11 KV SF6 INSULATED RING MAIN UNIT WITH VACUUM CIRCUIT BREAKER

SYSTEM RATED VOLTAGE UP TO 12 kV

ITEM- A: TECHNICAL SPECIFICATION FOR OUTDOOR 11 KV RING MAIN UNIT SWITCHGEAR

1.1 GENERAL:

1.1.1 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standard.

1.1.2 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.

1.1.3 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.

1.1.4 The high-tension switchgear offered shall in general comply with the latest issues including amendments of the following standards but not restricted to them.

1.2 SCOPE:

Design, Engineering, Manufacture, assembly, Stage testing, inspection and testing before supply and delivery at site, Installation, testing & Commissioning of Ring Main units outdoor type SF6 filled, with various combinations of load break isolators & breakers. (including earthing- Erection of earthing by using GI strip (minimum 35mm strip) with earthing plate including cost of coal/salt to RMU).The Installation of 11KV Outdoor SF6 Insulated RMU covering erection, testing and commissioning with associated equipment including civil work, supply & laying of 11kv cable, cable jointing kit etc. of RMU. The permission of Electrical inspector for charging of RMUs is in bidder scope. RMU fencing is in the scope of bidder. Cable termination kits, cable laying is in bidder scope.

The insulation/dielectric media inside the stainless steel welded tank should be SF6 gas. The RMUS should be Modular, extensible type on both sides with provision of attaching/connecting with SNAP FIT arrangement W/o External

Busbars additional load break switches and circuit breakers in future whenever required. However, RMU shall be extensible on both side however left side is occupied by metering panel and right side is free for extension on vice versa is also possible depending on site condition. Alternatively Extension shall be possible by adding trunking chambers and required accessories or by plug-in bushing type arrangement.

The Package scope of work shall include survey, design, manufacture, FAT and delivery, installation and commissioning of equipments.

Ring Main Units capable of being monitored and controlled by the SCADA/DMS.

Where relevant, the RMU scope of work shall be coordinated with the work to be carried out under the project's other construction packages & associated materials to the designated destinations as per this tender specification and Bill of quantities. Includes supply of relevant 11KV cable termination kits per this tender Specification.

Each new RMU shall be equipped with main-line load break switches and a fault passage indicator (FPI). Furthermore, to protect each of its lateral / transformer feeders, it shall be equipped with a corresponding set of circuit breakers and relay with auxiliary supply (24V DC) shall be provided.

Configurations Required:-

11KV RMU

a) 2-Way - 11KV Gas (SF6) Insulated RMU with One 630A load break switches and One SF6 Insulated VCB of suitable rating.
b) 3-way - 11KV ,Gas (SF6) Insulated RMU with 2 Nos. 630A load break switch and 1Nos. SF6 insulated VCB of suitable rating or 3 Nos 630A load break switch
c) 4-way- 11KV Gas (SF6) Insulated RMU with 2Nos 630A Load break switches and 2Nos. SF6 Insulated VCB of suitable rating – or 3 Nos 630A Load break switches and 1Nos , SF6 Insulated VCB of suitable rating.
d) 5-way -11KV Gas (SF6) Insulated RMU with 2Nos 630A load break switch and 3No. SF6 insulated VCB of suitable rating -
e) 6-way -11KV Gas (SF6) Insulated RMU with 3Nos 630A Load break switches

and 3Nos , SF6 Insulated VCB of suitable rating –

PLS NOTE: THE NOMINAL CURRENT RATING OF VCB SHALL BE ACCORDING TO LOAD OF THE FEEDER AND ACCORDINGLY SUITABLE RELAY SHALL BE PROVIDED AND ANY CHANGE IN COMBINATION/CONFIGURATION SHALL BE EXECUTED WITH THE APPROVAL OF CHIEF ENGINEER OF RESPECTIVE DISCOM.

a. This Specification provides for design, manufacture, inspection and testing before dispatch, packing and delivery F.O.R.(Destination) of SF6 insulated RMUs with necessary take off terminal units for their satisfactory operation.

b. The objective of the RMUs is for extremely small construction width, 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.

c. 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.

d. 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.

- Necessary current sensors / transformers for protection and metering (wherever required).
- All necessary dry (potential-free) contacts for indications relevant to RMU monitoring status and control.

1.3 GENERAL:

The Ring Main Unit shall be installed at 11 KV junction points to have continuous supply by isolating faulty sections. The RMU shall be extensible on both sides 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.

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/PP based powder paint. The overall paint layer thickness shall be not less than 80 microns.

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 ERDA/CPRI.

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 robotic or TIG or MIG welded stainless steel, to have the best weld quality. The gas cubicle shall be metal enclosed with stainless Steel of thickness as per IEC

Tested/ designed so as to provide safety and to avoid leakage of gas and should be provided with a pressure relief arrangement away from operator.

Both the load break switches and the tee off circuit breaker must be motorized.

The cable termination chamber of isolators and circuit breakers both should be of front access type/Round end type as per site requirement.

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.

GENERAL TECHNICAL REQUIREMENTS

1. Fixed type SF-6 gas insulated / Vacuum circuit breakers. It should be maintenance free, having stainless steel robotically/ TIG / MIG welded enclosure for IN DOOR /OUTDOOR RMU. However, offer with high quality of the welding which has necessary extensive leakage test with leak rate of 0.075% per annum can be accepted. The RMUs to be used are only outdoor type.

2. Low gas pressure devices- 1.4 Bar pressure. 1.4 bar pressure of SF6 gas in chamber of RMU is required.

3. Live cable indicators- High operator safety.

4. Fully rated integral earthing switch on each device.

5. Back up relay with auxiliary supply (24V DC) shall be provided.

6. For indoor Cable boxes should be front access and interlocked with earth switch. No rear /side access required. For outdoor RMUs cable boxes shall be on front.

7. Cable testing possible without disconnection of cables.

8. Compact in dimension.

9. Circuit Breaker with back up relay with auxiliary supply (24V DC) shall be provided.

10. Low pressure, sealed for life equipment, can operate at "0" bar pressure.

11. Cable earthing switch on all switching device-standard, for operator safety.

12. Enclosure with IP 54 standard protection for OUTDOOR RMUs and IP2X for INDOOR RMUs

13. All live parts should be inside a stainless steel enclosure for out door type RMU & minimum 2 mm thickness of stainless steel robotically/TIG/MIG welded enclosure for Outdoor / indoor RMU.

TECHNICAL AND GUARANTEED PARTICULARS:

The bidders shall furnish all guaranteed technical particulars as called for in Schedule "A" of this specification. Particulars which are subject to guarantee shall be clearly marked. Bids lacking information in G.T.P are liable to be rejected

The Entire units or minimum three functions 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 25 years of service life.

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.

The offered switchgear and control gear should be suitable for continuous operation under the basic service conditions indicated below. Installation should be in normal indoor conditions in accordance with IEC 60694.

Ambient te**mperatur**e – 10 degree C to + 50 degree C

Relative humidity - up to 95%

Altitude of installation - up to 1000m, IEC 60120

1.3.1 The RMU shall be tested for an internal arc rating of 20 kA for 1 Sec. for 11 KV RMU. Suitable temperature rise test on the RMU shall be carried out & test reports shall be submitted with tender for technical bid evaluation.

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

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.

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.

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.

All the RMUs must be routine tested for the following at factory in India:-

- Micro-ohm test (Contact Resistance test) for the assembly inside the tank.
- Circuit breaker analyzer test so as to ensure the simultaneous closing of all poles for VCB.
- SF6 gas leak test.
- Partial Discharge test on the complete gas tank so as to be assure of the proper insulation level and high product life.
- High voltages withstand.
- Secondary test to ensure the proper functioning of the live line indicators, fault passage indicators and relays.
- As per IEC/IS standards Mechanical operation of RMU switch Must be carried out.

1.3.2 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.

DIELECTRIC MEDIUM

SF6 gas/ VCB shall be used for the dielectric medium for 11KV RMUS in accordance with IEC376. It is preferable to fit an absorption material in the tank to absorb the moisture from the SF6 gas/ VCB and to regenerate the SF6 gas/ VCB following arc interruption. The SF6 gas / VCB insulating medium shall be constantly monitored via a temperature compensating gas pressure indicator offering a simple go, no-go indication.

General structural and mechanical construction:

The offered RMU should be of the fully arc proof metal enclosed, free standing, floor mounting, flush fronted type, consisting of modules assembled into one or more units. Each unit is made of a cubicle sealed-for life with SF6 gas / VCB and contains all high voltage components sealed off from the environment.

The overall design of the indoor switchgear should be such that front access only is required. It should be possible to erect the switchboard against a substation wall, with HV and LV cables being terminated and accessible from the front.

The units should be constructed from Minimum 2 mm thick stainless steel sheets. However, Offer with type test report of pressure withstand test for gas filled compartment with pressure relief device test as per cl. no. 6-103-1 of IEC 62271-200-2003 can be accepted for 2mm stainless steel tank thickness. The design of the units should be such that no permanent or harmful distortion occurs either when being lifted by eyebolts or when moved into position by rollers.

For outdoor RMUs a weather proofing process shall be carried out. SHEET METAL MUST BE GRIT BLASED / THERMALLY SPRAYED AND POLYURETHANE PAINTED WITH ABOUT 80 MICRON THICKNESSES, TO ACHIVE OUTDOOR WORTHINESS AND CORROSION PROOF NESS.

- RMU ENCLOSURE MUST BE SHIELDED AGAINST SOLAR IRRADIATION AND TESTED FOR A

AMBIENT OF 50 DEGREE C WITHOUT DERATING OF THE EQUIPMENT.

The cubicle 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 is allowed to be exhausted out at the bottom / top / rear of the cubicle. A controlled direction of flow of the hot gas should be achieved.

The switchgear should have the minimum degree of protection (in accordance with IEC 60529)

- IP 67 for the tank with high voltage components
- IP 2X for the front covers of the mechanism

- IP 3X for the cable connection covers
- IP 54 for the outdoor enclosure.

1.4 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.

1. IEC 60 298/IEC 62 271-200/IS 12729:1988 - General requirement for Metal Enclosed Switchgear
2. IEC60129/IEC62271-103/ IEC62271-102/IS 9921 - Alternating current disconnector(Load break isolators) and earthing switch
3. IEC 62 271-100 & 200/IEC 60 056/IS 13118:1991 - Specification for alternating current circuit breaker
4. IEC 62 271-1/IEC 60694 - Panel design, SF6/Vacuum Circuit Breakers
5. IEC 60044-1/IEC 60185/IS 2705:1992 - Current Transformer
6. IEC 60265-1/IS 9920:1988- High voltage switches.
7. IEC 376 - Filling of SF6 gas in RMU.
8. IEC 60273/IS: 2099 - Dimension of Indoor & Outdoor post insulators i. with voltage > 1000 Volts.
9. IEC 60529/IS 13947(Part-1) - Degree of protection provided by
   i. enclosures for low voltage switchgear and
   ii. Control gear.
10. Indian Safety Regulations 2010/Relevant IS

Equipment meeting with the requirements of any other authoritative standards, which ensures equal or better quality than the standard mentioned above as well as latest standard 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)

Applicable Standards

- The RMUs shall be manufactured to the highest quality consistent with best practice and workmanship and in full accord with the Supplier's quality assurance plan. The RMUs shall conform to the Indian or IEC international standards that are applicable. These include the standards listed in Table **1** below.

Table 1: Applicable Standards

Standard	Description
IS 3427	AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
IS 12063	Classification of degrees of protection provided by enclosures of electrical equipment
IS 9920 (Parts 1 to 4)	High Voltage Switches
IS 9921 (Parts 1 to 5)	Specification for AC disconnectors and earthing switches for voltages above 1000 V
IS 13118	HV AC Circuit Breakers
IS 10601	Dimensions of terminals of HV Switchgear and Control gear
IS 12729	General requirements of switchgear and control gear for voltages exceeding 1000 V
IEC 1330	High voltage/Low voltage prefabricated substations
IEC 60694	Common clauses for MV switchgear standards
IEC 6081	Monitoring and control
IS 2705	Current Transformers
IS 3156	Voltage transformers
IS 8686	Specification for Static Protective Relays
IEC 62271-200	Standards for high voltage metal clad switchgear up to 52 KV.
INDIAN ELECTRCIATY REGULATION 2010	This is to be as per Central Electricity Authority (Safety Requirement for Construction, Operation & Maintenance of Electrical Plants and Electric Lines) Regulations, 2010

1.5 THE STANDARDS MENTIONED ABOVE ARE AVAILABLE FROM:

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

ISO - INTERNATIONAL STANDARD ORGANISATION

1.6 SPECIFIC REQUIREMENTS IN RMU:-

1.6.1 CLIMATE CONDITIONS

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

- Maximum ambient air temperature :50 deg. C
- Minimum ambient air temperature :10 deg.C
- Maximum daily average ambient air temperature :45 deg C
- Maximum humidity :100%
- Altitude above M.S.L. (maximum) :1000 metres
- Average annual rainfall(mm) :925
- Max. wind pressure(Kg/sq.m) :200
- Seismic level(Horizontal accn.) :0.3 g
- Iso-ceraunic level(Days per Year) :50
- Average thunder storm days per annum :50

1.6.2 Distribution Network Electrical Parameters

The main parameters of the distribution network are as follows:

- Rated Voltage :12 KV
- Nominal system voltage: :11 kV (rms)
- Highest system voltage: :12 kV (rms)
- Number of phases: :3
- Frequency: :50 Hz
- Variation in frequency: : 48.5 Hz to 51.5 Hz

- Type of earthing: :Solid
- Power frequency withstand voltage: :28 kV
- Basic impulse withstand voltage : :95 kV

1.7 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, 11 KV, 50 cycles, A.C. System with short-time current rating of 20KA for 3 seconds for 11 KV 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.

RMU Design Features

All design features of the proposed RMU, as described in the supplier's bid and in the bid's reference materials, shall be fully supported by the equipment actually delivered. The key design features include those that relate to:

- Maintainability, expandability, and life span
- Ability to operate in severe outdoor environmental conditions.
- Immunity to electrical stress and disturbance.
- Acceptable insulation properties.

INDOOR RMU

1. MODULAR DESIGN, PANEL TYPE WITH FRONT CABLE ACCESS.
2. RMU MUST BE MADE OF ROBOTICALLY / TIG / MIG WELDED STAINLESS STEEL.
3. Offered RMU must be extensible.

OUT DOOR RMU

1. Stainless steel enclosure for OUT DOOR RMU application. The manufacturers shall conform the normal current ratings mentioned in GTP at 50 deg. Ambient without derating or as per IEC Standard
2. Enclosure with I.P.54 standard protection.
3. Offered RMU must be extensible.
4. Cable boxes shall be on Front sides.
5. RMU ENCLOSURE MUST BE SHIELDED AGAINST SOLAR IRRADIATION AND TESTED FOR AMBIENT OF 50 DEGREE C. The manufacturers shall conform the normal current ratings mentioned in GTP at 50 deg. Ambient without derating, however, design for higher ambient temperature than 50 degree may be admissible.

1.8 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 remote operation. Each load break switch shall be of the triple pole, simultaneously operated, 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.

Load break switch should have the following

- Motor operated 12 KV, 630A Load Break switch and manually operated Earthing Switch with making capacity.
- "Live Cable" LED Indicators thru Capacitor Voltage Dividers mounted on the bushings.

- ❖ Mechanical ON/OFF/EARTH Indication and interlocking between earth and on/off conditions.
- ❖ Anti-reflex operating handle
- ❖ Cable Testing facility without disconnecting the cable terminations, cable joints and terminal protectors on the bushings.

Cable terminations

- ❖ Cable boxes suitable for 1 X 3C x 300 sq mm XLPE Cable with right angle Cable Termination Protectors.

1.9 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.

1.10 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:-

- 5P10 class protection CTs,
- low burden trip coil and
- O/C & E/F relay with auxiliary supply (24V DC) shall be provided

IDMT protection relays (Numeric/Micro processor based) 3 x over current and earth fault element shall be Definite Time type relay. The relay should be housed within a pilot cable box accessible.

THE NOMINAL CURRENT RATING OF PROTECTION CLASS CT SHALL BE 250/1 Amp. AND ACCORDINGLY SUITABLE NEUMERICAL RELAY SHALL HAVE TO BE PROVIDED. THE MINIMUM RELAY CURRENT SETTING RANGE FOR O/C: 20% TO 250% AND E/F:10 TO 250% SHOULD BE FROM 2% TO 100%. AND ANY CHANGE IN COMBINATION/CONFIGURATION SHALL BE EXECUTED WITH THE APPROVAL OF CHIEF ENGINEER (P&P), UGVCL.

Circuit Breaker should have the following:

- Motor operated 200 A / 630A SF6 insulated Vacuum circuit breaker and Earthing Switch with making capacity 51KA
- Mechanical tripped on fault indicator
- Auxiliary contacts 4NO and 4NC
- Anti-reflex operating handle
- “Live Cable” LED Indicators through Capacitor Voltage Dividers mounted on the bushings.
- O/C + E/F relay with auxiliary supply (24V DC) shall be provided.
- Shunt Trip circuit for external trip signal
- Mechanical ON/OFF/EARTH Indication
- Cable boxes suitable for 1 X 3C x 300 sq mm XLPE Cable with right angle Cable Termination / protectors / boots

TECHNICAL DATA

1 . Ring Main Unit, Electrical data :

Electrical data and service conditions

	Rated voltage	KV	**12**
1	Power frequency withstand voltage	KV	28
2	**Impulse withstand voltage**	KVp	95
3	Rated frequency	Hz	50
4	Rated current busbars	A	630
5	Rated current (cable switch)	A	630
6	Rated current (T-off)	A	630
	Breaking capacities:		
7	active load	A	630
8	closed loop (cable switch)	A	630
9	off load cable charging (cable switch)	A	135
10	earth fault (cable switch)	A	200
11	earth fault cable charging (cable switch)		115
12	short circuit breaking current (T-off circuit breaker)	kA	20 / 21
13	Rated making capacity	kA	52
14	Rated short time current 3 sec.	kA	20 / 21
	Ambient temperature:		
15	Maximum value	°C	+ 50

16	Maximum value of 24 hour mean	°C	+ 40
17	Minimum value	°C	0
18	Altitude for erection above sea level4	m	...1000
19	Relative humidity		Max 95%

2. Ring Main Unit Technical data (11KV):

No.	General data, enclosure and dimensions	
1	Standard to which Switchgear complies	IEC
2	Type of Ring Main Unit	Metal Enclosed, Panel type, Compact Module.
3	Number of phases	3
4	Whether RMU is type tested	Yes
5	Whether facility is provided with pressure relief	Yes
6	Insulating gas	SF6
7	Nominal operating gas pressure	1.4 bar @ 20° C. However offer with Nominal operating gas pressure shall be as per manufacturer standard and suitable to satisfy the rated dielectric strength can be accepted
8	Gas leakage rate / annum	0.075%
9	Expected operating lifetime	30 years
10	Whether facilities are provided for gas monitoring	Yes, temperature compensated manometer can be delivered
11	Material used in tank construction	Stainless steel sheet, minimum 2 mm

No.	Operations, degree of protection and colours	
1	Means of switch operation	separate handle
2	Means circuit breaker operation	separate handle and push buttons
3	Rated operating sequence of Circuit Breaker	O - 3min-CO-3min-CO
4	Total opening time of Circuit Breaker	approx. 45ms
5	Closing time of Circuit Breaker	approx. 40ms
6	Mechanical operations of switch (co)	1000
7	Mechanical operations of CO earthing switch	1000
8	Mechanical operations of circuit breaker (co)	2000
9	Principle switch / earth switch	3 position combined switch / earth switch
	Degree of protection:	
10	High Voltage live parts, SF6 / VCB tank	IP 67
11	Front cover mechanism	IP 2X
12	Cable covers	IP 3X
13	Outdoor Enclosure	IP 54
	Colours:	
14	Front cover	
15	Side and cable cover	

1.11 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.

1.12 CABLE BOXES

All the cable boxes shall be air insulated suitable for dry type cable terminations and should have front access. The cable boxes at each of the two ring switches should be suitable for accepting HV cables of sizes 3c x 300 sq.mm and circuit breaker cable suitable up to 3c x 300 sq.mm. The cable boxes for an isolator in its 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. In cable box bushing fitting required 3 KN capacities.

1.13 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.

1.14 VOLTAGE INDICATOR LAMPS AND PHASE COMPARATORS

The RMU shall be equipped with a phase wise voltage indication to indicate whether or not there is voltage on the each phase of 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 each phase cables. Indicator should be visible from outside without opening door.

1.15 EXTENSIBLE

Each combination of RMU shall have the provision for extension both sides 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 630 A.

1.16 WIRING & TERMINALS:

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), 20% 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.

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 flexible copper conductor wires with P.V.C insulation.

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. 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.

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.

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.

All wires directly connected to trip circuits of breaker or devices shall be distinguished by addition of a red color unlettered ferrule.

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 20% 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 circuits : Red, Yellow, Blue for phase and Black for Neutral

- CT circuits : similar to the above
- DC circuits : Grey for both positive and negative
- 250V AC circuits : Black for both phase and neutral
- Earthing : Green

The wiring shall be in accordance to the wiring diagram for proper functioning of the connected equipment. Terminal blocks shall not be less than 1100V grade and shall be piece-molded type with insulation barriers.

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.

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.

1.17 EARTHING

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.

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.

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 sq.mm. Each end of conductor shall be terminated by M 10/equivalent quality and type of terminal for connection to earth system installation. Earth conductor location shall not obstruct access to cable terminations.

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 (a) earthing switches (b) Cable sheath or screen (c) capacitors used in voltage control devices, if any.

The metallic cases of the relays, instruments and other panel mounted Equipments 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.

Two no. of earthing with connecting G.I Strip (size=35mm*3mm) are to be provided as per attached Drawing(Appendix-2) with ref IS:3043-1987(2006).

1.18 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.

1.19 TESTING OF EQUIPMENT & ACCESSORIES:

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

1.19.1 TYPE TEST

The Tenderers should, along with the tender documents, submit copies of all Type test certificate of their make including breaker and Isolators 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.

1.19.2 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 DISCOM's representative. The supplier shall give at least 15 days advance intimation to the DISCOM 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.

1.19.3 ADDITIONAL TESTS

The DISCOM 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.

1.19.4 PRE-COMMISSIONING TESTS

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

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

1.20 INSPECTION:

The inspection may be carried out by the DISCOM at any stage of manufacture. The supplier shall grant free access to DISCOM's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the DISCOM 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 DISCOM informed in advance, about the manufacturing programme so that arrangement can be made for inspection. The DISCOM reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The DISCOM 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 DISCOM in writing.

1.21 QUALITY 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 & raw materials.

III. List of areas in manufacturing process, where stage inspections are to be carried out.

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-à-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 15days from the date of receipt of Purchase Order submit following information to the DISCOM.

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 DISCOM's inspection. The quality assurance plan and hold points shall be discussed between the DISCOM 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.

1.22 TRAINING:

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

1.23 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 so that Utility will planned and carry out civil works etc.

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/Distribution. A soft copy of the all Technical and Drawing furnished in a CD

1.24 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. Last date of completion of Guarantee period
k. Rated lightening impulse withstand voltage
l. Feeder name (Incoming and Outgoing), DTs Structure name, 11000 Volts Dangers etc.

j Name of DISCOM

NOTE:

I) THE WORD RATED NEED NOT APPEAR ON THE NAME PLATE. RECOGNIZED ABBREVIATIONS MAY BE USED TO EXPRESS THE ABOVE PARTICULARS.

II) WHETHER THE CIRCUIT BREAKER IS FITTED WITH CLOSING/TRIPPING DEVICES NECESSITATING AN AUXILIARY SUPPLY SHALL BE STATED EITHER ON THE CIRCUIT BREAKER NAME PLATE OR ANY OTHER ACCEPTABLE POSITION.

1.25 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/cable 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.

FPI has to give indication on short circuit and earth fault both.

FPI Indication should be visible from outside without opening of door.

The FPI inside the RMU may be non communicable and hard wired to the TB for the signals

Fault Passage indicator OK
Fault Passage indicator operated

The conventional practice is to have (N-1) FPI where N is nos. of LBS in a particular configuration of RMU i.e. following for tendered RMUs:

2WAY	-	1
3WAY	-	1
4WAY	-	1
5WAY	-	2
6WAY	-	2

1.26 TROPICALISATION

Due regard should be given to the climatic conditions under which the equipment is to work. Ambient temperatures normally vary between 20 deg C and 40 deg C, although direct sun temperature may reach 45 deg C. The climate is humid and rapid variations occur, relative humidity between 60% and 95% 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.

1.27 TECHNICAL SPECIFICATION FOR RMU

1.27.1 11 KV Bus Bar

I. Current Carrying Capacity : 630 Amps.
II. Short time rating current for 3 secs. : 20 KA for 11kv
III. Insulation of bus bar : SF6
IV. Bus bar connections : Anti-oxide grease

1.28 PARAMETERS FOR SWITCH GEAR OF DT 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 :95 KV
VII. Rated power frequency withstand voltage :28 KV
VIII. Insulating gas :SF6
IX. Rated filling level for insulation :As Per IEC.
X. Max.permissible site altitude at the above gas pressures : 1000m
(The operating pressure has to be adjusted for greater altitudes)
XI. Isolating distance between ON and OFF position in isolator :80 mm (min).
XII. Rated short time current :20 KA.for 11kv
XIII. Rated short time :3s
XIIII. Rated peak withstand current :50 KA.
XV. No of operations in Short circuit :15Nos (minimum)

Operating mechanism: Circuit breaker with spring assisted anti reflex mechanism. Rated current (Bus): :630 A

Rated current (breaker) :200 A
Circuit Breaker interrupter :SF6 insulated VCB
Rated frequency : 50 Hz
Rated operating sequence :O-3min- CO
Number of mechanical/Remote operations for earthing : As per IEC & Ring switches & Number of mechanical/ Remote operations for circuit breakers 60298

1.29 PRINCIPAL FEATURES

Sr. No	DESCRIPTION	Breaker
1	Circuit label	Yes
2	Mimic diagram	Yes
3	Supply voltage indication	Yes
4	Current Transformer	Yes

5	IDMT O/C & E/F Numerical/Microprocessor relay with auxiliary supply (24V DC) shall be provided.	Yes
6	Anti - Reflexing Handle	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

1.30 Earthing switch for 11 KV Line side Isolation and DT

Rated short time current : 20 KA.for 11kv.
Rated short time :3s
Rated peak withstand current :50 KA
Interlocking facility:
1) Between 11 KV Line side isolator “ON”&Earthing.
2) Between 11 KV DT side breaker on close condition &earthing

1.31 Current Transformers for breaker

CT Type : Tape wound
CT Description : **THE NOMINAL CURRENT RATING OF PROTECTION CLASS CT SHALL BE 250/1 Amp. AND ACCORDINGLY SUITABLE NEUMERICAL RELAY SHALL HAVE TO BE PROVIDED. THE MINIMUM RELAY CURRENT SETTING RANGE FOR O/C: 20% TO 250% AND E/F:10 TO 250% SHOULD BE FROM 2% TO 100%.**
Accuracy Class CT :0.5/5P10 Rated burden : 15 VA.

Guaranteed Technical Particulars for Extensible SF6 insulated Ring Main Unit(Mandatory To be submitted by Bidder)

Sr. No.	Particulars	Units	To be specified by Bidder
A.	Service		
1.	Type		
2.	Number of Phases		
3.	Voltage		
4.	Rated Frequency		
5.	Rated Current		
6.	Short Circuit rating		
7.	Breaking (breaker)		
8.	Short time withstand 3S		
9.	Fault making		
10.	Insulation Level		
11.	System earthing		
B.	**B** Vacuum or SF6 Circuit Breaker		
1.	Type		
2.	Rated Voltage		
3.	Breaking Current		
4.	Making Current		
5.	Rupturing Capacity		
6.	Rated Current		
7.	No. of Poles		
8.	Operating mechanism		

9.	Breaker Operating Time		
10.	i) Break Time msec. ii) Make Time msec. iii) No. of Operations a) At full load current b) At Fault Current		
C.	Isolators		
1.	Type		
2.	Duty cycle		
3.	Rated current		
4.	Rated breaking capacity		
5.	Fault making capacity		
6.	Rupturing Capacity		
7.	No. of poles		
8.	Operating mechanism		
9.	SF6 tank		
10.	Interlocks		
11.	Operation safety		
D.	Busbars:		
1.	Material		
2.	Type		
3.	Rated Current		

4.	Short time rating for 3 Sec.		
E.	Cable Boxes		
1.	Air Termination		
F.	Current Transformer		
1.	C.T. Ratio		
2.	Over current factor		
3.	Class of accuracy		
4.	Rated Burden		
G.	Configuration(Left to Right facing front of Ring Main Unit)		
H.	Protection		
1.	Three phase over current and Earth Fault		
I.	Size of RMUs(L X W X D)(for civil works etc –under Utility scope)		
	1. 1 Circuit Breaker 1 Isolater 2. 1 Circuit Breaker 2 Isolater 3. 1 Circuit Breaker 3 Isolater 4. 2 Circuit Breaker 2 Isolater 5. 3 Isolator 6. 3 Circuit Breaker 2 Isolater		