDICATORS (FPI):

These shall facilitate quick detection of faulty section of line. 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. The FPI shall be integral part of RMU. The FPI shall have **LCD/LED display**, automatic reset facility.

The sensors to be bushing mounted. The number of FPI should be put in all the three phases of the outgoing branch of the RMUs

- FPI should have suitable connectivity with the FRTUs for the SCADA purpose.
- The sensor for the FPI shall be of CBCT type if the RMU is of plinth mounted type. The sensor shall be mounted across 3-Ph cable terminated from overhead pole structure to RMU isolator termination box.
- If the RMU is of pole mounted type then FPI may have four separate sensors for all the three phases and for ground. These sensors shall be interfaced with common FPI controller device.
- For each isolator in RMU one FPI & associated sensor kit shall be provided. FPI shall have inbuilt potential free contact or separate potential free contact may be provided by RMU supplier for integration with FRTU. The potential free contacts shall be wired up to the TBs in RMU panel.
- FPI shall have LED/flag to indicate the passage of fault current through sensor. There shall be various features to reset the FPI LED/ Flag
  - o Self reset after set reset time (Through inbuilt timer)

- o Self reset after restoration of voltage
- o Manual reset from local through push button
- o Remote reset from SCADA control centre by issuing command
- Apart from above it shall also be possible to test the FPI by manually setting the FPLED/Flag through push button.

#### 26.27. TROPICALISATION

Due regard should be given to the climatic conditions under which the equipment is to work. Ambient temperature normally vary between 20 °C and 32 °C, although direct sun temperature may reach 50 °C. The climate is humid and rapid variations occur, relative humidity between 60% and 90% being frequently recorded, but these values generally correspond to the lower ambient temperatures. The equipment should also be designed to prevent ingress of vermin, accidental contact with live parts and to minimize the ingress of dust and dirt. The use of materials which may be liable to attack by termites and other insects should be avoided.

#### 26.28. Motorisation :

All the functions within the RMU i.e Isolators/Breakers should be fitted with motor mechanism and closing coil making it suitable to make it on from remote.

Other Accessories (required with RMU):-

- a) Shunt Trip Coil (Coil voltage shall be indicated later on)
- b) Battery & Battery Charger.
- c) 4N0+4NC auxiliary contacts.

#### 26.29. Metering:

Multifunction Energy meter shall be provided with, of accuracy class of 0.5 at incoming isolator of all RMUs. The Metering CTs and PTs of suitable rating shall be provided.

#### 26.30. TECHNICAL SPECIFICATION FOR RMU

##### 26.30.1. 11KV Bus Bar

- I.** Current Carrying Capacity : 630Amps.
- II.** Short time rating current for 3 sees. : 20 KA
- III.** Insulation of bus bar : SF6
- III.** Bus bar connections : Anti-oxide grease

26.31. Parameters for Switch Gear(VCB) and load break isolators

I.	Type	: Metal enclosed
II.	No of Phases	:3
III.	No. of poles	:3
IV.	Rated voltage	:12 KV
V.	Operating voltage	:11 KV(+10% to -20%)
VI.	Rated lightning impulse withstand voltage	:7S KV
VII.	Rated power frequency withstand voltage	:28 KV
VIII.	Insulating gas	:SF6
IX.	Rated filling level for insulation	:As Per IEC.

Max. Permissible site altitude at the above gas pressures : 1000m

(The operating pressure has to be adjusted for greater altitudes)

Isolating distance between ON and OFF position in isolator : 80 mm (min).

Rated short time current: 20 KA.

Rated short time: 3s

Rated peak withstand current: 50 KA.

No of operations in Short circuit: 1SNos (minimum)

Operating mechanism: Circuit breaker with spring assisted anti reflex mechanism.

Rated current (Bus):630 A

Rated current (breaker) :200A

Circuit Breaker interrupter :SF6 /VCB

Rated frequency :50 Hz

Rated operating sequence :0-3min- CO

Number of mechanical/Remote operations for earthing As per IEC & Ring switches & Number of mechanical/ 60298 remote operations for circuit breakers

26.32. PRINCIPAL FEATURES

SINo	DESCRIPTION	DT breaker
1	Circuit label	Yes
2	Mimic diagram	Yes
3	Supply voltage indication	Yes
4	Current Transformer	Yes
5	Self Powered based Microprocessor based IDMT Relay (30L)/EL	Yes

6	Anti- Reflexing Relay	Yes
7	Interlock to defeat the operation of the line side earthing when the line side isolator is ON.	Yes
8	Interlock to defeat the operation of the earthing when the breaker is in service position and is ON.	Yes
9	Breaker ON/OFF indication	Yes
10	Spring Charge indication / Spring assisted mechanism.	Yes
11	Fault Tripping indication	Yes
12	Bus bar end caps	Yes
13	Whether the SF6 gas pressure gauge indicator and filling arrangement.	Yes
14	Whether the spring assisted mechanism with operating handle for ON/OFF.	Yes
15	Whether the earth positions with arrangement for padlocking in each position and independent manual operation with mechanically operated indicator are provided	Yes
16	RMUs are provided with necessary take off terminals for future automation.	Yes

26.33. Earthing switch for 11 KV Line side Isolation and DT

Rated short time current :20 KA.

Rated short time :3s

Rated peak withstand current :50 KA

Interlocking facility:

- 1) Between 11KV Line side isolator 'ON"& Earthing.
- 2) Between 11KV DT side breaker on close condition & earthing

26.34. Current Transformers for breaker

CTType Tape wound

CT Description: The CTs of DT breaker shall be suitable for sensing the minimum primary variable current in the order of 10-100 A and the secondary current for the CT is 1A. The CT shall be housed in outside SF6 chamber for testing and Maintenance

Accuracy Class: class X/SP10 protection

Rated burden: Suitable for self powered relay and metering.

For the SCADA interface the signals to be provided by RMU are;

**3-Way RMU**

Signal Name	Signal Type	Total CMR
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DC Fail for station	SPI	1
Battery Charger Fail	SPI	1
FRTU Door Status	SPI	1
Local/Remote for Isolator 1	SPI	1
Local/Remote for Isolator 2	SPI	1
Local/Remote for Isolator 3	SPI	1
Earth Switch for Isolator 1	SPI	1
Earth Switch for Isolator 2	SPI	1
Earth Switch for Isolator 3	SPI	1
FPI status of Isolator 1	SPI	1
FPI status of Isolator 2	SPI	1
FPI status of Isolator 3	SPI	1
Open/Close status of Isolator 1	DPI	2
Open/Close status of Isolator 2	DPI	2
Open/Close status of Isolator 3	DPI	2
<b>Total</b>		<b>18</b>

#### 4Way RMU

Signal Name	Signal Type	Total CMR
DC Fail for station	SPI	1
Battery Charger Fail	SPI	1
FRTU Door Status	SPI	1
Local/Remote for Isolator 1	SPI	1
Local/Remote for Isolator 2	SPI	1
Local/Remote for Isolator 3	SPI	1
Local/Remote for Isolator 4	SPI	1
Earth Switch for Isolator 1	SPI	1
Earth Switch for Isolator 2	SPI	1
Earth Switch for Isolator 3	SPI	1
Earth Switch for Isolator 4	SPI	1
FPI status of Isolator 1	SPI	1
FPI status of Isolator 2	SPI	1
FPI status of Isolator 3	SPI	1
FPI status of Isolator 4	SPI	1
Open/Close status of Isolator 1	DPI	2
Open/Close status of Isolator 2	DPI	2
Open/Close status of Isolator 3	DPI	2
Open/Close status of Isolator 4	DPI	2
<b>Total</b>		<b>23</b>

Note: C&R panels of breakers/power transformers/RMU shall have CMR's mounted and wired as mentioned above for integration with RTU

