

22 kV, 630 Amps, Extensible / Non extensible type,  
Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker



Maharashtra State Electricity Distribution Company Limited

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Specification No. T&QC: MSC-I/ 22 kV, 630 Amps, Extensible / Non extensible type,  
Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum  
Circuit Breaker /2020/01

Technical Specification

Of

22 kV, 630 Amps, Extensible / Non extensible type,  
Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum  
Circuit Breaker

For

Distribution System

In

MSEDCL

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,  
Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

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## **MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.**

### **Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,**

### **Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker**

#### **1.0 Scope:**

- i) This specification covers design, manufacture, assembly, Stage inspection, testing before supply, inspection, packing and delivery of SF6 gas filled 22 kV, 630 Amps, Extensible / Non extensible type, Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker.
- ii) The Ring Main Unit shall be complete with all the accessories and auxiliary equipments required for their satisfactory operation in Distribution Network of MSEDCL in Maharashtra State, India.
- iii) The Ring Main Unit should have compatibility with Open Protocol Control and data Acquisition system. The Ring Main Units capable of being monitored and controlled by the Supervisory Control and data Acquisition (SCADA)/ Distribution Management System (DMS). The Ring Main Units should have the castell lock for avoiding dual supply and safety purpose.
- iv) The Ring Main Unit shall be complete with various combinations of Load Break Isolators & Circuit Breaker for Distribution transformers center and feeders.
- v) The Ring Main Units to be supplied against this specification are required for vital installations where continuity of service is very important. The design, materials and manufacture of the Ring Main Unit shall, therefore, be of the highest order to ensure continuous and trouble-free service over the years.
- vi) It is not the intent to specify, completely here in all the details of design and construction of the Ring Main Unit. However, the Ring Main Unit shall conform, in all respects to high standards of engineering, design and workmanship as per recent Indian standards or International standards. It shall be capable of performing in continuous commercial operation up to the supplier's guaranteed life of Ring Main Unit in a manner acceptable to the purchaser who will interpret the meanings of drawings and specifications and shall have power to reject any work or material which, in his judgment, is not in accordance therewith. The Ring Main Unit offered shall be compact, maintenance free, easy to install reliable, safe and easy to operate and complete with all parts necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of supplier's supply, irrespective of whether those are specifically brought out in this specification and/or in the commercial order or not.
- vii) Recommended spares: The bidder shall furnish in his offer a list of recommended spares with unit rates for each set of Ring Main Unit that may be necessary for satisfactory operation and maintenance of Ring Main Unit for a period of 5 years.

The purchaser reserves right of selection of items and quantities of these spares to be ordered. The cost of such spares shall not be considered for tender evaluation.

- viii) **Erection and maintenance tools:** The bidder shall submit a list and unit rates of all the special tools, equipment and instruments required for erection, testing, commissioning and maintenance of the Ring Main Unit. The purchaser shall decide the quantity of tools to be ordered. Prices of these tools shall not be considered for tender evaluation. However, the list of necessary tools/equipment which will be supplied free of cost with each Ring Main Unit may be furnished separately.
- ix) The Bidder shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

## 2.0 System Particulars:

- |      |   |   |  |
|------|---|---|--|
| 2.1  | Nominal System Voltage  | : | 22 kV  |
| 2.2  | Voltage variation on supply side                                      | : | ±10 %  |
| 2.3  | Corresponding Highest System Voltage:                                 |   | 24 kV  |
| 2.4  | Frequency   | : | 50 Hz with ± 3 % tolerance                                   |
| 2.5  | Transient condition   | : | -20 % or + 10 % combined variation of voltage and frequency. |
| 2.6  | Number of Phase   | : | 3 Phases   |
| 2.7  | Neutral earthing  | : | Solidly earthed.   |
| 2.8  | Fault level (minimum) kA /Sec   | : | 21/3   |
| 2.9  | Lightning Impulse Withstand Voltage (kVp)                             | : | 125  |
| 2.10 | One minute dry/wet power frequency withstand voltage primary (kV rms) | : | 50   |
| 2.11 | Rated Dynamic Withstand Current for 1 second duration (kAp)           | : | 52.5   |

## 3.0 Service Conditions :

- A) The SF6 gas filled 22 kV, 630 Amps, Extensible / Non extensible type, Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

- |     |   |          |
|-----|---|----------|
| 3.1 | Maximum ambient temperature (Degree C)  | 50       |
| 3.2 | Maximum temperature in shade (Degree C) | 45       |
| 3.3 | Minimum Temperature (Degree C)          | 3.5      |
| 3.4 | Relative Humidity (percent)             | 10 to 95 |
| 3.5 | Maximum Annual rain fall (mm)           | 1450     |
| 3.6 | Maximum wind pressure (kg/sq.m)         | 150      |

3.7	Maximum altitude above mean sea level ( Meter)	1000
3.8	Isoceranic level (days per year)	50
3.9	Seismic level (Horizontal Acceleration)	0.3 g
3.10	Climatic condition humid	Moderately hot and

tropical climate conducive to rust and fungus growth

B) The climatic conditions are prone to wide variations in ambient conditions and hence the SF6 gas filled 22 kV, 630 Amps, Extensible / Non extensible type, Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker shall be of suitable design to work satisfactorily under these conditions.

**4.0 Objective of Work & Tolerances:**

It is intended to have

- a) Enhanced safety and reliability.
- b) Maintenance free Ring Main Units.
- c) Reduction in space requirement
- d) Integrated remote control and monitoring-SCADA compatible

**Tolerances:** Tolerances on all the dimensions shall be in accordance with provisions made in the relevant Indian/International standards amended up to date and in this specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality of the product.

**5.0 Auxiliary Power Supply:**

- a) A. C. supply shall be provided for Control & Protective devices, lighting fixtures, space heaters and motors.
- b) D.C. supply shall be provided for alarm, control and protective device.

The rating, quality and location of electrical supply system that will be made available by the supplier for operation of the Ring Main units are described below:

i.	A. C. Supply	230 volts with $\pm 10\%$ variation
ii	D.C. Supply	24 V DC to 30 V DC with +10% to - 15% variation
iii	Frequency	50 Hz with $\pm 3\%$ variation

**6.0 Applicable Standards:**

- a) The design, manufacture and performance of the Ring Main Units shall comply with all currently applicable statutes, regulations and safety codes.

Nothing in this specification shall be construed to relieve the bidder off his responsibilities.

- b) Unless otherwise specified, the Ring Main Units offered shall conform to the latest applicable Indian, IEC, British, U.S.A. or International Standards and in particular, to the following:

Sr. No.	Standards	Particulars
1.	IEC 62271- 200/ IEC 60 298/ IS 12729 : 1988	General requirement for Metal Enclosed Switchgear
2.	IEC 265	Medium Voltage Switches
3.	IEC 60129/ IEC 62271 - 102/ IS 9921	Alternating Current disconnectors (Load Break Isolators) and earthing switch
4.	IEC 62271-100/IEC 60056/ IS 13118 : 1991	Specification for alternating current breakers
5.	IEC 62271 - 1/ IEC 60694	Panel design, SF6/ Vacuum Circuit Breakers
6.	IEC 60044 -1/ IEC 60185/ IS 16227 (Part-1)/(Part-2) /2016	Current Transformers
7.	IEC 60265/IS 9920 : 1981	High voltage switches
8.	IEC 376	Filling of SF6 gas in RMU
9.	IEC 60273/ IS : 2099	Dimension of Indoor & Outdoor post insulators with voltage > 1000 V
10.	IEC 60273/ IS 13947 ( Part1)	Degree of protection provided by enclosures for low voltage Switchgear and control gear.
11.	IEC 60694	Common clauses for high voltage switchgear and control gear standards
12.	IEC 62271-103	High voltage switches for rated voltages above 1 KV and less than 52 KV.
13.	IEC 60137	Bushings for alternating voltages above 1000 V
14.	IEC 60233	Tests for hollow insulators for use in electrical equipment
15.	IEC 60376	New Sulphur hexafluoride (SF6)
16.	IEC 60480	Guidelines for checking and treatment of Sulphur hexafluoride (SF6)
17.	IEC 61243-5	Voltage detection systems
18.	IEC 60044-2	Potential transformers
19.	IEC 62271-209	Cable connections for gas insulated switch gears
20.	IS:2544/1973	Porcelain Post Insulators / Resin cast insulators
21.	IS 8828/1996	MCB
22.	IS 12063/1987	Degree of protection provided for enclosures for electrical equipment.
23.	IS 5/2005	Colors for ready mixed paints and enamels.
24.	IS 5578/1984	Marking of insulated conductor.
25.	11353/1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals
26.	IS 1248/2003	Indicating instruments.
27.	IS 14697/1999 amended up to date & as per updated technical specifications of MSEDCL	HT Static tri vector TOD Energy meters
28.	IS 6875 amended up to date	Control switches.

29.	IS 3231/1986	Electrical Relays for Power System Protection.
30.	IEC 60255 amended up	Numerical protection relays.
31.	IS 8686/1977	Static protective relays.
32.	IS 4794/68 & 86	Push button.
33.	IS 9431/1979	Indoor post insulator of organic material
34.	IEC 60529 / EN 60529	Protection against accidental contact, foreign Objects and water.
35.	IEC 60529	Classification of degrees of protection provided enclosures of electrical equipment
36.	IEC 60298	A.C metal-enclosed switchgear and control gear for rated voltages above 1KV and up to and including 52kV
37.	IEC 1330	High voltage/Low voltage prefabricated substations
38.	IEC 60801	Monitoring and control
39.	BS 159	Bus Bar
40.	CP 1013(British Code of Practice)	Earthing
41.	IEC 60255	Specification for Static Protective Relays
42.	BS 6231	Wires and wiring
43.	IEC 61000	Electromagnetic compatibility
44.	IEC 60129	Alternating current Disconnecter (isolators) and earthing switches
45.	IEC 60060-1, BS 923	High Voltage test technique
46.	IEC 60947-4-1	Control Gears

All Indian Electricity Rules/ Bills amended up to date applicable for clearances, safety and operation of the equipment.

The Ring Main Unit meeting with the requirements of any other standards, which ensures equal or better quality than the standard mentioned above shall also be acceptable. If the Ring Main Unit, offered by the bidder conforms 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 in Hard Copy shall be furnished along with the offer.

## 7.0 General Requirement of Ring Main Unit:

The Ring Main Unit shall be installed at 22 kV junction points such as 200kVA, 315kVA, 630kVA distribution transformers centers or feeder branches to isolate faulty section. The Ring Main Unit shall be both Non extensible/Extensible. Two Load break isolators for incoming & outgoing cables and one Circuit breaker for transformer or feeder protection shall be enclosed in the main tank using SF6 gas as insulating and vacuum as arc quenching medium.

7.01 The Inner tank shall be stainless steel sheet of minimum 2mm thickness and robotically welded with a pressure relief arrangement.

- 7.02 Both the load break switches and circuit breaker shall be suitable for motorization.  
The total breaking time for transient fault should not exceed 40-60 ms (CB + Relay+ trip coil).
- 7.03 The main tank (Inner enclosure of Circuit Breaker & Load break Isolators assembly) and all Switchboard assembly shall be housed in a single compact metal clad suitable for both indoor/outdoor applications.  
The design of enclosure for Switchgear, Ring Main Unit & Switchboard housing shall be in accordance with IEC 298. The design of Ring Main Unit shall be in accordance with the Technical Specification.  
The switchgear and switchboard shall be designed such that the position of the different devices shall be visible to the operator on the front of switchboard and easy to operate and prevent access to all live parts during operation without the use of tools. There shall be no access to exposed conductors.
- 7.04 Circuit Breaker supplied with each Ring Main Unit shall be Vacuum Circuit Breaker. Insulating media for Bus Bar, Load Break Isolator, Earth Isolator and other associated equipment in Inner enclosure should be SF6 Gas.  
An absorption material such as activated alumina in the tank shall be provided to absorb the moisture from the SF6 gas to regenerate the SF6 gas following arc interruption. A temperature compensating gas pressure indicator offering a simple indication shall constantly monitor the SF6 insulating medium.
- 7.05 Each Ring Main Unit shall include its own power supply unit (including auxiliary transformer, batteries, and battery charger), which shall provide a stable power source for the Ring Main Unit. The auxiliary transformer of rating 500VA 22 kV/230 Volt shall be provide a stable power source which will supply **230V AC** for Remote Terminal unit (RTU).  
The Ring Main Unit shall also provide the necessary space for housing the Remote Terminal unit (RTU). In addition, space must be provided for auxiliary power transformer, which shall serve as the AC power supply 230 V inputs, along with all other Ring Main Unit devices.
- 7.06 Within this context, the general requirements of the Ring Main Unit shall include, but shall not be limited to provision of the following monitoring and control features:
- i) Positions of local/remote switches as used to control local and remote access to circuit breakers and load break switches.
  - ii) Power supply indications including battery failure and voltage alarms.
  - iii) Open/Closed position of load break switches, circuit breakers, and earthing switches.
  - iv) Enclosure door-open indications
  - v) SF6 gas-pressure low alarm
  - vi) Circuit breaker spring and load break switch charge (switch readiness) indications
  - vii) Circuit breaker relay indications
  - viii) Indications of fault current in the Ring Main Unit main feeder circuit as detected by the Fault Passage Indicator (FPI).
  - ix) Measurement of 22 kV voltages, current, power, energy, and power factor values as per voltage level.
  - x) Load break switch and circuit breaker open/close control
  - xi) Fault Passage Indicator (FPI) reset control
  - xii) Automatic Water Level Control

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xiii) Relay settings control

The acceptance of the RMUs shall not be complete until they have been demonstrated on a point-to-point basis to be fully interoperable with the Remote Terminal unit (RTU).

- 7.07 The Ring Main Unit shall be provided with necessary take off terminal units for automations and all these units should be shielded in an outdoor metal-body enclosure for making them suitable for Outdoor / Indoor use. The insulation/dielectric media of Inner enclosure the Non ferrite & Non magnetic grade stainless steel tank should be SF6 gas. The Ring Main Units shall be extensible on both sides.
- 7.08 The Ring Main Units should be motorized and suitable to be connected to Field / Feeder Remote Terminal unit (F-RTU) so as to be monitored and controlled through Supervisory Control and data Acquisition (SCADA)/ Distribution Management System (DMS).
- 7.09 A remote terminal unit (RTU) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA (Supervisory Control and Data Acquisition) system by transmitting telemetry data to a master system, and by using messages from the master supervisory. The Supervisory Control and Data Acquisition (SCADA) system is the heart of Distribution Management System (DMS).
- 7.10 The Ring Main Unit shall be equipped with main-line load break switches and a fault passage indicator (FPI). Furthermore, to protect each of its transformer / feeders, it shall be equipped with a corresponding set of circuit breakers and self-powered numerical relays. The Ring Main Unit shall include potential-free contacts and control contacts so as to connect to SCADA/DMS via FRTUs, so as to:
  - i) Monitor and control the open/closed status of the Ring Main Unit circuit breakers and load break switches.
  - ii) Monitor the local/remote position of Ring Main Unit motorized (in case of failure of motor) manually-operated switches that can be used to enable and disable remote monitoring.
  - iii) Monitor the health of the power supply, which will include battery failure and low voltage indications.
  - iv) Monitor the open/closed status of Ring Main Unit earthing switches.
  - v) Monitor the open/closed status of RMU enclosure doors in case of Hinge doors.
- 7.11 FRTU, Modem, Power and I/O cable interface between FRTU and Control panel of Ring Main Unit /sectionalizer are excluded in the scope of supply and these items will be provided by MSEDCL.

**8.0 Principal Technical Parameters of Ring Main Unit and accessories:**

The Ring Main Unit and accessories covered under this specification shall conform to specific parameters given below:

Sr. No.	Description	22 kV Ring Main Unit
<b>A) Ring Main Unit Assembly</b>		
1.	Indoor / Out door	Indoor / Out door
2.	Configurations(Type)	3 Way, M+LLV+ 4 Way, +LLLL+ 4 Way, M+LLL+V+ 4 Way, M+LLVV+ 5 Way, M+LLVVV+ 6 Way, +LLVVV+V+ L= Isolator.

		V= VCB. M=Metering
3.	Reference Standard	IEC-62271-100, 200, 103, IEC-62271-1
4.	Rated Voltage in kV	22
5.	Highest System Voltage in kV, Max.	24
6.	Number of Phase	3
7.	Frequency in HZ.	50 Hz $\pm$ 3%
8.	Short Circuit rating	
	a) Breaking Symmetrical for 3 Sec. in KA	21
	b) Breaking Asymmetrical for 3 Sec. in KA	21
	c) Short time for 3 Sec. in KA.	21
9.	Insulation Level	
	a) Impulse withstand in KV peak.	125
	b) 1 Minute 50 Hz. Voltage withstand in KV rms	50
10.	Internal arc rating for 1 sec. in kV	21
11.	Construction: Material and Size	
	Inner Enclosure	Main Stainless Steel Tank with 2 mm Thickness
	Outer Enclosure	CRCA Sheet of 2 mm thickness or Galvanized Sheet of 1.6 mm thickness
12.	Degree of protection	
	Inner Enclosure	IP 67
	Outer Enclosure	IP 54 (Main Door close) and IP 41 (Main Door open)
13.	The Ring Main Unit and accessories completely wire and tested at factory	Yes
14.	Paint	Polyurethane based powder paint
15.	Color	Dark Admiralty Grey, Shade No. 632 as per IS: 5, 2007
16.	Thickness of coat, Min.	150 microns for CRCA Sheet and 80 microns for galvanized sheets
<b>B) Bus Bar</b>		
17.	Reference Standard	IS: 1897, 2008
18.	Grade and Material	Electrolytic Grade Copper
19.	Cross sectional area in mm <sup>2</sup>	400
20.	Size in mm or as per design	40 x 10
21.	Current Density in Amps/mm <sup>2</sup> , Max.	1.6
22.	Continuous Current in Amps	630
23.	Maximum temperature rise over an ambient temperature 50°C.	55°C
24.	Short time current rating for 3 Sec in kA	21

	rms	
25.	Clearance in mm from bare bus bar or as per design	
	Phase to Phase for Isolator or as per design	78
	Phase to Phase for VCB	78
	Phase to Earth for Isolator or as per design	78
	Phase to Earth for VCB or as per design	78
26.	Bus Supports	
	Reference Standard	IEC 60243-1, ASTM D 648
	Voltage Class in kV	22 kV
	Creepage distance in mm or as per design	125 in SF6 gas
	Bus Bar support spacing in mm or as per design	125
27.	Filling SF6 gas pressure (Filling pressure at 20°C), Min.	1.4 Bar
28.	Operating SF6 gas pressure at 20°C, Min.	0.5 Bar
29.	Reference Standard	IEC 62271-100
30.	Rated Voltage in kV	22
31.	Highest System Voltage in kV, Max.	24
32.	Type	Vacuum Type
33.	Rated Frequency in Hz.	50 Hz $\pm$ 3%
34.	No. of Poles	3
35.	Rated Current	630A
36.	Maximum temperature rise over an ambient temperature 50°C.	55°C
37.	Rated operating Duty	O-3min-CO-3min-CO
38.	Rupturing capacity at rated voltage in MVA, Min.	As per design
39.	Breaking Capacity at rated voltage & operating duty	
	Symmetrical in kA rms	21
	Asymmetrical in kA rms	21
40.	Rated making current in kA peak	52.5
41.	Short time current for 3 sec in kA rms	21
42.	Transient Recovery Voltage	
	Rate of rise in kV/ $\mu$ s	0.34 kV/ $\mu$ s as per IEC 62271-100
	Peak Voltage in kV	50
43.	Insulation Level	
	Impulse Voltage with stand on 1.2/50 $\mu$ s full wave in kV	125
	1 minute power frequency voltage withstand in kV	50
44.	Total breaking time for transient fault ( CB + Relay+ trip coil) in ms	45-50 ms
45.	Opening time No load condition in ms	45-50 ms
46.	Opening time under SF6 gas low or vacuum loss condition in ms	45-50 ms

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47.	Number of breaks per pole	Single
48.	No of breaker operations permissible without requiring inspection replacement of contacts and other Main parts	
	At 100% rated current	2000
	At 100% rated breaking current, Min.	20
49.	Type of contacts	
	Main	Butt Type
	Arcing	Butt Type
50.	Material of contacts	
	Main	Copper
	Arching	Copper
	Chromium / Silver plated	Chromium / Silver plated
51.	Mechanical Endurance Test for Circuit Breaker, Number of operations	2000
52.	Spring charging mechanism	Motor Operated
53.	Operating mechanism for closing of Circuit Breaker	
	Type	Spring operated Mechanism
	No of breaker operations stored	One
	Trip free or fixed trip	Trip Free
	Earthing for operating mechanism and metal parts	Solidly Earthed
	Earth terminal size and material, Min.	Electrolytic grade Copper 25 x 3mm
54.	Operating mechanism for tripping of Circuit Breaker	
	Type	Spring Operated Mechanism
	No of breaker operations stored	One
	Trip free or fixed trip (V)	Trip Free
	Earthing for operating mechanism and metal parts	Solidly Earthed
	Earth terminal size and material	Electrolytic grade Copper 25 x 3mm
55.	Breaker Accessories	
	Mechanical safety Interlock	Provided
	Automatic safety Interlock	Provided
	Operational Interlock	Provided
	Emergency manual trip	Provided
	Operation counter	Provided
	Spring charge / discharge indicator	Provided
	Manual spring charging facility	Provided
c) Isolators		

56.	Reference standard	IEC-62271-102 / IEC-62271-103
57.	Nominal Voltage in KV	22
58.	Highest System Voltage in kV, Max.	24
59.	Rated Frequency in HZ	50 Hz $\pm$ 3%
60.	No. Of poles	3
61.	Rated Current in Amps	630
62.	Maximum temperature rise over an ambient temperature 50°C.	60°C
63.	Operation	Close-Open-Earth
64.	Rupturing Capacity at rated voltage	630 Amps at 33kV
65.	Maximum over voltage factor when switching off Loaded feeder cable in kA	52.5
66.	No. of isolator operation permissible without requiring inspection, replacement of contacts and other main parts	
	Mechanical Endurance in Number of operations	1000
	At 100% rated making current in Number of operations	100
	At 100% rated breaking current in Number of operations	100
67.	Isolator provided with the following Mechanical safety	
	Mechanical ON and OFF Indication	Provided
	Cable Earth Indication	Provided
	Operational Counter	Provided
	Manual Spring Charging facility	Provided
<b>D) Current Transformer</b>		
68.	Reference standard	IS:16227, I & II
69.	Type	Ring Type, Resin Cast/Tape wound
70.	Nominal Voltage in KV	22
71.	Highest System Voltage in kV, Max.	24
72.	Rated Frequency in HZ	50 Hz $\pm$ 3%
73.	Current Transformer Ratio	200-100/1Amps
74.	Short circuit withstand	
	Short time current for 1 sec. in kA rms	5
	Dynamic current in kA peak, Min.	7.5
75.	Class of insulation	Class B
76.	Basic insulation level in kV rms	3
77.	Maximum temperature rise over an ambient temperature 50°C.	60°C
78.	Class of Accuracy	
	Metering Core	0.5
	Protection Core	5P10
79.	Rated Burden	2.5 VA
80.	Over Current Rating in %	120
81.	Continuous Over Load in %	120
<b>E) Metering Voltage(Potential) Transformer</b>		

82.	Reference standard	IS:16227, I & III
83.	Type	Resin Cast/Tape wound
84.	Nominal Voltage in KV	22
85.	Highest System Voltage in kV, Max.	24
86.	Rated Frequency in HZ	50 Hz $\pm$ 3%
87.	Voltage Transformer Ratio	22 kV/ $\sqrt{3}$ /110V/ $\sqrt{3}$
88.	Rated Primary Voltage in kV	22 kV/ $\sqrt{3}$
89.	Rated Secondary Voltage in V	110V/ $\sqrt{3}$
90.	Rated Burden in VA	50
91.	Accuracy Class	0.5
92.	Insulation Class	B
93.	Voltage Factor	1.2 Continuous and 1.9 for 8 hrs.
94.	One Minute Power Frequency Dry Withstand Voltage Rating	
	Primary Winding Induced Test in kV rms	50
	Secondary Winding in kV rms	3
	Rated Impulse Voltage in kV peak	125
<b>F) Auxiliary Voltage(Potential) Transformer</b>		
95.	Reference standard	IS:16227, I & III
96.	Type	Resin Cast/Tape wound
97.	Nominal Voltage in KV	22
98.	Highest System Voltage in kV, Max.	24
99.	Rated Frequency in HZ	50 Hz $\pm$ 3%
100.	Voltage Transformer Ratio	22 kV / 230V
101.	Rated Primary Voltage in kV	22 kV
102.	Rated Secondary Voltage in V	230V
103.	Rated Burden in VA	500 VA
104.	Voltage Regulation in %	5
105.	Insulation Class	B
106.	Voltage Factor	1.2
107.	Application & Construction Type	Indoor, Single Phase/Two Pole
108.	One Minute Power Frequency Dry Withstand Voltage Rating	
	Primary Winding Induced Test in kV rms	50
	Secondary Winding in kV rms	3
	Rated Impulse Voltage in kV peak	125
<b>G) Numerical Protection Relay</b>		
109.	Reference Standard	IEC 60255
110.	Type and Model	3 Over Current(O/C) and 1 Earth fault(E/F)
111.	Current Transformer Secondary Input to Relay	1 A
112.	Operating Curve Type	Inverse Definite Minimum Time (IDMT)Relay
113.	Auxiliary Supply	Self Powered relay for Protection
114.	Rated Frequency in HZ	50 Hz $\pm$ 3%
115.	Over Current Protection	

	Low set Over Current protection	20-200% of CT secondary rated current with increment/decrement by 1 %
	High set Over Current protection	100-2000% of CT secondary rated current with increment/decrement by 50%
116.	Earth Fault Protection	
	Low set Earth Fault protection	5% to 80% of the CT rated current in steps of 1%
	High set Earth Fault protection	100-1000% of the CT rated current in steps of 50%
117.	Mounting	Flush Mounted
118.	Operational Indicator	LCD display and LED annunciation lamps
119.	Contact Details	4 Binary Input(BI) and 6 Binary Output(BO)
120.	Self-diagnosis feature	Yes
121.	Password protection	Yes
122.	Communication Protocol	RS 232 or RS 485 Port for IEC 103, Communication Protocol
123.	Event / fault record, Min.	10 Event and 5 Fault Records available
124.	Setting groups	2 Groups available
125.	Circuit Breaker control available	Yes, Only Trip
<b>H) Tripping Coil</b>		
126.	DC Voltage in Volt	24
127.	Maximum Tripping Current at rated voltage in Amps.	5
	Minimum Permissible voltage variation in %	85 to 110
<b>I) HT three phase four wire CT / PT operated 1 Amps fully Static &amp; AMR compatible TOD Tri - vector Energy Meter</b>		
128.	Reference Standard	IS: 14697, 1999 IS: 15959, 2011
129.	Make	Secure / L&T / other MSEDCL approved make
130.	Auxiliary supply Voltage	110V/ $\sqrt{3}$
131.	Class of Accuracy	0.5S
132.	Type of Display	Customized backlite liquid crystal display
133.	Measuring Parameters as per MSEDCL Specification	
		Instantaneous parameters
		Block Load Profile parameters
		Billing Profile Parameters
		Name Plate details

		Programmable Parameters
		Event Conditions
		All logging parameters for each of the event condition for 3 $\Phi$ / 4W
<b>J) Fault Passage Indicator (FPI) on Short Circuit and Earth fault</b>		
134.	Operating point/Current short circuit in Amp	Adjustable 100/200/300 /400/500 /600/700 /800/900/1000 /1100/1200A ( $\pm 15\%$ )
135.	Operating point/Current earth fault in Amp	Adjustable 10/20/30/40 /60/80/100A ( $\pm 15\%$ )
136.	Response Time in ms	For Short Circuit Adjustable 40/60/80/100/120 /160/200/240 ms Sec( $\pm 100$ m Sec) For Earth Fault Adjustable 40/60/80/160 ms ( $\pm 100$ m Sec)
137.	Auto Reset Time in Hrs	1/2/4/8 hrs (+ / - 1%) after fault
<b>K) Battery Charger</b>		
138.	Input AC Voltage in V	230
139.	Rated Frequency in Hz	50 Hz $\pm 3\%$
140.	Output DC Voltage in V	24
141.	Current Rating in Amps	10
142.	Output DC Voltage for charger	
	Boost Mode in V	27 to 28
	Float Mode in V	27 to 28
143.	Operating Temperature in $^{\circ}\text{C}$	-25 to 60
144.	Temperature Compensation	Junction temperature of SMPS crosses 142 $^{\circ}\text{C}$ , thermal shutdown occurs.
145.	Short Circuit and Overload Protection	Provided
146.	High Voltage Isolation	2 kV for 1 minute
147.	Efficiency	Above 85 %
<b>L) Battery</b>		
148.	Type	Dry Type
149.	Ah Efficiency	> 95%
150.	Self-Discharge	Self-Discharge
151.	Operating Temperature	Normal : +20 $^{\circ}\text{C}$ to +30 $^{\circ}\text{C}$ & Limits : -20 $^{\circ}\text{C}$ to +50 $^{\circ}\text{C}$



152.	Voltage (V)	24V (2 x 12V)
153.	Ah Capacity	7Ah / 12 Ah / 26 Ah
<b>M) Manometer with Non Return Valve</b>		
154.	Type	Analogue
155.	Material	Stainless Steel
156.	Accuracy of calibration pressure	+/-1% at 20°C
157.	Pressure Element	Stainless Steel Welded
158.	Dial	2"
159.	Pointer	Dark
160.	Window	Round
161.	Gas pressure low signal	Indicated by Red Color Zone
162.	Non Return Valve(NRV) Material	Stainless Steel
<b>N) Indoor cable terminations kits</b>		
163.	Type	33 kV touch proof screened termination kit
164.	Materials	Epoxy / EPDM / Silicon Rubber
165.	Size	Up to 3 x 400 sq. mm 33 kV HT cables
166.	Height of Bus bar / transformer / feeder Cable box from ground level	As per Manufacture design
167.	Arrangement for mounting an extra cable at incoming and outgoing side box of Bus bar.	As per Manufacture design
168.	Arrangement for mounting an extra cable at outgoing side box of transformer / feeder.	As per Manufacture design
<b>O) Automatic Water Level Controller</b>		
172.	Position of Automatic Water Level Controller	200 mm below live contacts
173.	Auxiliary contacts	4 NO + 4 NC
174.	Breaker Tripping and Load break Isolator opening due to water level increases signals to Control room	Yes
<b>P) Name Plate</b>		
175.	Material	Anodized Aluminum / Stainless Steel
176.	Thickness	18 swg / 1.00 mm
177.	Size	145 mm x 116 mm
<b>Q) Painting</b>		
178.	Inside	Powder Coated

179.	Outside	Polyurethane based powder paint. Dark Admiralty Grey, Shade No. 632 as per IS: 5, 2007.
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## 9.0 Principle Requirement of Ring Main Unit:

### 9.1) Enclosure:

- i) The Ring Main Unit enclosure (Outer) shall be made up of CRCA Sheet of 2 mm thickness or galvanized Sheet of 1.6 mm thickness. The rating of enclosure shall be suitable for operation on three phases, three wire, 22 kV, 50 cycles, A.C. System with short-time current rating of 21kA for 3 seconds for 22kV with Panels. The complete Ring Main Unit Outer enclosure shall be of degree of protection IP 54 (Main Door close) and IP 41 (Main Door open).
- ii) The enclosure shall provide full insulation, making the Switchgear insensitive to the environment like temporary flooding, high humidity etc. The active parts of the Switchgear shall be maintenance-free and the unit shall be minimum -maintenance.
- iii) The Ring Main Unit Outer enclosure shall be painted with Polyurethane based powder paint. The color of Ring Main Unit Outer enclosure shall be Dark Admiralty Grey, Shade No. 632 as per IS: 5, 2007.
- iv) Each switchboard shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics.
- v) The Ring Main Unit metal parts shall be made of high thickness high tensile steel which must be grit/short blasted, thermally sprayed with Zinc alloy ( not galvanized), phosphate and subsequently painted with Polyurethane based powder paint, the overall (Including outer and inner paint layer), the thickness of paint layer shall be not less than 150 microns for CRCA Sheet and 80 microns for galvanized Sheet.

### 9.2) Inner enclosure (Main tank):

- i) The tank shall be robotically welded stainless steel sheet of minimum 2 mm thickness. The tank shall be sealed and no handling of gas is required throughout the 25 years of service life. However, the SF<sub>6</sub> gas pressure inside the tank shall be constantly monitored by a temperature compensating gas pressure indicator offering a simple go, no-go indication. The gas pressure indicator shall be provided with green pressure and red pressure zones. There shall be one Non – return valve to fill up the gas. The manufacturer shall give guarantee for maximum leakage rate of SF<sub>6</sub> gas will be lower than 0.1 % per year. An absorption material such as activated alumina in the tank shall be provided to absorb the moisture from the SF<sub>6</sub> gas to regenerate the SF<sub>6</sub> gas following arc interruption. The degree of protection of the inner enclosure shall be IP 67.
- ii) Oil or Air filled Switchgear will not be considered. The temperature rise test shall be carried out on complete Ring Main Unit and test reports shall be submitted with the offer.
- iii) The compact Ring Main Unit shall be provided with a pedestal made up of M.S. Angle to mount the unit on plain surface. The height of the bottom of cable box shall be 310 mm to provide the turning radius for the HT cable termination.

### 9.3) Configurations recommended:

The following configurations of Ring Main Units are recommended:

**i) Non Extensible:**

Non extensible Ring Main Unit with one number of 200A circuit breaker for transformer protection up to 630 kVA and two number of Load Break Isolators for network sectionalizing with earth isolator.

**ii) Extensible:**

Extensible Ring Main Unit with one number of 200A circuit breaker and two Load break isolators with earth isolator arrangement having provision for adding one number of 200A circuit breaker for one extensible and two 200 A circuit breakers for two extensible Ring Main Unit.

**9.4) Bus bars:**

The three numbers of continuous Bus bars made up of EC grade tinned copper of rating current 630A shall be provided. The Short time rating current shall be 21 kA for 3 seconds for 22 kV. The Bus bar connections shall Anti- oxide greased.

**9.5) Sulphur Hexa 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 Ring Main Units under the stipulated service conditions. The SF6 gas 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 bidder indicating all the tests as per IEC 376 for each lot of SF6 Gas.

**9.6) Load Break Switches (Load Break Isolators):**

- i) The Load Break Isolators for Incoming and Outgoing supply must be provided and the load break isolators are fully insulated by SF6 gas.
- ii) The operating mechanism shall be spring assisted mechanism with operating handle for ON /OFF. Earth positions with arrangement for padlocking in each position. Also independent manual operations with mechanically operated indicator. The earth 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.
- iii) The load break isolators shall be remotely operated. Each load break switch shall be of the triple pole, simultaneously operated, automatic type with quick break contacts and with integral earthing arrangement.
- iv) The rated current of Isolator shall be 630 Amps continuous at maximum ambient temperatures. No Derating shall be allowed. For the isolator at an Ambient temperature of 50 °C, which means that Isolator rating should be 630 Amps maximum ambient temperature of 50 °C. The temperature rise of Isolator shall be 55°C maximum. The relevant type test report to prove the temperature rise below 55 °C shall be submitted by the bidder with the offer.

**9.7) Current Transformer:**

- i) The Current Transformers being prone to failure due to various reasons, the quality and reliability of the Current Transformers are of vital importance.

Current Transformer's insulation used shall be of very high quality, details of which shall be furnished in the technical offer.

- ii) The Current Transformers shall be single wound double ratio, one Current Transformers for metering and one Current Transformers for protection.
- iii) The instrument security factor for metering Current Transformers shall be low enough but not greater than 5 at lower ratio. This shall be demonstrated on metering Current Transformers in accordance with the procedure specified in IS: 16227, I & II and relevant IEC.
- iv) The Current Transformers shall be ring type (Tape wound / resin cast). Contact tips of terminals shall be silver plated.
- v) Correct polarity shall be invariably marked on each terminal.
- vi) A panel shall be provided in each Ring Main Unit enclosure to mount a single wound double ratio, Current Transformers for metering and protection purposes. Current Transformers access for maintenance or any other purpose shall be from the back of these panels.
- vii) Secondary terminals of Current Transformers shall be brought out suitably to a terminal block, which will be easily accessible for testing and terminal connections.
- viii) Further characteristics and features of Current Transformers used for metering and protection are listed as follows:

**Metering Current Transformers:**

- a) Type: Ring Type
- b) Material:, Resin Cast
- c) Burden: 2.5VA
- d) Ratio: 200-100/1 Amps
- e) Accuracy Class for metering: 0.5

**Protection Current Transformers:**

- a) Type: Ring Type
- b) Material:, Resin Cast
- c) Burden: 2.5VA
- d) Ratio: 200-100/1 Amps
- e) Accuracy Class for protection: 5P10.

**9.8) Metering Voltage (Potential) Transformer:**

- i) The Potential Transformers shall be of Resin Cast and they shall conform to IS: 16227, I & III. Their design and construction, in particular, shall be sufficiently robust to withstand the thermal and dynamic stresses during short circuits.
- ii) A panel shall be provided in each Ring Main Unit enclosure to mount Potential Transformers. The primary and secondary contacts (moving & fixed type) shall have firm grip while in service. Service position locking mechanism shall be provided and indicated by bidder in relevant drawing. Rigidity of primary stud point with earth bus in service position shall be confirmed.
- iii) Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal.

- iv) Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud nut and washer shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be at least 10 mm.
- v) Each secondary core will be protected by suitable MCB.
- vi) HRC fuses shall be provided on the HV side.
- vii) Further characteristics and features of Potential Transformers used for metering are listed as follows:
  - a) Type: Ring Type
  - b) Material:, Resin Cast
  - c) Burden: 50 VA
  - d) Ratio:  $22\text{ kV}/\sqrt{3} / 110\text{V}/\sqrt{3}$
  - e) Accuracy Class for metering: 0.5

#### 9.9) Auxiliary Voltage (Potential) Transformer:

- i) The Auxiliary Potential Transformers shall be of Resin Cast and they shall conform to IS:16227, I & III. Their design and construction, in particular, shall be sufficiently robust to withstand the thermal and dynamic stresses during short circuits.
- ii) A panel shall be provided in each Ring Main Unit enclosure to mount Auxiliary Potential Transformers. The primary and secondary contacts (moving & fixed type) shall have firm grip while in service. Service position locking mechanism shall be provided and indicated by bidder in relevant drawing. Rigidity of primary stud point with earth bus in service position shall be confirmed.
- iii) Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal.
- iv) Further characteristics and features of Potential Transformers used for metering are listed as follows:
  - a) Type: Ring Type
  - b) Material:, Resin Cast
  - c) Burden: 500 VA
  - d) Ratio:  $22\text{ kV}/\sqrt{3} / 230\text{V}$
  - e) Voltage Regulation: 5 %

Note: Instrument transformers shall be suitable for continuous operation at the ambient temperature prevailing inside the Ring Main Unit enclosure, when the Ring Main Unit is operating at its rated load and the outside ambient temperature is 50°C. The class of insulation shall be E or better.

All instrument transformers shall withstand the power frequency and impulse test voltage specified for the Ring Main Unit assembly. The current transformer shall further have the dynamic and short time ratings at least equal to those specified for the associated Ring Main Unit and shall safely withstand the thermal and mechanical stress produced by maximum fault currents specified when mounted inside the Ring Main Unit enclosure.

The parameters of instrument transformers specified in this specification are indicative and shall be finalized by the Employer during detailed engineering, considering the actual burden of various relays and other devices finally selected. In case the Bidder finds that the specified ratings are not adequate for the relays and other devices offered by him, he shall offer instrument transformer of adequate ratings without any cost implication.

All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block.

**9.10) Earthing of Bus bars ( Earth Switch):**

- i) The unit shall consist of a 630 Amp Tee Off spring assisted three position rotating arc type SF6 circuit breaker unit, with integral fault making/dead breaking earth switch, the function shall be naturally interlocked to prevent the main and earth switch from being switched `ON` at the same time and the CB not allowed to close in `Earth On` position. The selection of the main/earth switch lever on the fascia, which is allowed to move only if the main or earth switches in the off position. The lever may be padlocked in either the main or earth position.
- ii) The cables shall be earthed by an integral earthing switch with short-circuit making capacity, in compliance with IEC 129 standard. The earthing switch shall be operable through the main circuit mechanism and manual closing shall be driven by a fast-acting mechanism, independent of operator action.

**9.11) Circuit Breaker (Vacuum media for arc quenching):**

- i) The 3 pole circuit breaker for the protection of Distribution transformers or feeder shall be enclosed in the main tank. The rated breaking and making current at rated voltage shall be as follows:

For 22 kV System: Rated breaking capacity shall be 21 kA for 3 second.  
Rated making current shall be 52.5 kA for 3second.

- ii) The manual operation of the circuit breaker shall not have an effect on the spring charging mechanism.
- iii) The circuit breaker shall be fitted with a mechanical flag, which shall operate in the event of fault occurrences. The breaker indications ON and OFF positions shall be indicated by suitable flag. For ON position indication by Red flag and OFF position indication by Green flag shall be provided.
- iv) The circuit breaker shall be operated by the same unidirectional handle or switch. The rated operating sequence shall be O-3min-CO-3 min- CO.

**9.12) Bushings:**

All the bushings shall be of same height, parallel, on equal distances from the ground and protected by a cable cover. It is preferable to have bushings accessible from the front / rear side of the Ring Main Unit.

### 9.13) Cable Boxes:

All cable boxes shall be air insulated suitable for dry type cable terminations. The cable boxes at each of the two ring switches suitable HV cables of size 3C x 300 sq.mm and circuit breaker cable suitable up to 3C x 300 sq.mm. Necessary Right angle Boot should be supplied to the cable terminations. Compound filled cable boxes are not acceptable. The cable box shall be arc resistant as per IEC 62271-200 amended up to date.

The internal arc fault test on cable box shall be carried out for 22 kV systems at 21 kA for 1 second.

The clearance between phase to phase and phase to earth shall be as per IEC 61243 – 5 amended up to date. The cable termination and gland arrangements shall be appropriate for the type and style of cables used at the time.

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.

### 9.14) Voltage Indicator Lamps and Phase Comparators:

The Ring Main Unit shall be equipped with a voltage indication. 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 Ring Main Unit to be equipped with a permanent voltage indication as per IEC 61958 to indicate whether or not there is voltage on the cables.

The capacitive dividers will supply low voltage power to sockets at the front of the unit, an external lamp must be used to indicate live cables.

Three outlets can be used to check the synchronization of phases with the use of an external device.

### 9.15) Extensible:

Each combination of Ring Main Unit shall have the provision for extension by load break isolators / breakers in future, with suitable trenching chamber, accessories and necessary Bus bars. 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 standard i.e 21 kA for 1 second for 22 kV system. The Breaker should have a rated current carrying capacity of 200 A for Distribution Transformers and Feeders.

### 9.16) Wiring and Terminals:

- a) 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 wiring for automation, DC, Control wiring), Spare terminals shall be provided by the bidder. The wiring cable must be standard single-core multi stranded, 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.
- b) The wiring shall be carried out using single core multi-strand copper conductor super flexible PVC insulated and shall be flame retardant low smoke type wires of 1.1 KV 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.

- c) 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.
- d) 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.
- e) All wires directly connected to trip circuits of breaker or devices shall be distinguished by addition of a red color unlettered ferrule.
- f) Inter-connections to adjacent Panels (Switch Gear) shall be brought out to a separate set of Terminal blocks located near the slots or holes to be provided at the top portion of the panel. Arrangements shall be made for easy connections to adjacent Panels (Switch Gear) at site and wires for this purpose shall be provided and bunched inside the panel. The bus wire shall run at the top of the panel. Terminal block with isolating links should be provided for bus wire. At least 10% of total terminals shall be provided as spare for further connections. Wiring shall be done for all the contacts available in the relay and other equipment and brought out to the terminal blocks for spare contacts. Color code for wiring is preferable in the following colors:

Voltage supply: Red, Yellow, Blue for phases, Black for Neutral

CT circuits: Red, Yellow, Blue for phases, Black for Neutral

230V AC circuits: Black for both phases 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-moulded 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.

#### 9.17) Earthings:

The Ring Main Unit outdoor metal clad, Switch Gear, Earth contact of Load break isolators, Neutral and body of Distribution Transformer, M.S. Channels / M.S. Angles etc, shall be equipped with an earth bus securely fixed along the base of the Ring Main Unit.

When several units of the Ring Main Unit (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 earth bus bar of tinned copper flat shall be as per IEC/IS standards and shall be fixed with the Ring Main Unit. Provision shall be made on



end of Ring Main Unit for connecting the earth bus to the earth grid by erecting suitable 2 earth pipes of 40mm diameter MS rod of 3 meters in pits. Both the earth pipes are also to be connected in a grid formation. Necessary terminal clamps and connectors shall be included in the scope of supply.

#### **9.18) Motorization :**

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

Control Supply and Auxiliaries following has to considered:

- (i) Shunt trip coil – 24VDC for Isolators and Breakers
- (ii) Closing Coil – 24VDC
- (iii) Motor Mechanism – 24VDC
- (iv) 6NO+6NC – Potential free auxiliary contacts for breakers / isolator
- (v) Auxiliary supply should be – 24VDC
- (vi) Battery/ Battery charger with battery backup of at least 1hours
- (vii) Local / Remote switch for breaker and Isolators.

#### **9.19) Metering:**

The Ring Main Unit should be provided with separate Metering Module Consisting of Bus connected Potential Transformer and metering cum protection Current Transformer to be provided for VCB function i.e. for Distribution Transformer / Feeder along with provision of installing Tri-vector Meter (TVM). The Potential Transformer with PT Fuse and Ring Core type Current Transformer provided shall be made up of Epoxy Cast Resin. The CT ratio shall as per transformer rating.

#### **9.20) Take OFF Terminal Units for Automation:**

The Ring Main Unit should be provided with necessary take off terminal units for automations. Remote operation of the Ring Main Units line switches must be possible using motors fitted to the operating mechanism.

It shall be possible to fit the motors either directly in manufacturing plant or on site as and when required. Installation on site shall be possible with the Ring Main Unit fully energized and manufacturer should provide detailed instructions for installation to the control mechanism.

The fitting of the motors to the mechanism must not in any way impede or interfere with the manual operation of the switches or circuit breaker.

The bidder may wish to advice of options and cost for remote supervisory control units of the Ring Main Unit and MV network supervisory control system.

Complete Ring Main Unit shall be capable of withstanding 630A current without any damage being caused, in accordance with the recommendations IEC 694 and IEC 298.

Control and Interlocks:

The circuit breaker shall normally be controlled remotely from SCADA system closing through Motor and tripping through spring.

The isolators and earth isolator shall normally be controlled remotely from SCADA system closing and opening through Motor.

However, it shall also be designed to control locally from Ring Main Unit panel. Suitable mimic on Panel shall be provided.

Facilities shall be provided for mechanical tripping of the breaker in an emergency. Facility shall also be provided for manual charging of the stored energy mechanism for a complete duty cycle.

Necessary mechanical & Electrical interlocks shall be provided between CB, Isolator & Earth switches for safe operation.

Each CB, Isolator & earth switch shall have 8 NO + 6 NC Auxiliary spare of good quality (corrosion free and easy for making connection) for future use by owner. It should be located at accessible position in panel.

All the binary inputs/outputs shall be wired to the terminals & kept ready for SCADA connectivity.

#### **9.21) Fault Passage Indicators (FPI) on Short Circuit and Earth fault:**

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 Fault Passage Indicators (FPI) shall be integral part of Ring Main Unit.

The Fault Passage Indicators (FPI) shall facilitate for detection of short circuit fault and earth fault through Current Transformer inbuilt in Fault Passage Indicators.

#### **9.22) Tropicalisation:**

Due regard should be given to the climatic conditions under which the equipment is to work. Ambient temperature normally varies between 20 °C and 32 °C, although direct sun temperature may reach 45 °C. The climate is very humid and rapid variations occur, relative humidity between 90% and 100% 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.

#### **9.23) Safety of people:**

Any accidental overpressure inside the sealed chamber will be limited by the opening of a pressure limiting device in the enclosure. Gas will be released to the rear of the unit away from the operator. Manufacturer shall provide type test report to prove compliance with IEC 298 appendix AA 'Internal fault'.

#### **9.24) Automatic Water Level Controller Using Mercury Float Switch:**

The float switch shall be provided in Ring Main Unit at 200 mm below live contacts to avoid flash over due to water.

The float switch is a device used to detect the level of water within the Ring Main Unit. The float switch shall be used in the Ring Main Unit as an indicator, an alarm (at Control Room), tripping of Vacuum Circuit Breaker and opening of Load Break switch.

A mercury switch is a switch whose purpose is to allow the flow of electric current in an electrical circuit in a manner that is dependent on the switch's physical position.

Mercury switches shall have 4 NO + 4 NC Auxiliary contacts in a sealed glass envelope which contains a bead of mercury. The envelope may also contain air, an inert gas, or a vacuum. Gravity is constantly pulling the drop of mercury to the lowest point in the envelope. When the switch is tilted in the appropriate direction,

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,

the mercury touches a set of contacts, thus completing the electrical circuit through those contacts. 'Normally Open' contact becomes 'Normally Close' contact, hence signals to breaker and motor for tripping of Vacuum Circuit Breaker and opening of Load Break switch. These signals shall be goes to Sub Station Control Room / SCADA Control Room via RTU with opening reason for further action.

**9.25) Operating lever:**

An anti-reflex mechanism on the operating lever shall prevent any attempts to re-open immediately after closing of the switch or earthing switch.

All manual operations will be carried out on the front of the switchboard.

The effort exerted on the lever by the operator should not be more than 250 N for the switch and circuit breaker.

The overall dimensions of the Ring Main Unit shall not be increased due to the use of the operating handle. The operating handle should have two workable positions 180° apart.

**9.26) Front plate:**

The front shall include a clear mimic diagram which indicates different functions.

The position indicators shall give a true reflection of the position of the main contacts.

They shall be clearly visible to the operator.

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

The manufacturer's plate shall include the switchboard's main electrical characteristics.

**9.27) Danger Board:**

The danger Board plate as per relevant IS: 2551, 1982 shall be riveted on the front plate of the Ring Main Unit.

**9.28) Internal arc rating:**

The Ring Main Unit 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 Ring Main Unit shall be tested for an internal arc rating of 25 kA for 1 Sec for 33 kV.

Suitable temperature rise test on the Ring Main Unit shall be carried out & test reports shall be submitted with tender for technical bid evaluation.

**9.29) Specific Requirement for Automation:**

The Ring Main Units should be provided with provision of following minimum signals available at separate SCADA terminal box.

Minimum signals for SCADA/DMS - to be wired to separate TBs

Sr. No.	Particulars	Contacts
1.	CB Close / Open	Potential free contacts

2.	LBS Close / Open	Potential free contacts
3.	LBS & CB Earth Switch Close / Open	Potential free contacts
4.	CB Test/Service Position	Potential free contacts
5.	Spring charge Status indication	Potential free contacts
6.	SF6 gas pressure low	Potential free contacts
7.	O/C Operated	Potential free contacts
8.	E/F Operated	Potential free contacts
9.	Local/Remote	Potential free contacts
10.	Common Power Supply Healthy	Potential free contacts
11.	Motor MCB Healthy Status	Potential free contacts
12.	Battery charger Fail	Potential free contacts
13.	RMU Door Open	Potential free contacts
14.	CB Trip Coil Healthy	Potential free contacts
15.	Current Transformer Status	Potential free contacts
16.	Potential Transformer Status	Potential free contacts
17.	FPI Control	Potential free contacts
18.	CB control	Potential free contacts
19.	LBS Control	Potential free contacts
20.	Water Level Alarm	Potential free contacts
21.	CB Open	Potential free contacts
22.	LBS Open	Potential free contacts

## A) Specific requirement for SCADA Connectivity:

- i) Fault Passage Indicator shall be provided per isolator
- ii) DC control supply system should be 24V DC.
- iii) Battery charger to cater load of minimum 10 motorized operation cycles (Close-Open) in absence of battery.
- iv) Battery to cater load of minimum 10 motorized operation cycles (Close-Open) in absence of battery charger. The battery backup should be minimum of 6 Hrs.
- v) Miniature Circuit Breakers (MCB) shall be provided for battery charger supply, RMU Motor supply & FRTU supply (Minimum 2 Amp circuit for future use of FRTU).

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,

- vi) Individual control circuit of Isolator/Circuit Breaker to have point of isolation/protection.
  - vii) Individual motor circuit of Isolator/Circuit Breaker to have point of isolation/protection.
  - viii) The Ring Main Unit shall have minimum protection of IP54 for Outer Enclosure with gland plate & knock outs. Provision for control cable entry should preferably be from Right/ Left top through LV cable box & shall be independent of HV Isolator/Circuit Breaker status. It should be vermin proof.
  - ix) Control cable gland plate shall be independent of power cable gland plate.
  - x) A point of earthing for control cables shall be electrically isolated from power cable earthing.
  
  - xi) Ambient temperature of 50°C max. Allowable temperature rise of battery & battery charger above ambient 40°C.
  - xii) Local / Remote switch shall be provided on all the isolator & breaker panels for selection of controls.
  - xiii) Current Transformer & Potential Transformer terminals for all the circuit breakers for Distribution Transformers / Feeders only.
- B) Following is the list of I/O requirements for Ring Main Unit modules. Please note that all DI & DO should be potential free contacts.
- i) List of potential free contacts for Isolator (Terminals shall be provided):
    - a) Digital Indications:
      - 1. Isolator ON --02 No. & 2 NC
      - 2. Isolator OFF --02 No. & 2 NC
      - 3. Isolator Earth switch Status (ON/OFF)
      - 4. FPI Operated
      - 5. LOCAL/REMOTE switch position
    - b) List of commands:
      - 1. Isolator Close
      - 2. Isolator Open
      - 3. FPI reset
  
  - ii) List of potential free Contacts for Circuit Breakers (Terminals shall be provided):
    - a) Digital Indications:
      - 1. Circuit Breaker ON
      - 2. Circuit Breaker OFF
      - 3. Auto Trip
      - 4. LOCAL/REMOTE switch position
    - b) List of commands:

1. Circuit Breaker Close
2. Circuit Breaker Open

iii) Requirement of Tri-Vector Meter (TVM):

- a) The terminals shall be provided for CT and PT Connections
- b) Space shall be provided for Tri-Vector Meter (TVM) mounting on Outer Enclosure panel

**9.30) Distribution Automation System Interface:**

The Ring Main Unit shall be equipped so that it can be monitored and controlled via the SCADA. In this respect, it shall interoperate with the RTU that will be housed in the Ring Main Unit Control Cabinet. The RTU in turn will interoperate with the SCADA via the remote communications system.

The Ring Main Unit shall have provisions for opening and closing its switches / breakers using output from the RTU. The Ring Main Unit shall also supply analog and status signals to the RTU for monitoring the condition of the Ring Main Unit's distribution network circuits as well as the components of the Ring Main Unit.

**10.0 Tests:**

**a. Type tests:**

The Ring Main Unit and accessories offered in the tender should have been successfully type tested at NABL laboratories in India or equivalent International Laboratories in line with the relevant standard and technical specification, within the last 5 (five) years from the date of offer. The bidder shall be required to submit complete set of the type test reports in physical format along with the offer. The bidder must provide the original copies of type test reports for verification purpose or produce authentic documents to confirm the type tests are authentic in case of tests carried out at equivalent International Laboratories

In case these type tests are conducted earlier than five years, all the type tests as per the relevant standard shall be carried out by the successful bidder at NABL in presence of purchaser's representative free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection.

Type tests:

- i) Short time current withstand test and peak current withstand test.
- ii) Lightning Impulse voltage with-stand test
- iii) Temperature rise test.
- iv) Short Circuit current making and breaking tests.
- v) Power frequency voltage withstand test (dry).
- vi) Capacitive current switching test confirming to IEC.

- vii) Mechanical operation test.
- viii) Measurement of the resistance of the main circuit.
- ix) Degree of protection of Inner enclosure and outer enclosure
- x) Switch, circuit breaker, earthing switch making capacity.
- xi) Switch, circuit breaker breaking capacity.
- xii) Internal arc withstand Test for Inner Enclosure and Cable Chamber.
- xiii) Checking of partial discharge on complete unit.

The details of type test certificate according to the composition of the Switchboard shall be submitted with the offer.

In addition, for switches, test reports on rated breaking and making capacity shall be supplied.

For earthing switches, test reports on making capacity, short-time withstand current and peak short-circuit current shall be supplied.

In addition to that, Test report of Vacuum Interrupter along with Catalogues & Literatures to be submitted along with the Offer.

#### **b. Acceptance and Routine Tests:**

All acceptance and routine tests as stipulated in the respective applicable standards amended up-to-date for all the equipment shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser before dispatch.

The bidder shall have full facilities to carry out all the acceptance and routine test as per the applicable standards.

After finalization of the program of acceptance/routine testing, the supplier shall give 15 days' advance intimation to the purchaser, to enable him to depute his representatives for witnessing the tests.

The routine tests should be carried out by the manufacturer at his works in presence of EE (Testing) MSEDCL and EE ( IW) , MMC, MSEDCL.

All the Ring Main Units must be routine tested for the following:

1. Conformity with drawings and diagrams,
2. Measurement of closing and opening speeds,
3. Measurement of operating torque,
4. Checking of filling pressure,
5. Checking of gas-tightness / SF6 gas leak test.
6. Dielectric testing and main circuit resistance measurement.
7. Power frequency voltage
8. Resistance test for the circuit
9. Mechanical operation tests.
10. Micro-ohm test for the assembly inside the tank.
11. Circuit breaker analyzer test so as to ensure the simultaneous closing of all poles  
for VCB.

12. Partial Discharge test on the complete gas tank so as to be assure of the proper insulation level and high product life.
13. High voltage withstands.
14. Secondary test to ensure the proper functioning of the live line indicators, fault passage indicators and relays.

F

All major type tests shall have been certified at an independent authority with the tests carried outside country of manufacture shall be translated in English and submitted in hard copy.

The supplier in the presence of MSEDCL's representative shall carry out all above acceptance and routine tests. The supplier shall give at least 15 days advance intimation to the MSEDCL to enable them to depute their representative for witnessing the tests. The cost towards transport, stay and other expenses shall be borne by the supplier.

The MSEDCL 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 MSEDCL to satisfy that the material complies with the intent of this specification.

#### **11.0 Inspection:**

The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser 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 purchaser informed, in advance, about the manufacturing program so that arrangement can be made for stage inspection.

The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall keep the purchaser informed, in advance, about such testing program.

#### **12.0 Qualifying Requirement:**

- a) The Bidder should have proven experience of not less than 10 years in design, manufacture, supply and testing at work for Ring Main Units and accessories offered for equal or higher voltage class. The Ring Main Units and accessories offered by bidder should be in the successful operation, at least for five years as on the date of submission of the tender.
- b) The bidder should have adequate in house testing facilities for conducting acceptance / routine tests in accordance with relevant IS.
- c) Bidder should have a minimum turnover of 60% of the value of the material offered in any one financial year during the previous 3 years. However, being commercial aspect, MM Cell is requested to verify this point.
- d) The bidder should furnish all the relevant documentary evidence to establish the fulfillment of the above requirement.



- e) The bidders not meeting the requirement at clause No. 12,(a) can also participate, provided they have valid ongoing collaboration with a manufacturer who has at least 10 years experience in the design, manufacture and testing of the Ring Main Units and accessories of same type and class offered which have been in satisfactory service for a period of at least five years. In such an event the bidder shall furnish along with the bid the documentary evidence for the same and undertaking from the bidder and collaboration accepting joint and several liability for all obligations under the contract.

### **13.0 Prototype Sample:**

The successful bidders should manufacture 3 Nos. of prototype Ring Main Units as per the specification and keep ready at their works for the purpose of sample inspection and testing. The MSEDCL at their option may send a team of Engineers to the works. Prior intimation of this inspection may not be given to the Bidder.

### **14.0 Manufacturing Facilities:**

As Ring Main Units are having sealed pressure system in compliance with IEC 298, manufacturer shall have complete facility with state of the art equipments for ensuring the quality of product delivered strictly adhering to IEC 298 Guidelines. Following are the work station at manufacturer place to ensure the adherence: -

1. Robotic welding station for stainless steel main tank ensuring the leak rate less than 0.1% per annum.
2. Work stations with adjustable work benches and torque wrenches, giving flexibility to workmen for proper tightness of internal components of sealed tank.
3. State of the Gas leak testing system ensuring the quality of sealing and have precision to measure leak rate less than 0.1% per annum.
4. High voltage testing station to have high voltage power frequency test and partial discharge measurement.
5. Computerized system to measure time travel characteristic of breaker before sealing the tank.
6. Computerized SF6 filling and testing facility.
7. Partial Discharge Lab for conducting the partial discharge test.

### **15.0 Quality Assurance Plan:**

The bidder shall invariably furnish following information along with his offer.

- 1) 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.

- 2) Information and copies of test certificates as in (1) above in respect of bought out accessories.

- 3) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 4) Special features provided in the equipment to make it maintenance free.
- 5) List of testing equipment available with the Bidder for final testing of Ring Main Unit and associated combinations vis-à-vis, the type, special, acceptance and routine tests specified in the relevant standards. The supplier shall, within 15 days from the date of receipt of Purchase Order submit following information to the MSEDCL.

1. List of raw materials as well bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
2. Necessary test certificates of the raw material and bought out accessories.
3. Quality Assurance Plan (QAP) with hold points for MSEDCL's inspection. The quality assurance plan and hold points shall be discussed between the MSEDCL 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.

#### **16.0 Drawings and Documentations:**

a. All drawings shall conform to relevant IEC Standards Specification. All drawings shall be in clear and visible.

The Bidder shall submit following drawings for approval:

- i) General Arrangement Drawing.
  - ii) General Arrangement Drawing with Door Open.
  - iii) Name Plate Drawing.
  - iv) Foundation Drawing.
  - v) Single Line Diagram Drawing.
  - vi) MIMIC Diagram Drawing.
  - vii) Control Schematic Wiring Diagram of Load Break Switch.
  - viii) Control Schematic Wiring Diagram of Circuit Breaker.
  - ix) Control Schematic Wiring Diagram of Earth Switch.
  - x) Control Schematic Wiring Diagram of Automatic Water Level Controller.
  - xi) Control Schematic Wiring Diagram of Voltage Indicator Lamps.
  - xii) Control Schematic Wiring Diagram of Fault Passage Indicators (FPI).
  - xiii) Terminal Block Drawing.
  - xiv) Mechanical Interlock Drawing.
  - xv) Electrical Interlock Drawing.
  - xvi) SF6 Monitoring Pressure Switch and Indication Schematic Drawing.
  - xvii) Schematic Wiring Diagram of Metering Unit.
  - xviii) Vacuum Interrupter Drawing.
  - xix) Danger Plate Drawing.
  - xx) Two Cable Arrangement Drawing.
  - xxi) Technical Detail Sheet Drawing.
  - xxii) Bill of Material.
  - xxiii) Packing List.
1. After issue of letter of acceptance, the successful bidders shall submit 3 identical sets of complete drawings along with detailed bill of materials for approval, to the Chief Engineer (Testing), 5th floor, Prakashgad, MSEDCL, Bandra (E), Mumbai-

400 051. If any modifications are required on these, the same will be conveyed to the supplier who shall modify the drawings accordingly and furnish final drawings for approval. In no case delivery extension will be granted for any delay in drawing approval.

2. The manufacturing of the Ring Main Units shall be strictly in accordance with the approved drawings and no deviation will be permitted without the written approval of MSEDCL. All manufacturing and fabrication work in connection with the Ring Main Units prior to the approval of the drawings shall be at the supplier's risk and cost.
  3. Approval of drawings by the purchaser shall not relieve the supplier of any of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revisions of applicable standards, rules and codes of practices.
  4. After approval of the drawings detailed packing lists and bills of materials, the suppliers shall be forwarded to the respective consignees. Copies of packing lists shall also be submitted to the Chief Accounts Officer (SB), MSEDCL, Prakashgad, Bandra(East) along with the bills for payment.
  5. Before dispatch of Ring Main Units to various consignees, the suppliers shall furnish sets of final drawings, including bills of materials and wiring schedules and also sets of technical literature and commissioning manuals. These shall be in Five sets and shall be furnished to the office of CE (MMD), 1st floor, Prakashgad, Bandra(E), Mumbai positively before the dispatch of Ring Main Units. All drawings shall preferably be of A3 size. No drawing of width more than 35 cm will be acceptable. One set each of the final drawings; bill of materials, wiring schedules and commissioning manuals shall invariably be forwarded to the consignee along with each Ring Main Units consignment and shall be listed out in the packing list, when submitted for approval.
  6. In case the supplier fails to furnish contractual drawings and manuals even at the time of supply of Ring Main Units, the date of furnishing of drawings/manuals will be considered as the date of supply of Ring Main Units for the purpose of computing penalties for late delivery.
  7. The successful bidder shall furnish in the form of nicely bound volumes, the manuals covering erection, commissioning, operation and maintenance instructions and all relevant information and drawings pertaining to the Ring Main Unit as well as auxiliary devices. Marked erection drawings shall identify the component parts of the Ring Main Unit as shipped to enable Engineer/Purchaser to carry out erection with his own personnel. Each manual shall also contain one set of all the approved drawings type test reports as well as acceptance test reports to corresponding consignment dispatched. The total quantity of the operating manuals/approved drawings sets to be supplied by the supplier shall be equal to the number of Ring Main Units ordered.
- b.** The Bidder shall submit along with his tender illustrative and descriptive literature in triplicate for various items in the Ring Main Units, which are all essentially required for automation.

The Bidder shall submit following documents along with the tender:

- i) Instruction manuals.
- ii) Catalogues of spares recommended with drawing to indicate each items of spares.
- iii) List of spares and special tools recommended by the supplier.
- iv) Copies of Type Test Certificates as per latest IS/IEC.

- v) Dimensional drawings of each material used for item.
- vi) Actual single line diagram of Ring Main Unit with or without extra combinations shall be made displayed on the front portion of the Ring Main Unit so as to carry out the operations easily.

Operation, Maintenance and erection instruction manual in English language shall be also supplied along with each Ring Main Unit to the respective consignee as per the dispatch instructions given from Material Management Cell under CE (MMD), Corporate Office, Mumbai. The successful bidder shall submit the drawings, bill of materials, packing lists, etc. in time and get these approved from the office of Chief Engineer (Testing), 5th floor, Prakashgad, MSEDCL, Mumbai.

#### **17.0 Name Plate:**

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

- b. Name of manufacturer.
- c. Type.
- d. Serial number.
- e. Voltage.
- f. Current.
- g. Frequency.
- h. Symmetrical breaking capacity.
- i. Making capacity.
- j. Short time current and its duration.
- k. Purchase Order number and date.
- l. Month and Year of supply.
- m. Rated lighting impulse withstands voltage.

#### **18.0 Packing and Forwarding :**

The equipment shall be packed in crates suitable for vertical/horizontal transport as the case may be and the packing shall be suitable to withstand handling during the transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.

Each consignment shall be accompanied by a detailed packing list containing the following information:

- a. Name of the consignee.
- b. Details of consignment
- c. Destination.
- d. Total weight of consignment.
- e. Sign showing upper/lower side of the crate.
- f. Handling and unpacking instructions.
- g. Bill of material indicating contents of each package.

All the equipment covered in this specification shall be delivered to the various stores centers of the MSEDCL as will be intimated to the successful bidders. The equipment shall be delivered to these stores centers only by road transport and shall be suitably packed to avoid damages during transit in the case of indigenous supplies.

The bidder shall quote delivery periods for various equipment and shall stick to the committed delivery. The delivery period will be counted from the date of receipt of letter of award of the contract. It is therefore, the responsibility of the successful bidder to submit the drawings, bill of materials, packing lists, etc. in time and get these approved from the office of Chief Engineer (Quality Control and Testing), 5th floor, Prakashgad, MSEDCL, Mumbai.

It may clearly be noted that the delivery period will under no circumstances be linked up with other formalities like drawing approval, etc.

#### **19.0 Training:**

All successful bidders for Ring Main Units shall provide training facilities for the MSEDCL's Engineers. The training shall be for not less than 8 man weeks. Syllabus and other details of the training shall be finalized in consultation with the MSEDCL. Boarding, lodging and traveling expenses for the deputed trainees will be borne by the MSEDCL. Charges for training shall be quoted in the offer separately. These will not be considered for evaluation of the offer.

#### **20.0 Performance Guarantee:**

All Ring Main Units and accessories supplied against this specification shall be guaranteed for a period of 66 months from the date of receipt at the consignee's Stores Center or 60 months from the date of commissioning, whichever is earlier. However, any engineering error, omission, wrong provision, etc. which do not have any effect on the time period, shall be attended to as and when observed/pointed out without any price implication.

#### **21.0 Annexure:**

The bidder shall fill in the following Annexure 'A' which forms part of the Tender Specification and offer. If the Annexure 'A' is not submitted duly filled in with the offer, the offer shall be liable for rejection.

Annexure 'A' - Principal Technical Parameters of Ring Main Units.

#### **22.0 Schedules:**

The bidder shall fill in the following Schedule which forms part of the Tender Specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule – 'A-1' - Guaranteed Technical Particulars of 22 kV Ring Main Units.

Schedule – 'A-2' - Guaranteed Technical Particulars of 33 kV Ring Main Units.

Schedule – 'B' - List of Type Test Reports to be enclosed with the offer

Schedule – 'C' - Schedule of Deviations from Specification

Schedule – 'D' - Schedule of Bidder's Experience

Schedule – 'E' - Schedule of Deviations from Specified Standards

Schedule – 'F' - Deviations from specified Test requirements specified in Relevant Standards and Present Specification

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,

22 kV, 630 Amps, Extensible / Non extensible type,  
Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

#### Schedule – ‘G ‘ - Proforma of Undertaking

The Bidder shall submit the list of orders for supply of Ring Main Units executed or under execution during last three years, with full details, in the schedule of Bidders experience (Schedule ‘D’) to enable the purchaser to evaluate the tender.

Any additional information may be furnished separately by the bidder, if felt necessary by him.

#### **23.0 Guaranteed Technical Particulars:**

The bidder should fill up the details in schedule A – “Guaranteed Technical Particulars” and the statement such as “as per drawing enclosed”, “as per MSEDCL requirement”, “as per IS”, “as per specification” etc. shall be considered as details not furnished and such offers will be rejected.

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,  
Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

**Annexure 'A'****Principal Technical Parameters of Ring Main Unit and accessories:.**

Sr. No.	Description	22 kV Ring Main Unit
<b>A)Ring Main Unit Assembly</b>		
1.	Indoor / Out door	Indoor / Out door
2.	Configurations(Type)	3 Way, M+LLV+ 4 Way, +LLLL+ 4 Way, M+LLLV+ 4 Way, M+LLVV+ 5 Way, M+LLVVV+ 6 Way, +LLVVV+V+ L= Isolator. V= VCB. M=Metering
3.	Reference Standard	IEC-62271-100, 200, 103, IEC-62271-1
4.	Rated Voltage in kV	22
5.	Highest System Voltage in kV, Max.	24
6.	Number of Phase	3
7.	Frequency in HZ.	50 Hz $\pm$ 3%
8.	Short Circuit rating	
	a) Breaking Symmetrical for 3 Sec. in KA	21
	b) Breaking Asymmetrical for 3 Sec. in KA	21
	c) Short time for 3 Sec. in KA.	21
9.	Insulation Level	
	a) Impulse withstand in KV peak.	125
	b) 1 Minute 50 Hz. Voltage withstand in KV rms	50
10.	Internal arc rating for 1 sec. in kV	21
11.	Construction: Material and Size	
	Inner Enclosure	Main Stainless Steel Tank with 2 mm Thickness
	Outer Enclosure	CRCA Sheet of 2 mm thickness or Galvanized Sheet of 1.6 mm thickness
12.	Degree of protection	
	Inner Enclosure	IP 67
	Outer Enclosure	IP 54 (Main Door close) and IP 41 (Main Door open)
13.	The Ring Main Unit and accessories completely wire and tested at factory	Yes
14.	Paint	Polyurethane based powder paint
15.	Color	Dark Admiralty Grey,

		Shade No. 632 as per IS: 5, 2007
16.	Thickness of coat, Min.	150 microns for CRCA Sheet and 80 microns for galvanized sheets
<b>B) Bus Bar</b>		
17.	Reference Standard	IS: 1897, 2008
18.	Grade and Material	Electrolytic Grade Copper
19.	Cross sectional area in mm <sup>2</sup>	400
20.	Size in mm or as per design	40 x 10
21.	Current Density in Amps/mm <sup>2</sup> , Max.	1.6
22.	Continuous Current in Amps	630
23.	Maximum temperature rise over an ambient temperature 50°C.	55°C
24.	Short time current rating for 3 Sec in kA rms	21
25.	Clearance in mm from bare bus bar or as per design	
	Phase to Phase for Isolator or as per design	78
	Phase to Phase for VCB	78
	Phase to Earth for Isolator or as per design	78
	Phase to Earth for VCB or as per design	78
26.	Bus Supports	
	Reference Standard	IEC 60243-1, ASTM D 648
	Voltage Class in kV	22 kV
	Creepage distance in mm or as per design	125 in SF6 gas
	Bus Bar support spacing in mm or as per design	125
27.	Filling SF6 gas pressure (Filling pressure at 20°C), Min.	1.4 Bar
28.	Operating SF6 gas pressure at 20°C, Min.	0.5 Bar
29.	Reference Standard	IEC 62271-100
30.	Rated Voltage in kV	22
31.	Highest System Voltage in kV, Max.	24
32.	Type	Vacuum Type
33.	Rated Frequency in Hz.	50 Hz ± 3%
34.	No. of Poles	3
35.	Rated Current	630A
36.	Maximum temperature rise over an ambient temperature 50°C.	55°C
37.	Rated operating Duty	0-3min-CO-3min-CO
38.	Rupturing capacity at rated voltage in MVA, Min.	As per design
39.	Breaking Capacity at rated voltage & operating duty	



	Symmetrical in kA rms	21
	Asymmetrical in kA rms	21
40.	Rated making current in kA peak	52.5
41.	Short time current for 3 sec in kA rms	21
42.	Transient Recovery Voltage	
	Rate of rise in kV/ $\mu$ s	0.34 kV/ $\mu$ s as per IEC 62271-100
	Peak Voltage in kV	50
43.	Insulation Level	
	Impulse Voltage with stand on 1.2/50 $\mu$ s full wave in kV	125
	1 minute power frequency voltage withstand in kV	50
44.	Total breaking time for transient fault ( CB + Relay+ trip coil) in ms	45-50 ms
45.	Opening time No load condition in ms	45-50 ms
46.	Opening time under SF6 gas low or vacuum loss condition in ms	45-50 ms
47.	Number of breaks per pole	Single
48.	No of breaker operations permissible without requiring inspection replacement of contacts and other Main parts	
	At 100% rated current	2000
	At 100% rated breaking current, Min.	20
49.	Type of contacts	
	Main	Butt Type
	Arcing	Butt Type
50.	Material of contacts	
	Main	Copper
	Arching	Copper
	Chromium / Silver plated	Chromium / Silver plated
51.	Mechanical Endurance Test for Circuit Breaker, Number of operations	2000
52.	Spring charging mechanism	Motor Operated
53.	Operating mechanism for closing of Circuit Breaker	
	Type	Spring operated Mechanism
	No of breaker operations stored	One
	Trip free or fixed trip	Trip Free
	Earthing for operating mechanism and metal parts	Solidly Earthed
	Earth terminal size and material, Min.	Electrolytic grade Copper 25 x 3mm
54.	Operating mechanism for tripping of	

	Circuit Breaker		
	Type		Spring Operated Mechanism
	No of breaker operations stored		One
	Trip free or fixed trip (V)		Trip Free
	Earthing for operating mechanism and metal parts		Solidly Earthed
	Earth terminal size and material		Electrolytic grade Copper 25 x 3mm
55.	Breaker Accessories		
	Mechanical safety Interlock		Provided
	Automatic safety Interlock		Provided
	Operational Interlock		Provided
	Emergency manual trip		Provided
	Operation counter		Provided
	Spring charge / discharge indicator		Provided
	Manual spring charging facility		Provided
c) Isolators			
56.	Reference standard		IEC-62271-102 / IEC-62271-103
57.	Nominal Voltage in KV		22
58.	Highest System Voltage in kV, Max.		24
59.	Rated Frequency in HZ		50 Hz $\pm$ 3%
60.	No. Of poles		3
61.	Rated Current in Amps		630
62.	Maximum temperature rise over an ambient temperature 50°C.		60°C
63.	Operation		Close-Open-Earth
64.	Rupturing Capacity at rated voltage		630 Amps at 33kV
65.	Maximum over voltage factor when switching off Loaded feeder cable in kA		52.5
66.	No. of isolator operation permissible without requiring inspection, replacement of contacts and other main parts		
	Mechanical Endurance in Number of operations		1000
	At 100% rated making current in Number of operations		100
	At 100% rated breaking current in Number of operations		100
67.	Isolator provided with the following Mechanical safety		
	Mechanical ON and OFF Indication		Provided
	Cable Earth Indication		Provided
	Operational Counter		Provided
	Manual Spring Charging facility		Provided
D) Current Transformer			
68.	Reference standard		IS:16227, I & II
69.	Type		Ring Type, Resin Cast/Tape wound

22 kV, 630 Amps, Extensible / Non extensible type,

Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

70.	Nominal Voltage in KV	22
71.	Highest System Voltage in kV, Max.	24
72.	Rated Frequency in HZ	50 Hz $\pm$ 3%
73.	Current Transformer Ratio	200-100/1Amps
74.	Short circuit withstand	
	Short time current for 1 sec. in kA rms	5
	Dynamic current in kA peak, Min.	7.5
75.	Class of insulation	Class B
76.	Basic insulation level in kV rms	3
77.	Maximum temperature rise over an ambient temperature 50°C.	60°C
78.	Class of Accuracy	
	Metering Core	0.5
	Protection Core	5P10
79.	Rated Burden	2.5 VA
80.	Over Current Rating in %	120
81.	Continuous Over Load in %	120
<b>E) Metering Voltage(Potential) Transformer</b>		
82.	Reference standard	IS:16227, I & III
83.	Type	Resin Cast/Tape wound
84.	Nominal Voltage in KV	22
85.	Highest System Voltage in kV, Max.	24
86.	Rated Frequency in HZ	50 Hz $\pm$ 3%
87.	Voltage Transformer Ratio	22 kV/ $\sqrt{3}$ /110V/ $\sqrt{3}$
88.	Rated Primary Voltage in kV	22 kV/ $\sqrt{3}$
89.	Rated Secondary Voltage in V	110V/ $\sqrt{3}$
90.	Rated Burden in VA	50
91.	Accuracy Class	0.5
92.	Insulation Class	B
93.	Voltage Factor	1.2 Continuous and 1.9 for 8 hrs.
94.	One Minute Power Frequency Dry Withstand Voltage Rating	
	Primary Winding Induced Test in kV rms	50
	Secondary Winding in kV rms	3
	Rated Impulse Voltage in kV peak	125
<b>F) Auxiliary Voltage(Potential) Transformer</b>		
95.	Reference standard	IS:16227, I & III
96.	Type	Resin Cast/Tape wound
97.	Nominal Voltage in KV	22
98.	Highest System Voltage in kV, Max.	24
99.	Rated Frequency in HZ	50 Hz $\pm$ 3%
100.	Voltage Transformer Ratio	22 kV / 230V
101.	Rated Primary Voltage in kV	22 kV
102.	Rated Secondary Voltage in V	230V
103.	Rated Burden in VA	500 VA
104.	Voltage Regulation in %	5
105.	Insulation Class	B
106.	Voltage Factor	1.2
107.	Application & Construction Type	Indoor, Single Phase/Two Pole

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,

Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

108.	One Minute Power Frequency Dry Withstand Voltage Rating	
	Primary Winding Induced Test in kV rms	50
	Secondary Winding in kV rms	3
	Rated Impulse Voltage in kV peak	125
<b>G) Numerical Protection Relay</b>		
109.	Reference Standard	IEC 60255
110.	Type and Model	3 Over Current(O/C) and 1 Earth fault(E/F)
111.	Current Transformer Secondary Input to Relay	1 A
112.	Operating Curve Type	Inverse Definite Minimum Time (IDMT) Relay
113.	Auxiliary Supply	Self Powered relay for Protection
114.	Rated Frequency in HZ	50 Hz $\pm$ 3%
115.	Over Current Protection	
	Low set Over Current protection	20-200% of CT secondary rated current with increment/decrement by 1 %
	High set Over Current protection	100-2000% of CT secondary rated current with increment/decrement by 50%
116.	Earth Fault Protection	
	Low set Earth Fault protection	5% to 80% of the CT rated current in steps of 1%
	High set Earth Fault protection	100-1000% of the CT rated current in steps of 50%
117.	Mounting	Flush Mounted
118.	Operational Indicator	LCD display and LED annunciation lamps
119.	Contact Details	4 Binary Input(BI) and 6 Binary Output(BO)
120.	Self-diagnosis feature	Yes
121.	Password protection	Yes
122.	Communication Protocol	RS 232 or RS 485 Port for IEC 103, Communication Protocol
123.	Event / fault record, Min.	10 Event and 5 Fault Records available
124.	Setting groups	2 Groups available
125.	Circuit Breaker control available	Yes, Only Trip
<b>H) Tripping Coil</b>		
126.	DC Voltage in Volt	24
127.	Maximum Tripping Current at rated voltage in Amps.	5
	Minimum Permissible voltage variation in	85 to 110

	%	
<b>I) HT three phase four wire CT / PT operated 1 Amps fully Static &amp; AMR compatible TOD Tri - vector Energy Meter</b>		
128.	Reference Standard	IS: 14697, 1999 IS: 15959, 2011
129.	Make	Secure / L&T / other MSEDCL approved make
130.	Auxiliary supply Voltage	110V/ $\sqrt{3}$
131.	Class of Accuracy	0.5S
132.	Type of Display	Customized backlite liquid crystal display
133.	Measuring Parameters as per MSEDCL Specification	
		Instantaneous parameters
		Block Load Profile parameters
		Billing Profile Parameters
		Name Plate details Programmable Parameters
		Event Conditions
		All logging parameters for each of the event condition for 3 $\Phi$ / 4W
<b>J) Fault Passage Indicator (FPI) on Short Circuit and Earth fault</b>		
134.	Operating point/Current short circuit in Amp	Adjustable 100/200/300 /400/500 /600/700 /800/900/1000 /1100/1200A ( $\pm 15\%$ )
135.	Operating point/Current earth fault in Amp	Adjustable 10/20/30/40 /60/80/100A ( $\pm 15\%$ )
136.	Response Time in ms	For Short Circuit Adjustable 40/60/80/100/120 /160/200/240 ms Sec( $\pm 100$ m Sec) For Earth Fault Adjustable 40/60/80/160 ms ( $\pm 100$ m Sec)
137.	Auto Reset Time in Hrs	1/2/4/8 hrs (+ / - 1%) after fault
<b>K) Battery Charger</b>		
138.	Input AC Voltage in V	230
139.	Rated Frequency in Hz	50 Hz $\pm$ 3%
140.	Output DC Voltage in V	24
141.	Current Rating in Amps	10
142.	Output DC Voltage for charger	

	Boost Mode in V		27 to 28
	Float Mode in V		27 to 28
143.	Operating Temperature in °C		-25 to 60
144.	Temperature Compensation		Junction temperature of SMPS crosses 142°C, thermal shutdown occurs.
145.	Short Circuit and Overload Protection		Provided
146.	High Voltage Isolation		2 kV for 1 minute
147.	Efficiency		Above 85 %
<b>L) Battery</b>			
148.	Type		Dry Type
149.	Ah Efficiency		> 95%
150.	Self-Discharge		Self-Discharge
151.	Operating Temperature		Normal : +20°C to +30°C & Limits : -20°C to +50°C
152.	Voltage (V)		24V (2 x 12V)
153.	Ah Capacity		7Ah / 12 Ah / 26 Ah
<b>M) Manometer with Non Return Valve</b>			
154.	Type		Analogue
155.	Material		Stainless Steel
156.	Accuracy of calibration pressure		+/-1% at 20°C
157.	Pressure Element		Stainless Steel Welded
158.	Dial		2"
159.	Pointer		Dark
160.	Window		Round
161.	Gas pressure low signal		Indicated by Red Color Zone
162.	Non Return Valve(NRV) Material		Stainless Steel
<b>N) Indoor cable terminations kits</b>			
163.	Type		33 kV touch proof screened termination kit
164.	Materials		Epoxy / EPDM / Silicon Rubber
165.	Size		Up to 3 x 400 sq. mm 33 kV HT cables
166.	Height of Bus bar / transformer / feeder Cable box from ground level		As per Manufacture design
167.	Arrangement for mounting an extra cable at incoming and outgoing side box of Bus bar.		As per Manufacture design
168.	Arrangement for mounting an extra cable at outgoing side box of transformer /		As per Manufacture design

22 kV, 630 Amps, Extensible / Non extensible type,

Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

	feeder.		
<b>O) Automatic Water Level Controller</b>			
172.	Position of Automatic Water Level Controller		200 mm below live contacts
173.	Auxiliary contacts		4 NO + 4 NC
174.	Breaker Tripping and Load break Isolator opening due to water level increases signals to Control room		Yes
<b>P) Name Plate</b>			
175.	Material		Anodized Aluminum / Stainless Steel
176.	Thickness		18 swg / 1.00 mm
177.	Size		145 mm x 116 mm
<b>Q) Painting</b>			
178.	Inside		Powder Coated
179.	Outside		Polyurethane based powder paint. Dark Admiralty Grey, Shade No. 632 as per IS: 5, 2007.

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,

Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

22 kV, 630 Amps, Extensible / Non extensible type,

Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker

**Schedule 'B'**

**Guaranteed Technical Parameters of 22 KV, 630 Amps with, Extensible / Non extensible type, Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker**

Sr. No.	Description	22 kV Ring Main Unit	Parameters to be filled by Bidder
<b>A)Ring Main Unit Assembly</b>			
1.	Indoor / Out door	Indoor / Out door	
2.	Manufacturer's Name & address		
3.	Manufacturer's Type Designation		
4.	Model		
5.	Configurations(Type)	L= Isolator. V= VCB. M=Metering	
	i) Configurations	3 Way, M+LLV+	
	ii) Configurations	4 Way, +LLLL+	
	iii)Configurations	4 Way, M+LLL+	
	iv)Configurations	4 Way, M+LLVV+	
	v) Configurations	5 Way, M+LLVVV+	
	vi)Configurations	6 Way, +LLVVV+V+	
6.	Reference Standard	IEC-62271-100, 200, 103 and IEC-60694	
7.	Rated Voltage in kV	22	
8.	Highest System Voltage in kV, Max.	24	
9.	Number of Phase	3	
10.	Frequency in HZ.	50 Hz $\pm$ 3%	
11.	Short Circuit rating		
	a) Breaking Symmetrical for 3 Sec. in KA	21	
	b) Breaking Asymmetrical for 3 Sec. in KA	21	
	c) Short time for 3 Sec. in KA.	21	
12.	Insulation Level		
	a) Impulse withstand in KV peak.	125	
	b) 1 Minute 50 Hz. Voltage withstand in KV rms	50	
13.	Internal arc rating for 1 sec. in kV	25	
14.	Construction: Material and Size		

Technical Specification for 22 kV, 630 Amps, Extensible / Non extensible type,

Outdoor / Indoor, SCADA Compatible Motorized Ring Main Unit with 200Amps Vacuum Circuit Breaker



	a) Inner Enclosure	Main Stainless Steel Tank with 2 mm Thickness	
	b) Outer Enclosure	CRCA Sheet of 2 mm thickness or Galvanized Sheet of 1.6 mm thickness	
15.	Degree of protection		
	a) Inner Enclosure	IP 67	
	b) Outer Enclosure	IP 54 (Main Door close) and IP 41 (Main Door open)	
16.	The Ring Main Unit and accessories completely wire and tested at factory	Yes	
17.	Paint	Polyurethane based powder paint	
18.	Color	Dark Admiralty Grey, Shade No. 632 as per IS: 5, 2007	
19.	Thickness of coat, Min.	150 microns for CRCA Sheet and 80 microns for	
<b>Overall Dimensions and Weight</b>			
20.	Tolerance to Overall Dimensions	+ 5 %	
	1. Extensible 3 Way RMU(3 Way, M+LLV+)	As per Manufacture Design	
	W x D x H, in mm	As per Manufacture Design	
	Weight in kg	As per Manufacture Design	
	2. Extensible 4 Way RMU(4 Way, +LLLL+)	As per Manufacture Design	
	W x D x H, in mm	As per Manufacture Design	
	Weight in kg	As per Manufacture Design	
	3. Extensible 4 Way RMU(4 Way, M+LLL+)	As per Manufacture Design	
	W x D x H, in mm	As per Manufacture Design	
	Weight in kg	As per Manufacture Design	
	4. Extensible 4 Way RMU(4 Way, M+LLVV+)	As per Manufacture Design	
	W x D x H, in mm	As per Manufacture Design	
	Weight in kg	As per Manufacture Design	
	5. Extensible 5 Way RMU(5 Way, M+LLVVV+)	As per Manufacture Design	
	W x D x H, in mm	As per Manufacture Design	
	Weight in kg	As per Manufacture Design	
	6. Extensible 6 Way RMU(6 Way, +LLVVV+V+)	As per Manufacture Design	
	W x D x H, in mm	As per Manufacture Design	
	Weight in kg	As per Manufacture Design	
<b>B) Bus Bar</b>			

21.	Make	As per Manufacture Design	
22.	Reference Standard	IS: 1897, 2008	
23.	Grade and Material	Electrolytic Grade Copper	
24.	Cross sectional area in mm <sup>2</sup>	400	
25.	Size in mm	40 x 10 or as per Manufacture design	
26.	Current Density in Amps/mm <sup>2</sup> , Max.	1.6	
27.	Continuous Current in Amps	630	
28.	Maximum temperature rise over an ambient temperature 50°C.	55°C	
29.	Short time current rating for 3 Sec in kA rms	21	
30.	Clearance in mm from bare bus bar		
	a) Phase to Phase for Isolator or as per design	78	
	b)Phase to Phase for VCB or as per design	78	
	c)Phase to Earth for Isolator or as per design	78	
	d)Phase to Earth for VCB or as per design	78	
31.	Bus Supports		
	i)Make	As per Manufacture Design	
	ii)Type	As per Manufacture Design	
	iii)Reference Standard	IEC 60243-1, ASTM D 648	
	iv)Voltage Class in kV	22 kV	
	v) Creepage distance in mm or as per design	125 in SF <sub>6</sub> gas	
	vi)Bus Bar support spacing in mm or as per design	125	
32.	Filling SF <sub>6</sub> gas pressure (Filling pressure at 20°C), Min.	1.4 Bar	
33.	Operating SF <sub>6</sub> gas pressure at 20°C, Min.	0.5 Bar	
<b>C)Vacuum Circuit Breaker</b>			
34.	Make	As per Manufacture Design	
35.	Type	As per Manufacture Design	
36.	Reference Standard	IEC 62271-100	
37.	Rated Voltage in kV	22	
38.	Highest System Voltage in kV, Max.	24	
39.	Type	Vacuum Type	
40.	Rated Frequency in Hz.	50 Hz ± 3%	
41.	No. of Poles	3	
42.	Rated Current	630A	
43.	Maximum temperature rise over an ambient	55°C	

	temperature 50°C.		
44.	Rated operating Duty	0-3min-CO-3min-CO	
45.	Rupturing capacity at rated voltage in MVA, Min.	As per Design	
46.	Breaking Capacity at rated voltage & operating duty		
	i) Symmetrical in kA rms	21	
	ii) Asymmetrical in kA rms	21	
	iii) Rated making current in kA peak	52.5	
47.	Short time current for 3 sec in kA rms	21	
48.	Transient Recovery Voltage		
	i) Rate of rise in kV/ $\mu$ s	0.34 kV/ $\mu$ s as per IEC 62271-100	
	ii) Peak Voltage in kV	50	
49.	Insulation Level		
	a) Impulse Voltage with stand on 1.2/50 $\mu$ s full wave in kV	125	
	b) 1 minute power frequency voltage withstand in kV	50	
50.	Vacuum Bottle		
	i) Make	As per Manufacture Design	
	ii) Type	As per Manufacture Design	
	iii) Rated Voltage in kV	As per Manufacture Design	
	iv) Rated Current in Amps.	As per Manufacture Design	
51.	Total breaking time for transient fault ( CB + Relay+ trip coil) in ms	45-50 ms	
52.	Opening time No load condition in ms	45-50 ms	
53.	Opening time under SF6 gas low or vacuum loss condition in ms	45-50 ms	
	i) At 100% Breaking capacity		
	a) Opening time (ms)	As per Manufacture Design	
	b) Arcing time (ms)	As per Manufacture Design	
	c) Total break time (ms)	As per Manufacture Design	
	ii) At 60% Breaking capacity		
	a) Opening time (ms)	As per Manufacture Design	
	b) Arcing time (ms)	As per Manufacture Design	
	c) Total break time (ms)	As per Manufacture Design	
	iii) At 30% Breaking capacity		
	a) Opening time (ms)	As per Manufacture Design	
	b) Arcing time (ms)	As per Manufacture Design	
	c) Total break time (ms)	As per Manufacture Design	
	iv) At 10% Breaking capacity		
	a) Opening time (ms)	As per Manufacture Design	
	b) Arcing time (ms)	As per Manufacture Design	
	c) Total break time (ms)	As per Manufacture Design	
54.	Number of breaks per pole	Single	

55.	No of breaker operations permissible without requiring inspection replacement of contacts and other Main parts		
	a)At 100% rated current	2000	
	b)At 100% rated breaking current, Min.	20	
56.	Type of contacts		
	i)Main	Butt Type	
	ii)Arcing	Butt Type	
57.	Material of contacts		
	i)Main	Copper	
	ii)Arching	Copper	
	iii)Chromium / Silver plated	Chromium / Silver plated	
58.	Mechanical Endurance Test for Circuit Breaker, Number of operations	2000	
59.	Spring charging mechanism	Motor Operated	
60.	Operating mechanism for closing of Circuit Breaker		
	i)Type	Spring operated Mechanism	
	ii)No of breaker operations stored	One	
	iii)Trip free or fixed trip	Trip Free	
	iv)Earthing for operating mechanism and metal parts	Solidly Earthed	
	v)Earth terminal size and material, Min.	Electrolytic grade Copper 25 x 3mm	
61.	Operating mechanism for tripping of Circuit Breaker		
	i)Type	Spring Operated Mechanism	
	ii)No of breaker operations stored	One	
	iii)Trip free or fixed trip (V)	Trip Free	
	iv)Earthing for operating mechanism and metal parts	Solidly Earthed	
	v)Earth terminal size and material	Electrolytic grade Copper 25 x 3mm	
	vi)Spring charging mechanism		
	a)Make	As per Manufacture Design	
	b)Type	As per Manufacture Design	
	c)Motor, Voltage and Watts	As per Manufacture Design	
62.	Breaker Accessories		
	i)Mechanical safety Interlock	To be Provided	
	ii)Automatic safety Interlock	To be Provided	
	iii)Operational Interlock	To be Provided	
	iv)Emergency manual trip	To be Provided	
	v)Operation counter	To be Provided	
	vi)Spring charge / discharge indicator	To be Provided	
	vii)Manual spring charging	To be Provided	

	facility		
63.	Impact load on foundation design (to include dead load plus impact value on Closing at maximum interrupting rating)in kg		
	i)Extensible 3 Way RMU(3 Way, M+LLV+)	As per Manufacture Design	
	ii)Extensible 4 Way RMU(4 Way, +LLLL+)	As per Manufacture Design	
	iii)Extensible 4 Way RMU(4 Way, M+LLL+)	As per Manufacture Design	
	iv)Extensible 4 Way RMU(4 Way, M+LLV+)	As per Manufacture Design	
	v)Extensible 5 Way RMU(5 Way, M+LLVV+)	As per Manufacture Design	
	vi)Extensible 6 Way RMU(6 Way, +LLVV+V+)	As per Manufacture Design	
<b>D)Isolators</b>			
64.	Make	As per Manufacture Design	
65.	Type	As per Manufacture Design	
66.	Reference standard	IEC-62271-102 / IEC-62271-103	
67.	Nominal Voltage in KV	22	
68.	Highest System Voltage in kV, Max.	24	
69.	Rated Frequency in HZ	50 Hz $\pm$ 3%	
70.	No. Of poles	3	
71.	Rated Current in Amps	630	
72.	Maximum temperature rise over an ambient temperature 50°C.	60°C	
73.	Operation	Close-Open-Earth	
74.	Rupturing Capacity at rated voltage	630Amps at 22 kV	
75.	Maximum over voltage factor when switching off Loaded feeder cable in kA	52.5	
76.	No. of isolator operation permissible without requiring inspection, replacement of contacts and other main parts		
	i)Mechanical Endurance in Number of operations	1000	
	ii)At 100% rated making current in Number of operations	100	
	iii)At 100% rated breaking current in Number of operations	100	
77.	Isolator provided with the following Mechanical safety		

	a)Mechanical ON and OFF Indication	To be Provided	
	b)Cable Earth Indication	To be Provided	
	c)Operational Counter	To be Provided	
	d)Manual Spring Charging facility	To be Provided	
<b>E) Current Transformer</b>			
78.	Make	As per Manufacture Design	
79.	Reference standard	IS:16227, I & II	
80.	Type	Ring Type, Resin Cast/Tape wound	
81.	Nominal Voltage in KV	22	
82.	Highest System Voltage in kV, Max.	24	
83.	Rated Frequency in HZ	50 Hz $\pm$ 3%	
84.	Current Transformer Ratio	200-100/1Amps	
85.	Short circuit withstand		
	i)Short time current for 3 sec. in kA rms	5	
	ii)Dynamic current in kA peak, Min.	7.5	
86.	Class of insulation	Class B	
87.	Basic insulation level in kV	3	
88.	Maximum temperature rise over an ambient temperature 50°C.	60°C	
89.	Class of Accuracy		
90.	Metering Core	0.5	
91.	Protection Core	5P10	
92.	Rated Burden	2.5 VA	
93.	Over Current Rating in %	120	
94.	Continuous Over Load in %	120	
<b>F) Metering Voltage(Potential) Transformer</b>			
95.	Make	As per Manufacture Design	
96.	Reference standard	IS:16227, I & III	
97.	Type	Resin Cast/Tape wound	
98.	Nominal Voltage in KV	22	
99.	Highest System Voltage in kV, Max.	24	
100.	Rated Frequency in HZ	50 Hz $\pm$ 3%	
101.	Voltage Transformer Ratio	22 kV/ $\sqrt{3}$ /110V/ $\sqrt{3}$	
102.	Rated Primary Voltage in kV	22 kV/ $\sqrt{3}$	
103.	Rated Secondary Voltage in V	110V/ $\sqrt{3}$	
104.	Rated Burden in VA	50	
105.	Accuracy Class	0.5	
106.	Insulation Class	B	
107.	Voltage Factor	1.2 Continuous and 1.9 for 8 hrs.	
108.	One Minute Power Frequency Dry Withstand Voltage Rating		
	a) Primary Winding Induced	50	

	Test in kV rms		
	b)Secondary Winding in kV rms	3	
	c)Rated Impulse Voltage in kV peak	125	
<b>G) Auxiliary Voltage(Potential) Transformer</b>			
109.	Make	As per Manufacture Design	
110.	Reference standard	IS:16227, I & III	
111.	Type	Resin Cast/Tape wound	
112.	Nominal Voltage in KV	22	
113.	Highest System Voltage in kV, Max.	24	
114.	Rated Frequency in HZ	50 Hz $\pm$ 3%	
115.	Voltage Transformer Ratio	22 kV/ $\sqrt{3}$ / 230V	
116.	Rated Primary Voltage in kV	22 kV/ $\sqrt{3}$	
117.	Rated Secondary Voltage in V	230 V	
118.	Rated Burden in VA	500 VA	
119.	Voltage Regulation in %	5	
120.	Insulation Class	B	
121.	Voltage Factor	1.2	
122.	Application & Construction Type	Indoor, Single Phase/Two Pole	
123.	One Minute Power Frequency Dry Withstand Voltage Rating		
	a)Primary Winding Induced Test in kV rms	50	
	b)Secondary Winding in kV rms	3	
	c)Rated Impulse Voltage in kV peak	125	
<b>H) Numerical Protection Relay</b>			
124.	Make	As per Manufacture Design	
125.	Type and Model	As per Manufacture Design	
126.	Reference Standard	IEC 60255	
127.	Type and Model	3 Over Current(O/C) and 1 Earth fault(E/F)	
128.	Current Transformer Secondary Input to Relay	1 A	
129.	Operating Curve Type	Inverse Definite Minimum Time (IDMT)Relay	
130.	Auxiliary Supply	Self Powered relay for Protection	
131.	Rated Frequency in HZ	50 Hz $\pm$ 3%	
132.	Over Current Protection		
	a)Low set Over Current protection	20-200% of CT secondary rated current with increment/decrement by 1 %	
	b)High set Over Current protection	100-2000% of CT secondary rated current with increment/decrement by 50%	
133.	Earth Fault Protection		

	a)Low set Earth Fault protection	5% to 80% of the CT rated current in steps of 1%	
	b)High set Earth Fault protection	100-1000% of the CT rated current in steps of 50%	
134.	a)Mounting	Flush Mounted	
	b)Mounting Dimensions, W X L x H in mm	As per Manufacture Design	
135.	Operational Indicator	LCD display and LED annunciation lamps	
136.	Contact Details	4 Binary Input(BI) and 6 Binary output(BO)	
137.	Self-diagnosis feature	To be Provided	
138.	Password protection	To be Provided	
139.	Communication Protocol	RS 232 or RS 485 Port for IEC 103 Communication Protocol	
140.	Event / fault record, Min.	10 Event and 5 Fault Records available	
141.	Setting groups	2 Groups available	
142.	Circuit Breaker control available	Yes, Only Trip	
<b>I) Tripping Coil</b>			
143.	Make	As per Manufacture Design	
144.	Type	As per Manufacture Design	
145.	DC Voltage in Volt	24, Pulse operated	
146.	Maximum Tripping Current at rated voltage in Amps.	5	
147.	Minimum Permissible voltage variation in %	85 to 110	
148.	Power at Voltage in Watts	As per Manufacture Design	
<b>J) HT three phase four wire CT / PT operated 1 Amps fully Static &amp; AMR compatible TOD Tri - vector Energy Meter</b>			
149.	Reference Standard	IS: 14697, 1999 IS: 15959, 2011	
150.	Make	Secure / L&T / other MSEDCL approved make	
151.	Auxiliary supply Voltage	110V/√3	
152.	Class of Accuracy	0.5S	
153.	Type of Display	Customized backlite liquid crystal display	
154.	Measuring Parameters as per MSEDCL Specification		
	i)Instantaneous parameters	To be Provided	
	ii)Block Load Profile parameters	To be Provided	
	iii)Billing Profile Parameters	To be Provided	
	iv)Name Plate details Programmable Parameters	To be Provided	
	v)Event Conditions	To be Provided	
	vi)All logging parameters for each of the event condition for 3	To be Provided	



	$\Phi / 4W$		
<b>K) Fault Passage Indicator (FPI) on Short Circuit and Earth fault</b>			
155.	Make	As per Manufacture Design	
156.	Type and Model	As per Manufacture Design	
157.	Operating point/Current short circuit in Amp	Adjustable 100/200/300 /400/500 /600/700 /800/900/1000 /1100/1200A ( $\pm 15\%$ )	
158.	Operating point/Current earth fault in Amp	Adjustable 10/20/30/40 /60/80/100A ( $\pm 15\%$ )	
159.	Response Time in ms	For Short Circuit Adjustable 40/60/80/100/120 /160/200/240 ms Sec( $\pm 100$ m Sec) For Earth Fault Adjustable 40/60/80/160 ms ( $\pm 100$ m Sec)	
160.	Auto Reset Time in Hrs	1/2/4/8 hrs (+ / - 1%) after fault	
<b>L) Battery Charger</b>			
161.	Make	As per Manufacture Design	
162.	Type and Model	As per Manufacture Design	
163.	Input AC Voltage in V	230	
164.	Rated Frequency in Hz	50 Hz $\pm 3\%$	
165.	Output DC Voltage in V	24	
166.	Current Rating in Amps	10	
167.	Output DC Voltage for charger		
	i) Boost Mode in V	27 to 28	
	ii) Float Mode in V	27 to 28	
168.	Operating Temperature in $^{\circ}C$	-25 to 60	
169.	Temperature Compensation	Junction temperature of SMPS crosses $142^{\circ}C$ , thermal shutdown occurs.	
170.	Short Circuit and Overload Protection	To be Provided	
171.	High Voltage Isolation	2 kV for 1 minute	
172.	Efficiency	Above 85 %	
173.	Mounting Arrangement	As per Manufacture Design	
174.	Dimensions, W x D x H in mm	As per Manufacture Design	
<b>N) Battery</b>			
175.	Make	As per Manufacture Design	
176.	Type	Dry Type	

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177.	Ah Efficiency	> 95%	
178.	Self-Discharge	Self-Discharge	
179.	Operating Temperature	Normal : +20°C to +30°C & Limits : -20°C to +50°C	
180.	Voltage (V)	24V (2 x 12V)	
181.	Ah Capacity	7Ah / 12 Ah / 26 Ah	
<b>O) Manometer with Non Return Valve</b>			
182.	Make	As per Manufacture Design	
183.	Type and Model	Analogue, ---	
184.	Material	Stainless Steel	
185.	Accuracy of calibration pressure	+/-1% at 20°C	
186.	Pressure Element	Stainless Steel Welded	
187.	Dial	2"	
188.	Pointer	Dark	
189.	Window	Round	
190.	Gas pressure low signal	Indicated by Red Color Zone	
191.	Non Return Valve(NRV) Material	Stainless Steel	
<b>P) Indoor cable terminations kits</b>			
192.	Make	As per Manufacture Design	
193.	Type	22 kV touch proof screened termination kit	
194.	Materials	Epoxy / EPDM / Silicon Rubber	
195.	Cable Size	Up to 3 x 400 sq. mm 22 kV HT cables	
196.	Height of each Cable box from ground level	As per Manufacture Design	
197.	Arrangement for mounting an extra cable at incoming and outgoing side box of Bus bar.	As per Manufacture Design	
198.	Arrangement for mounting an extra cable at outgoing side box of transformer / feeder.	As per Manufacture Design	
<b>Q) Automatic Water Level Controller</b>			
199.	Make	As per Manufacture Design	
200.	Type and Model	As per Manufacture Design	
201.	Position of Automatic Water Level Controller	200 mm below live contacts	
202.	Auxiliary contacts	4 NO + 4 NC	
203.	Breaker Tripping and Load break Isolator opening due to water level increases; signals to Control room	To be Provided	

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<b>R) Name Plate</b>			
204.	Material	Anodized Aluminum / Stainless Steel	
205.	Thickness	18 swg / 1.00 mm	
206.	Size	145 mm x 116 mm	
<b>S) Painting</b>			
207.	Inside	Powder Coated	
208.	Outside	Polyurethane based powder paint. Dark Admiralty Grey, Shade No. 632 as per IS: 5, 2007.	
<b>T) Danger Board</b>			
209.	Reference Standard	IS: 2551, 1982	
210.	Material	Mild Steel	
211.	Thickness in mm, Min.	1.6	
212.	Size H x L in mm	200 x 250	
<b>U) Type Test</b>			
213.	Following Type Test carried out within 5 years at NABL laboratories in India or equivalent International Laboratories, Yes / No		
214.	Short time Current withstand test and peak current withstand test.	Yes	
215.	Lightening Impulse voltage with-stand test	Yes	
216.	Temperature rise test.	Yes	
217.	Short Circuit current making and breaking tests.	Yes	
218.	Power frequency voltage withstand test (dry).	Yes	
219.	Capacitive current switching test confirming to IEC.	Yes	
220.	Mechanical operation test.	Yes	
221.	Measurement of the resistance of the main circuit.	Yes	
222.	Degree of protection of	Yes	

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	Inner enclosure and outer enclosure		
223.	Switch, circuit breaker, earthing switch making capacity.	Yes	
224.	Switch, circuit breaker breaking capacity.	Yes	
225.	Internal arc withstand Test for Inner Enclosure and Cable Chamber.	Yes	
226.	Checking of partial discharge on complete unit.	Yes	
227.	Guarantee of Ring Main Units and accessories supplied against this specification	66 months from the date of receipt at the consignee's Stores Center or 60 months from the date of commissioning	

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**Schedule 'C'**  
**List of Type Test Reports to be enclosed with the offer**

Sr. No.	Description of Type Test	Type & Make of Ring Main Unit & its rating	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No., dt & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1.						
2.						
3.						
4.						

Name of the firm\_\_\_\_\_

Signature of the bidder\_\_\_\_\_

Designation\_\_\_\_\_

Date\_\_\_\_\_

**Schedule 'D'**  
**Schedule of Deviations from Specification**

Sr. No.	Clause No.	Details of Deviations
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Name of the firm\_\_\_\_\_

Signature of the bidder\_\_\_\_\_

Designation\_\_\_\_\_

Date\_\_\_\_\_

**Schedule 'E'**  
**Schedule of Bidder's Experience**

Bidder shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by Purchaser in case he considers such a reference necessary.

Sr. No.	Name of Client & Description order	Value of order along with size & qty	Period of supply and commissioning	Name & Address to whom reference may be made
1.				
2.				
3.				
4.				
5.				
6.				
7.				

Name of the firm \_\_\_\_\_  
Signature of the bidder \_\_\_\_\_  
Designation \_\_\_\_\_  
Date \_\_\_\_\_

**Schedule 'F'**

**Deviations from specified Test requirements specified in Relevant Standards  
and Present Specification**

Sr. No.	Name of Test	Standard No. & Clause No.	Requirement of standards	Proposed deviation	Reasons for deviation.
1.	Type Test				
2	Additional Test				
3	Acceptance Test				

Name of the firm\_\_\_\_\_

Signature of the bidder\_\_\_\_\_

Designation\_\_\_\_\_

Date\_\_\_\_\_



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**Schedule 'G'**  
**Proforma Of Undertaking**

We hereby confirm that ---Rating Ring Main Units offered by us against this tender are of the same design and type as have been supplied to M.S.E.D.C.L. against earlier order No. \_\_\_\_\_ dtd. \_\_\_\_\_ and all the Type Test Reports thereof were approved by C.E. (Quality Control and Testing) vide letter No. \_\_\_\_\_ dtd. \_\_\_\_\_ (copy enclosed.)

We further confirm that the said Type Test have been carried out at \_\_\_\_\_ within five years prior to the date of opening of present tender.

Seal and signature of Bidder

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