

SECTION-III

(TN-2667)

A) TECHNICAL SPECIFICATION OF RING MAIN UNITS HAVING PROVISION FOR FUTURE MOTORIZATION AND SCADA COMPATIBILITY

- 1.0 Scope of work : Design, Engineering, Manufacturing, assembly, inspection and testing before despatch, packing & forwarding and delivery at site/stores of outdoor type compact 11KV Ring Main Units SF6 with Load break Isolators for 11 KV Incoming & Out going cables and VCB for Distribution Transformer with future provisions for motorization and necessary take off terminal units for future SCADA automations, other accessories and auxiliaries equipments and mandatory spares, described herein and required for their satisfactory operation in various locations of the Jaipur Vidut vitran Nigam Ltd., in following tentative quantity and combinations of load break isolators & breakers and all these units are shielded in a outdoor metal body with a dielectric media of SF6 gas/ solid state epoxy with provision of additional load break switches and circuit breakers extensible at both side:-

S.NO	COMBINATION DETAILS of RMU	NOS. REQUIRED
1	2 LBS + 1 VCB BOTH SIDE EXTENSIBLE	6
2	1 LBS BOTH SIDE EXTENSIBLE	2
3	1 VCB BOTH SIDE EXTENSIBLE	2
	G.Total	10

Nigam has right to purchase any quantity of any combination

Provision of all the RMU with necessary take off terminal units for future SCADA automations.

- 1.1 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. The dimensions of a RMU shall preferably be Approx. 1000x1000x1800 mm (WxDxH).
- 1.2 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 and purchaser shall have the right to reject any material which in his judgment is not in full accordance therewith.
- 1.3 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 / solid state epoxy confirming to relevant IS/IEC.

- 1.4 The complete RMU must be fully Type Tested including for Internal Arc Fault withstand for 20KA / 0.1 Seconds. as per latest Standard IEC 62271-100/200.
- 1.5 As the Ring Main Units will be installed mostly under existing half four pole / two pole structures, therefore RMUs having FOOT PRINTS that fits exactly underneath shall be preferred for certain specific requirements.

2.0 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 of the following standards.

IEC 60 298/ IEC 62271-200/IS 12729:1988	General requirement for Metal Enclosed Switchgear
IEC62271-102/ IS 9921	Alternating current Dis-connector's (Load break isolators) and Earthing switch
IEC 62271-100/ IEC 62271-200	Specification for alternating current circuit breakers.
IEC 62271-1/ IEC 60694	Panel design, Vacuum Circuit Breakers
IEC 60044-1/IEC 60185/IS 2705:1992	Current Transformer
IEC 62271-103	High voltage switches
IEC 60273/IS :2099	Dimension of Indoor & Outdoor post insulators with voltage > 1000 Volts
IEC 60529/IS 13947(Part-1)	Degree of protection provided by enclosures for low voltage switchgear and control gear
IEC 60255	Electrical Relays
IEC 60376	Filling of SF6 Gas in RMUs

The following parts of RMU shall be type tested for Degree of protection:-

- IP 67 - tank with high voltage components.
- IP 2X - front covers of the mechanism.
- IP 3X - cable connection covers.
- IP 54 - outdoor enclosure/kiosk.

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

3.0. SERVICE CONDITIONS:

All out door Equipment / material to be supplied against this specification shall be suitable for satisfactory continuous operation under tropical conditions as specified below:-

1.	Maximum ambient air temperature in shade	50 ⁰ C
2.	Minimum ambient temperature in shade	-2.5 ⁰ C
3.	Maximum Relative humidity	90%
4.	Minimum Relative humidity	10%
5.	Average Annual rainfall	10-100 Cm.
6.	Maximum wind pressure (Kg. Per sq. m.)	45
7.	Height above mean sea level	< 1000 Meter
8.	Dust storms are liable to occur during the period	March to July
9.	Average number of rainy days per annum	100
10.	Isoceraunic level (days / year)	40
11.	Moderately hot and humid tropical, climate, Conductive to rust and fungus growth	Yes
12.	Seismic level (horizontal acceleration)	0.08 g

Due regard should be given to the climatic/service conditions under which the equipment is to work. Ambient temperature normally vary between -02.5°C and 50 °C, although direct sun temperature may reach 55 °C. The climate is also moderately humid and rapid variations occurs, relative humidity between 70% 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.

4.0 TECHNICAL PARAMETERS OF RMU:

I. 11KV Bus Bar

Type of material	: Copper
Current Carrying Capacity	: 630 Amps.
Short time rating current for 3 secs.	: 20 KA
Insulation of bus bar	: SF6/solid state epoxy
Bus bar connections	: Anti-oxide grease

II. Parameters for Switch Gear of DT and load break isolators

Type	: Metal enclosed
No of Phases	: 3
No. of poles	: 3

Rated voltage	:12 KV
Operating voltage	:11 KV(+10% to –20%)
Rated lightning impulse withstand voltage	:75 KV
Rated power frequency withstand voltage	:28 KV
Insulating medium	:SF6/Solid State epoxy.
Rated filling level for insulation	:0.5 bar/As Per IEC.
Max.permissible site altitude at the above gas pressures:	≤1000m
(The operating pressure has to be adjusted for greater altitudes)	
Rated short time current	:20 KA.
Rated short time	:3s
Rated peak withstand current	:50 KA.
Operating mechanism	: Circuit breaker with spring assisted anti reflex mechanism.
Rated current (Bus):	:630 A
Rated current Load Break Isolator:	:630 A
Rated current (breaker)	:200 A
Circuit Breaker interrupter	:Vacuum Interrupter
Rated frequency	: 50 Hz
Rated operating sequence	:O-3min- CO
Number of mechanical/Remote operations for earthing & Ring switches	1000 Nos.
Number of mechanical/ remote operations for circuit breakers	2000 Nos.

III. PRINCIPAL FEATURES:

S. No	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 (3OC+1EF)	Yes
6	Anti-Reflexing Mechanism	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	Local /Remote Switch	Yes
10	Breaker ON/OFF indication	Yes
11	Spring Charge indication / Spring assisted mechanism.	Yes

12	Fault Tripping indication	Yes
13	Bus bar end caps	Yes
14	Whether the SF6 gas pressure gauge indicator and filling arrangement.	Yes
15	Whether the spring assisted mechanism with operating handle for ON/OFF.	Yes
16	Whether the earth positions with arrangement for padlocking in each position and independent manual operation with mechanically operated indicator are provided	Yes
17	RMUs are provided with necessary take off terminals for future SCADA automation.	Yes

IV.1 Load break switch(Isolators) :

Type : SF6/solid state epoxy load breaking and fault making.
 Rated current : 630 A
 Fault making capacity (KA peak min.) : 50 KA

IV.2 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 11 KV Line side isolator 'ON' & Earthing.
 2) Between 11 KV DT side breaker on close condition & Earthing.

IV.3 Current Transformers for breaker

CT Type : Tape wound
 CT Description :The CTs of DT breaker shall be suitable for sensing the minimum primary variable current in the order of 10-60 A and the secondary current for the CT is 1 A. The CT shall be housed in outside SF6 chamber for testing and Maintenance.
 Accuracy Class : Class 10P10 protection
 Rated burden : Suitable for Self Powered Relay.

5. GENERAL CONSTRUCTION FEATURE FOR RING MAIN UNIT:

The compact RMU shall be designed to operate at the rated voltage of 12 KV. It shall include, within the same metal enclosure, earthing switches for each Load Break Switch and Circuit Breaker for earthing each of the devices. Suitable fool-proof interlocks shall be provided to these earthing switches to prevent its inadvertent or accidental closing when the circuit is live and the concerned Load Break Switch/Circuit Breaker is in closed position. The limiting dimensions shall be preferably around 1000-mm width x 1000-mm depth x 1800-mm height for the initial two Load Break Switches and one Circuit Breaker. An additional width of 1000-mm for each addition of the

Circuit Breaker is allowed. Provision should be made for extension of few more Circuit Breakers or Load Break Switches on a future date. The degree of protection required against environment shall be not less than IPX4 of IS 12063. The Compact RMU shall have atleast an IP54 Protection Index as per IS 12063 against dust and splashing of water. The active parts of the switchgear shall be maintenance free and the Compact RMU shall be of low-maintenance type.

- 5.1 The Ring Main Unit shall be installed at 11 KV junction points to have continuous supply by isolating faulty sections. The RMU shall be both side extensible and consists of the combinations of load break switches and Circuit breakers for a nominal voltage of 12 KV using SF6 gas/ solid state epoxy as insulating and Vacuum as arc quenching medium.
- 5.2 The RMU and combination shall be 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 and subsequently painted with polyurethane based powder paint, the overall paint layer thickness shall be not less than 80 microns.
- 5.3 **Relevant IE rules for clearances, safety and operation inside the enclosure shall be applicable.** The enclosure shall be free from pollution, humidity, dust, vermin etc. IP-54 and type tested for accelerated aging & weather proof at EREDA/CPRI/any other testing house meeting PQR.
- 5.4 All high voltage live parts except for the cable connections shall be insulated with SF6 gas/solid state epoxy. The SF6 /solid state epoxy enclosure shall be made of robotically/laser / TIG/ MIG welded stainless steel/ hermetically sealed metalized cast resin tank without use of sealant, gaskets, 'O' rings, etc. and shall be type tested for IP-67 Degree of protection.
- 5.5 The cubicle shall be touch proof metallic encapsulation with a electro galvanized sheet steel of high thickness and provided with a pressure relief arrangement away from operator.
- 5.6 RMU should be suitable for motorization in future for remote operation through SCADA.
- 5.7 Any accidental over pressure inside the sealed chamber shall be limited by the opening of a pressure-limiting device in the rear/top part of the enclosure. Gas will be release to the rear of the switchboard away from the operator to ensure safety of the operating personnel and all the manual operations will be carried out on the front of the switchboard.
- 5.8 The enclosure for switchgear and metallic RMU housing 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 & Standard IEC 62271-100/200 and relevant TYPE TEST certificates shall be submitted.
- 5.9 The Entire units of RMU shall be in a single compact metal clad weather proof enclosure, outdoor type suitable for all weather conditions. The switchgear and bus

bar shall all be filled with SF6 at 0.5 bar G/IEC/IS Standards relative pressure to ensure the insulation and breaking functions. The enclosure must be sealed for life and shall meet the "sealed pressure system" criterion in accordance with the IEC 298 & 62271-100/200 standard .The RMU must be a system for which no handling of gas is required throughout the 30 years of service life.

- 5.10 Suitable temperature rise test on the RMU with enclosure shall be carried out as per relevant IEC/IS.
- 5.11 Each switchboard shall be identified by an appropriately sized label, which clearly indicates the functional units and their electrical characteristics.
- 5.12 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.
- 5.13 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.
- 5.14 The entire 11 KV RMU shall be insulated by inert gas (SF6) / solid state epoxy suitable for operating voltage up to 12 KV respectively. The 12 KV circuit breakers must be VCB. It is necessary to fit an absorption material in the tank to absorb the moisture from the SF6 gas to regenerate the SF6 gas following arc interruption. The SF6 insulating medium shall be constantly monitored via a temperature compensating gas pressure indicator offering a simple indication. All the combination of the RMUs should have the required SF6 insulation by providing necessary gas chamber capacity. The provision to indicate pressure of SF6 Gas on RMU Panel shall be provided.
- 5.15 The tank shall be made of suitable stainless steel/ cast resin tank of adequate thickness and shall be able to withstand any accidental internal over pressure of atleast 3 bars.
- 5.16 The Compact RMU shall be suitable for mounting on its connecting cable trench. A suitably sized nameplate clearly indicating its functional units and their electrical characteristics shall identify each unit. The positions of the different devices shall be clearly visible to the operator on the front of the compact RMU and the operations shall be clearly visible. The compact RMUs shall be such that access to live parts shall not be possible without the use of tools.
- 5.17 The design shall incorporate such features to prevent any accidental opening of the earth switch when it is in closed position. Similarly accidental closing of Circuit Breaker or Load Break Switch shall be prevented when the same is in open position from the release of any latch or spring in tension due to vibrations caused externally or internally and shall prevent accidents.

FORMATION OF COMPACT RMU:

- 5.18 The compact RMU shall be of single busbar outdoor, tropicalized in accordance with the relevant clauses mentioned in these specifications. An earth fault passage indicator using a core balance Current Transformer shall be provided for the Incomers to assist in identifying the faulty cable section in order to isolate the same.
- 5.19 The Incomers panel shall comprise of, but not limited to the following:
- A triple pole Solid State epoxy /SF₆ Load Break Switch rated 630 Amps or higher, with a rated making capacity under fault conditions with short circuit levels of 20 KA or above at 11 KV
 - Core balance Current Transformer and earth fault passage indicators (The indicator flag of the relay shall be visible till such time the relay is reset manually)
These shall not require any external Power Supply and must be suitable for unattended places.
- 5.20 The transformer loop circuit control panels shall consist of but not limited to the following:
- A triple pole Vacuum Circuit Breaker rated 200 Amps or higher, with a rated making capacity under fault conditions with short circuit levels of 20 KA or above at 11 KV
 - Manually charged spring closing mechanism
 - Electronic relay with associated Transformers of accuracy class 10P10 and tripping mechanism. CT burden shall be as per requirement of self powered Relay.
 - Mechanical "ON", "OFF" indicator
 - Manual tripping device
 - Mechanical "Spring Charged", "Spring Free" indicator in case of stored energy devices.
 - Provision for retrofitting meters and SCADA System

6. Sulphur Hexafluoride Gas (SF6 GAS) :

The SF6 gas shall comply with relevant standard IEC-376, 376A & 376B and shall be suitable in all respects for use in 12 KV panels under the operating conditions. The SF6 shall be tested for purity, dew point air hydrolysable fluorides and water content as per IEC-376, 376A & 376B and test certificate shall be furnished to the purchaser indicating all the tests as per IEC-376 for each Lot of SF6 Gas. The metallic enclosure should be tested for leakage at site.

7. RMU OUTDOOR METAL CLAD:-

The RMU enclosure must be a metallic; it follows an industrialized process of manufacturing. The RMU shall be of single bus bar SF6 gas/solid state epoxy insulated outdoor, tropicalised and metal enclosed type. The RMU metal parts shall be made of high thickness high tensile steel which must be grit/short blasted, thermally sprayed with Zinc alloy, phosphate and 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, 12 KV, 50 cycles, A.C. System with short-time current rating of **20KA for 3 seconds** with Panels.

TAKE OFF TERMINAL UNITS FOR FUTURE AUTOMATION :

The RMU should be provided with necessary take off terminal units for future SCADA automations. Both the load break switches and the tee off circuit breaker shall be suitable for motorization in future.

8. ISOLATORS (LOAD BREAK TYPE) :

The load break isolators for Incoming and Outgoing supply must be provided and the load break isolators are fully insulated by SF6 gas/Solid State Epoxy. 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 fascia, 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 earthing switch shall also be designed for rated fault making of 50KA for operator's safety reasons.

9. SCADA CONNECTIVITY:

Provision shall be made in all the RMUs with necessary take off terminal units for future automations / SCADA connectivity.

10. VACUUM CIRCUIT BREAKER :

The VCB for the controlling of Distribution Transformer must be provided inside the outdoor metal clad and insulated by SF6 gas/Solid State epoxy. 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 fascia, 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: The circuit breaker unit fitted with 3 class X protection CT's, a low burden trip coil and auxiliary switch assembly allowing the use of 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 100 KVA to 1000 KVA . The relay should be housed within a pilot cable box accessible. A facility of provision for the delay of transformer in-rush current shall be provided on relay to avoid nuisance tripping. Outlived/ defective batteries wherever provided shall be replaced promptly during the Guarantee period of RMU.

11. BUSHINGS :

The units are fitted with the standardized bushings that comply with IEC standards. All the bushings are the same height from the base and are protected by a cable cover. All the bushings shall be Partial Discharge free & preferably Laser welded with the SS container in case of stain less steel tank type RMU.

12. CABLE BOXES :

All the cable boxes shall be air insulated suitable for dry type cable terminations. The cable boxes at each of the two ring switches shall be suitable for accepting HV cables of sizes 3c x 300 / 3c x 185 sq.mm and circuit breaker cable be suitable up to 3c x 70 sq.mm.

- Necessary Right angle Boot should be supplied to the cable terminations. The type of the Right angle Boot should be cold applied insulating Boot.
- A non Ferro- magnetic cable clamp arrangement for 3 core XLPE cables must be provided for all cables terminated on the RMU. Glands in the base plate of the RMU shall be provided for proper Cable termination.

13. FAULT PASSAGE INDICATORS (FPI):

This shall be integral part of the RMU and shall be provided to assist in identifying the faulty cable section in order to isolate the same. The Fault Passage Indicators (FPI) shall have automatic reset facility and shall be suitable for trouble free operation. The indicator flag of the relay shall be visible till such time the relay is reset. LED indicating bulb should be provided for better visibility particularly in day time. The relay should not require any external power supply

14. CABLE TESTING FACILITY :

It shall be possible to test the cable without opening the cable boxes or 'where there is no provision for testing the cable without opening the door or cover', opening of door or cover should not be possible unless the earthing switch is closed as per IEC 298 clause 5.102.4. The cable testing should be possible without dismounting the cable plugs but the after opening the cable covers.

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. The indicating lamp shall be LED type for better visibility during day light.

16. EXPANDABILITY :

Each combination of RMU shall have the provision for future extension on both sides by load break isolators / Circuit breakers, with a suitable trunking chamber and accessories and necessary Bus Bar except for RMU having PT Panel which may be expendable only on one side. Extensible isolator(s) and circuit breaker(s) shall be individually housed in a separate SF6 gas/Solid State epoxy enclosures. Even 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.

17. BUS COUPLER/ BUS BAR SECTIONALISER WITH LOAD BREAK SWITCH

The load break switch of the Bus bar Sectionalizer shall be rated for 12 KV, 630A, 20KA for 3 secs. The LBS should be housed in a SF6/solid state epoxy Insulated stainless steel / cast resin enclosure conforming to IP-67 Degrees of protection and shall be with motorized mechanism. The sectionalizer shall be provided with all the necessary electrical and mechanical interlocks required for proper functioning with the Incomers.

18. PADLOCKING FACILITIES

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. The circuit breakers and earthing switches can be locked in the open or closed position by 1 to 3 padlocks 6 to 8 mm in diameter.

19. WIRING & TERMINALS:

The wiring should be of high standard and should 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. All wiring shall be provided with single core multi-strand copper conductor wires with P.V.C insulation and shall be flame retardant low smoke type. 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.

Flexible wires should 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 should 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 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. Colour code for wiring is preferable in the following colours.

Voltage supply	: 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 650V 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.

20. EARTHING :

EARTHING OF ISOLATORS AND DISTRIBUTION TRANSFORMER BREAKERS (EARTH SWITCH) :

Necessary arrangements shall be made at Load break isolators / Distribution Transformer 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.

The RMU outdoor metal clad, Switch Gear, Load break isolators, Distribution Transformer, LT pillar box, & steel structure etc., shall be equipped with an earth bus securely fixed along the base of the RMU.

When several units of the RMU (Extra Isolators / Breakers) are mounted adjoining to each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply. The size of the earth bus shall be made of IEC / IS standards with tinned copper flat for RMU earthing. Provision shall be made on end of RMU for connecting the earth bus to the earth grid.

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 Cross Sectional area of minimum 75 mm². 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.

The following items are to be connected to the main earth conductor by rigid or copper conductors having a minimum cross section of 75 mm² (a) earthing switches (b) Cable sheath or screen (c) capacitors used in voltage control devices, if any.

All 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 only and soldering shall not be permitted.

21. ACCESSORIES & SPARES:

The following spares and accessories shall be supplied free of cost, along with per 300 Nos. RMU or part thereof:-

1. Charging lever for operating load break isolators & circuit breaker of each RMU
2. Kit for identifying SF6 gas leakage – 5 numbers
3. All pressure gauges indications – 5 numbers
4. Necessary SF6 gas filling plant with adopter and tools etc for filling SF6 gas at Site --2 Nos
5. Necessary gas cylinders with adopter, pressure gauge for storage of SF6 gas – 2 Nos
6. Any other spares & Tools, which are all essentially required at the time of emergency and routine maintenance.

The following accessories shall be supplied with each compact RMU at free of cost:

1. Pad locks for all doors with one set (3 Nos.) Master keys
2. Earth bus formed out of 30X5 mm tinned Copper flat.

3. Wire guard protective mesh on the front doors and back for prevention of pasting of papers etc.
4. Base channel with foundation bolts
5. Live part shrouds, danger plates, caution boards, name plates, rating plates etc. as per requirements
6. All other components, even though not specifically mentioned, but required for the safe operation of the unit.

22. TESTING OF EQUIPMENT & ACCESSORIES:

22.1 INSPECTION & TESTING :

The inspection may be carried out by the JVVNL at any stage of manufacture. The supplier shall grant free access to DISCOM's representative at any 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 JVVNL reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The JVVNL 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 JVVNL in writing.

22.2 ACCEPTANCE AND ROUTINE TESTS :

All acceptance and routine tests as stipulated in the latest relevant IS/IEC shall be carried out by the supplier at his works in the presence of Nigam'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 cost towards these tests and other expenses shall be borne by the supplier.

22.3 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 tests, acceptance and routine tests at the cost of the DISCOM to satisfy that the material complies with the intent of this specification.

22.4 TYPE TEST

The Tenderers 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 laboratory/ testing house as detailed in Pre Qualifying Requirement (PQR) attached with.

The above type test certificates should accompany the drawings for the materials duly signed and certified by the institution who has issued the type test certificate. The following type test certificate shall be provided:

S. No.	Name of Type Test
01.	Short time current withstand test and peak current withstand test.
02.	Lightning Impulse voltage with-stand test
03.	Temperature rise test
04	Short Circuit current making and breaking tests <ul style="list-style-type: none"> ➤ CB ➤ Isolator
05.	Power frequency voltage withstand test (dry/wet)
06	Capacitive current switching test confirming to IEC
07.	Mechanical Endurance Test confirming to IEC /
08	Measurement of the resistance of the main circuit.
09	Checking of degree of protection
10	Switch, circuit breaker, earthing switch making Capacity <ul style="list-style-type: none"> ➤ CB ➤ Earth Switch
11	Switch, circuit breaker, earthing switch breaking Capacity <ul style="list-style-type: none"> ➤ CB
12	Internal Arc Withstand
13	Partial Discharge test on Complete RMU
14	Other type & routine tests insists by IEC for RMU

22.5 PRE-COMMISSIONING TESTS :

All the pre-commissioning tests shall be carried out by Nigam representative in the presence of the supplier's representative (if wish to present), for which 7 day advance intimation will be issued by field officer to the firm.

23.0 PERFORMANCE GUARANTEE

23.1 The performance Guarantee period shall be 5 (Five) years from the date of receipt of equipment along with its all accessories.

The supplier will be required to furnish a Performance Bank Guarantee @ 10% (for new suppliers)/ @ 5% (for old & established suppliers) amount of the total ordered value, which is required to be valid for 5 years.

23.2 Successful bidder shall attend the complaint within 15 days from the date of receipt of complaint. The date of receipt of complaint shall be treated as the date of FAX/ 3 days from the date of despatch of complaint by the field officer/ stores/ Purchaser. If the

supplier fails to attend the complaint within 15 days from the date of receipt of complaint intimated by the field officer/ purchaser then penalty @1/4% per week or part thereof for first 4 weeks in case delay is exceeds more than 4 weeks then @1/2% per week or part thereof shall be charged for entire delay, subject to a maximum of 5% . This penalty will be in addition to the penalty leviable towards delay in delivery mentioned in purchase order.

- 23.3 Further to this, in case of emergency, equipment can be get rectified by the field officer at the risk & cost of the supplier firm. The rectification of equipment means satisfactory performance report duly signed by the field officer
- 23.4 These guarantees shall supplement the general provisions covered under General Conditions of Contract in clause entitled "Guarantee".
- 23.5 Liquidated damages for not meeting specified performance shall be assessed and recovered from the supplier. Such liquidated damages shall be without any limitation whatsoever and shall be in addition to damages, if any payable under any other clause of General Conditions of Contract.

24.0. DOCUMENTATION

24.1 DRAWINGS

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.
- viii) Dimensional drawings of each material used for item Vii.
- ix) Actual single line diagram of RMU/RMUs with or without Extra combination 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 along with the initial supply of the equipments ordered.

5 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.

3 sets of the manuals as above shall be supplied to the Superintending Engineer(MM), JVVNL, Jaipur. A soft copy of the all Technical and Drawing furnished in a CD.

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

- 24.1.1 All drawings submitted by the Supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, dimensions, material description, Bill of Materials, weight of each component, break-up for packing and shipment, required fixing arrangement, the required dimensions for installation and any other information specifically requested in the Specification.
- 24.1.2 Each drawing submitted by the Supplier shall be clearly marked with the name of the Purchaser, the unit designation, the Specification title, the Specification number and the name of the Project. All titles, noting, markings and in writings on the drawing shall be in English. All the dimensions should be to the scale and in metric units.
- 24.1.3 The drawings submitted by the Supplier shall be reviewed by the Purchaser as far as practicable within 15 days and shall be modified by the Supplier if any modifications and / or corrections are required by the Purchaser in compliance with the Specification. The Supplier shall incorporate such modifications and or corrections and submit the final drawings for approval. Any delays arising out of failure by the Supplier to rectify the drawings in good time shall not alter the completion date.
- 24.1.4 The drawings submitted for approval to the Purchaser shall be in quadruplicate. One print of such drawings shall be returned to the Supplier by the Purchaser marked "approved / approved with corrections". The Supplier shall thereupon furnish the Purchaser additional print as stipulated in Technical Specification along with one reproducible in original of the drawings after incorporating all corrections.
- 24.1.5 Further work by the Supplier shall be strictly in accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.
- 24.1.6 All manufacturing and fabrication work in connection with the equipment / material prior to the approval of the drawings shall be at the Supplier's risk. The Supplier may make any changes in the design, which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Supplier's drawing or work by the Purchaser shall not relieve the Supplier of any of his responsibilities and liabilities under the Contract.
- 24.1.7 All rights of the design / drawing shall be strictly reserved with the Purchaser only and any designs / drawings / data sheets submitted by the supplier from time to time shall become the property of the Purchaser. Under no circumstances, the Supplier shall be allowed to use / offer above designs / drawings / data sheets to any other authority without prior written permission of the Purchaser. Any deviation to above is not acceptable and may be a cause of rejection of the bid.

24.2 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 & Expiry of Guarantee period
- (j) Rated lightning impulse withstand voltage
- (k) D.C. component of current.
- (l) Feeder name(Incoming and Out going),DTs Structure name,11000Volts Dangers etc.

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.

25. TRAINING:

The supplier shall give rigorous training to at least 25 JVVNL Engineers & staff at the site for 3 days in attending trouble shooting and maintenance. The cost towards transport, food and other expenses shall be borne by the supplier.

26. Furnishing of Type Test Reports in case of successful bidder:

"Successful bidder will have to furnish complete Type Test Reports before commencement of supply."

B) TECHNICAL SPECIFICATION OF RING MAIN UNITS FULLY MOTORIZED AND SCADA COMPATIBLE

Nigam is also intend to purchase RMU fully motorized with SCADA compatibilty for which additional features shall be incorporated in addition to metioned in the above specification of RMU having provision for future motorization & SCADA compatibility to fullfill the following requirement :-

- i) Both LBS & T-off VCB shall be compatible for remote operation through SCADA.
- ii) Fault Passage Indicator (Non-communicable) shall be provided with potential free contacts for SCADA compatibilty & should have provision for remote reset.
- iii) Protection & auxialry relay should have self resetting feature as well as remote resetting feature.

- iv) status (Potential free contacts) signal to SCADA – to be wired to marshalling terminal block:
- LBS close/open
 - LBS & CB Earth switch close/open
 - Battery Charger Fail
 - CB close/open
 - Protection relay operated
 - FPI operated
 - SF6 gas pressure low
 - Trip Coil healthy
 - Local remote
 - Spring charge
 - RMU door open
 - Power supply healthy
- v) Commands from SCADA – to be wired to marshalling terminal block: LBS close/open, CB close/open, FPI Reset etc.

The following are the specific requirement for SCADA connectivity & motorization:

Each RMU shall be fitted with a power supply unit, which includes 24/48 Volt DC battery & battery charger suitable for min. 5 Nos. operation on after failure of power supply. The power supply unit shall conform to following requirements:-

Input: 230 V AC /110 V AC with a possible variation of +/- 10%.

Output: Stable 24 / 48 V DC

Battery : 24/48 V DC .

The Power supply unit shall have sufficient capacity to supply power to the following devices with a nominal backup of 4 hour:-

- RMU's motor for minimum of 5 Nos. operations.
- RMU's trip coils, close coil, FPI (in case required).

The battery charger to meet out the above requirement shall be provided.

RMU fully motorized & SCADA compatible i.e. Type B shall be purchased with or without Battery Set & Battery Charger. Accordingly, Price may be quoted for the same in the Revised BOQ (Price Bid), available at the site of e-procurement.

C) TECHNICAL SPECIFICATION OF RING MAIN UNITS FULLY MOTORIZED AND SCADA COMPATIBLE WITH PT PANEL

In addition to the features incorporated in the above specification of RMU fully motorized with SCADA compatibility, following shall be added in the specification for purchase of RMU fully motorized with SCADA compatibility with PT Panel:

- i) Potential Transformers & Current Transformer with metering Core shall be provided for metering using MFT for DMS system.

- ii) 3 Nos. Current transformer shall be provided in Circuit Breaker for metering purpose in addition to 3 Nos. CT provided for protection purpose. The CT access for maintenance or any other purpose shall be from front only. The CT shall conform to relevant Indian Standards. The design & constructions shall be sufficient robust to withstand thermal & dynamic stress during short circuit. Secondary terminal of CT shall be brought out suitable to a terminal block which shall be easily accessible for testing & terminal connections. The CT ratio shall be 100-50/1 Amp. with accuracy class 0.5 with suitable burden.
- iii) 3 Nos. single phase Potential Transformers shall be provided. These should be housed in a separate air insulated PT panel, directly connected to RMU through main bus. The burden per transformer shall not be more than 50 VA and voltage ratio shall be 11 KV/110 V. The accuracy class shall be 0.5. The PT shall have cast resin epoxy construction and shall conform to relevant Standards. Their design & construction shall be robust to withstand thermal & dynamic stress during short circuit. Provision for installation of meter shall also be kept in the panel.

Bidder shall indicate separate price of (i) RMU having provision for future motorization & SCADA compatibility (ii)RMU fully motorized with SCADA compatible (iii) RMU fully motorized with SCADA compatible along with Potential Transformer Panel and (iv) Unit price for future motorization with SCADA compatibility in the price schedule separately.

Schedule – V(A)**GUARANTEED TECHNICAL PARTICULARS FOR 11 KV OUTDOOR RING MAIN UNITS AGAINST TN-2667****GUARANTEED TECHNICAL PARTICULARS****SCHEDULE OF GUARANTEED PARTICULARS FOR OUTDOOR METAL CLAD RMU**

01.	Manufacturer's Name and Country of origin	
02.	Manufacturer's Design / Type ref/Model.	
03.	Material used for making the body of the enclosure	
04.	Standards of manufacturing	
05.	Whether painting for RMU metal enclosure is done as per high standards.	
06.	Whether the enclosure is fire resistive, anti-corrosive	
07.	Whether the RMU metal clad is provided with sufficient space for integration of a) Minimum 2 numbers load break isolators and 1 number Vacuum Circuit breaker. b) Sufficient space for inspection, testing, etc c) Earthing arrangements d) Terminal output points for future SCADA automation e) Sufficient arrangement for future extension with Load break isolators/Breakers f) Arrangement/provision for motorization of Load break isolators/Breakers in future for SCADA automation.	
08.	Maximum temperature with stand of enclosure.	
09.	Spacing between live part to Earth	
10.	Whether the enclosure are designed to withstand the in all weather conditions (Seashore area, Chemical industries polluted area)	
11.	Period of guarantee of the RMU enclosure.	
12.	Over all dimensions of the RMU enclosure (L x B x H)	
13.	Gauge of the Material used for the fabrication of the RMU enclosure	
14.	Whether the RMU enclosure is manufactured as per IEC/IS standards to hold SF6 gas without leakage.	
15.	Whether the RMU enclosure made provision for sensors for temperature compensated pressure measurement in the relevant gas compartment to monitor the pressure of SF6 gas.	
16.	Whether the RMU enclosure is sealed pressure system.	
17.	Weight of RMU complete with operating mechanism.	
18.	RMUs are provided with necessary take off terminals	
19	Whether the gas chamber is made of stainless steel/cast resin tank	

SCHEDULE OF GUARANTEED PARTICULARS FOR DT BREAKER

01.	Manufacturer's Name and Country of origin	
02.	Manufacturer's Design / Type ref/Model.	
03.	Material used for making the body of the breaker	
04.	Standards of manufacturing	
05.	Whether the breakers are manufactured as per IEC/IS standards	
06.	Maximum temperature with stand of the breakers	
07.	1)Spacing between live part to Earth inside the breaker 2)Spacing between poles	
08.	Period of guarantee of the breaker	
09.	Rated frequency	
10.	Rated voltage	
11.	Highest system voltage	
12.	Rated current	
13.	Short time current rating with duration	
14.	Certificate or report of short circuit type test	
15.	Rated operating duty cycle	
16.	Short circuit breaking current (a)Symmetrical (b)Symmetrical at rated voltage ©Asymmetrical at rated voltage (i)Per Phase (ii)Average (d)DC Component	
17.	Arcing time (At rated breaking current) in ms.	
18.	Opening time	
19.	Total break time in milli sec. (a)At 10% rated interrupting capacity (b)At rated interrupting capacity	
20.	Breaking Current (a)Rated out of phase current (b)Rated cable charging current (c)Rated kilometric fault level (d)Rated capacitor breaking current	
21.	Make time in ms.	
22.	Maximum temperature rise over ambient (a)Main contacts Terminals	

23.	Rated restriking voltage at 100% and 50% rated capacity. (a)Amplitude factor (b)Phase factor ©Natural frequency (d)R.R.R.V.(Volts/micro sec.)	
24.	Dry 1 minute power frequency withstand test voltage (a)Between line terminal and earth KV RMS (b)Between terminals with breaker contacts open KV RMS.	
25.	1.2/50 full wave impulse withstand test voltage (a)Between line terminal and earth KVp. (b)Between terminals with breaker contacts open KVp.	
26.	VCB interrupter make	
27.	Contact separation distance	
28.	Type of main contacts	
29.	Contact pressure	
30.	Contact resistance	
31.	Life of the interrupter (in number of operations)	
32.	(i)Tripping at rated current (ii)Tripping at maximum fault current. (iii)Mechanical operations.	
33.	Details of main contacts making contact with the breaker truck with the panel	
34.	Control circuit voltage AC/DC.	
35.	Whether trip free or not	
36.	Whether all the interlocks provided	

SCHEDULE OF GUARANTEED PARTICULARS FOR LOAD BREAK ISOLATORS & EARTHING ARRANGEMENTS

SL.NO.	DESCRIPTION	ISOLATORS	EARTHING SWITCH FOR DT & ISOLATOR
01.	Manufacturer's Name and Country of origin		
02.	Manufacturer's Design / Type ref/Model.		
03.	Material used for making the body of the isolators .		
04.	Standards of manufacturing		
05.	Whether the isolators & earth positions are manufactured as per IEC/IS standards		
06.	Maximum temperature with stand of the isolators & earth switches		
07.	1)Spacing between live part to Earth 2)Spacing between fixed and moving contacts in the open position.		
08.	Period of guarantee of the isolators		
09.	Rated frequency		
10.	Rated voltage		
11.	Highest system voltage		
12.	Rated current		
13.	Short time current rating with duration		
14.	Certificate or report of short circuit type test		
15.	Rated operating duty cycle		
16.	Short circuit breaking current		
17.	Arcing time (At rated breaking current) in ms.		
18.	Opening time		
19	Whether all the interlocks provided		
20	Whether Sufficient arrangements are made to operate the isolators through SCADA in future, also to be ensured for provision of space for accommodation of motor in future		
21	Fault passage indicator 1)Type/Model 2)Self powered Yes/No 3)Current readings 4)Fault currents 5)Phase currents		

SCHEDULE OF GUARANTEED PARTICULARS FOR CURRENT TRANSFORMERS

01.	Manufacturer's Name and country of origin	
02.	Manufacturer's design ref / model	
03.	Applicable Standards	
04.	1)Type of CT 2)Ratio	
05.	Rated Primary current	
06.	Rated secondary current	
07.	Rated frequency	
08.	Transformation ratio	
09.	Number of cores	
10.	Rated output (a) For Core-I	
11.	Class of insulation	
12.	Class of accuracy For Protection	
13.	Short time current rating and its duration	
14.	Secondary resistance at 70 Deg °C	
15.	Continuous over load (percentage)	
16.	One minute power frequency dry withstand voltage	
17.	1.2/50 micro sec. impulse withstand test voltage	
18.	One minute power frequency withstand test voltage on secondary	
19.	Instrument safety factor	
20.	Type of primary winding	
21.	Literature/leaflets pamphlets about the current transformer offered	
22.	Period of guarantee	

**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR SELF POWERED
MICRO PROCESSOR BASED NUMERICAL RELAYS**

01.	Manufacturer's Name and Country of origin	
02.	Manufacturer's design / Ref. Type	
03.	Applicable Standards	
04.	CurrentSetting range for (a)Overcurrent relay	IDMT
	(b)Earthfault Element	Definite Time
05.	Whether the relay has the in-built facilities of IDMT, OL, EL	
06.	Details of IDMT Characteristics	
07.	Accuracy for different settings and limits of errors	
08.	Whether Alpha numeric / LED display	
09.	Whether compatible for 1 A CT Secondary	
10.	Whether draw out type	
11.	Types of case	
12.	Reset time	
13.	Burden of relay	
14.	Maximum and Minimum, operating ambient air temp.	
15.	Whether technical literature pamphlets about the relay offered.	
16.	Period of guarantee.	
17.	Certificate of Proof for Electro Magnetic Interference.	

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR DRAWINGS.

01.	RMU	
02.	General arrangement drawing of panels in station	
03.	Engineering drawing for each panel including foundation details	
04.	Wiring schedule	
05.	Terminal block arrangement drawing	
06.	Descriptive operation and maintenance manual for individual items such as relays, meters, switches recorders etc.	
07.	Any other drawing required for complete understanding of the equipments supplied.	
08.	i)Foundation drawings of RMU ii)Dimensional drawings of each materials used.	

Name of Firm
Signature of Bidder
Designation & Seal
Date
