

**TECHNICAL SPECIFICATION FOR 11 KV COMPACT RING MAIN UNITS (Non DAS) FOR  
OUT DOOR USE IN 11 KV UNDERGROUND CABLE SYSTEM**

**1.0 SCOPE:**

- 1.1 This specification covers the design, manufacture, testing and delivery of "11 kV Outdoor Type Prefabricated Compact Switching Stations", hereinafter called "Compact RMU" (Non DAS) to be erected in the 11kV distribution system.
- 1.2 The Compact RMU shall be suitable for main cable network of 630 Amps and loop cable network of 400 Amps and shall consist of the following:
  - (a) Two Load Break Switches (ODs) with Earthing Switches for incoming and out going main loop 11 kV XLPE cables of size 95/240/400 square millimeter cross section aluminum conductor,
  - (b) One/Two/Three Circuit Breaker (VL) with Earthing Switch for connecting Distribution loop 11 kV XLPE cables of size 95/240/400 square millimeter cross section aluminum conductor, and
  - (c) Provision for adding more number of Circuit Breakers (VL) of the type mentioned in item (b).
- 1.3 The bidder should quote separate costs for the unit comprising of two Load Break Switches for Incomers along with one Circuit Breaker, and additional Circuit Breakers. The purchaser shall select a suitable configuration compounding these units at the time of placing the order.
- 1.4 These shall comply with the following system parameters:
  1. Nominal System Voltage: 11 kV
  2. Highest System Voltage: 12 kV
  3. Rated Voltage: 12 kV
  4. System frequency: 50 Hz
  5. Number of Phases: Three Phase - Three Wire
- 1.4(b) The RMU shall be suitable for outdoor installation in 11kV system and shall be with 630Amps insulated copper/Aluminum Bus Bars.
- 1.5 The Load Break Switches with Earthing Switches, and the Circuit Breakers with Earth Switches used in the Compact RMU shall be of SF<sub>6</sub> gas filled type using SF<sub>6</sub> / Vacuum circuit breaker meeting the following criteria:

1. Lightning Impulse Withstand Voltage
  - (a) Phase - to - Phase & Phase - to - Earth: 75 kVp
  - (b) Across the Isolating distance: 85 kVp
2. Power Frequency Withstand Voltage:
  - (1) to earth, between poles and across opening switch device 28 kV rms for 1 minute
  - (2) across isolating device 32 kV rms for 1 minute
3. Rated Short Time Withstand/Breaking Current: 20 kA rms
4. Rated duration of Short Circuit: 3 seconds
5. Rated Normal Current: 630 Amps rms
6. Load Break Switches :
  - (a) Rated Short Circuit making capacity: 50 kA peak at rated voltage (both the earth switches and Load Break Switches)
  - (b) Rated Load Interrupting Current: 630 A rms
  - (c) Rated Cable Charging Interrupting Current: 25 A

1.6 The configuration of the Compact RMU shall be generally as per Figure 1 enclosed. Provision should be made to extend the Compact RMU by installing additional Circuit Breakers of similar design.

1.7 All the switchgear shall be capable of withstanding the specified current without any damage being caused, in accordance with the latest versions of IEC 60694 and IS 3427.

## **2.0 SERVICE CONDITIONS:**

2.1 The equipment shall be suitable for installation at location having the following climatic conditions:

- (a) Annual average ambient temperature: 40°C
- (b) Maximum ambient temperature: 45°C
- (c) Temperature rise due to solar absorption: 10°C
- (d) Maximum relative humidity: 95%
- (e) Annual rainfall: 1000 to 1200 mm
- (f) Duration of rainy season: May to October
- (g) Altitude: up to 1000 M above MSL
- (h) Environmental condition: The RMU should be compact Modular in construction and suitable for outdoor application without any further covers

or enclosure. The RMU shall be tested for weather proofing tests as per IS & IEC. The RMU's are exposed to sun and rain by the side of road and subject to dust and Pollution from the heavy vehicular Traffic.

### **3.0 STANDARDS:**

3.1 The equipments and all the components shall meet the requirements of the latest versions of the following standards:

- (a) IS 3427: AC metal enclosed switchgear and control gear for rated voltages above 1 KV and upto and including 52 KV.
- (b) IS 12063: Classification of degrees of protection provided by enclosures of electrical equipment.
- (c) IS 9920 (Parts 1 to 4): High Voltage Switches.
- (d) IS 9921 (Parts 1 to 5): Specification for AC disconnectors and earthing switches for voltages above 1000 V
- (e) IS 13118: HV AC Circuit Breakers.
- (f) IS 12729: General requirements of switchgear and control gear for voltages exceeding 1000 V
- (g) IS 10601: Dimensions of terminals of HV Switchgear and Control gear.
- (h) IEC 1330: High voltage/Low voltage prefabricated substations
- (i) IEC 60694: Common clauses for MV switchgear standards.
- (j) IEC 6081: Monitoring and control.
- (k) IS 2705: Current Transformers
- (l) IS 8686: Specification for Static Protective Relays
- (m) IEC 62271-200 standards for high voltage metal clad switchgear up to 52 kV.
- (n) IS 9431: Busbar support Insulator

3.2 In case of equipments and/or components of the same conforming to any other International standards, which are equal to or higher but not less rigid than the standards and specifications mentioned above, the same should be clearly indicated and a copy of such standards shall be furnished along with the offer. Whenever such standards are in any other language other than English, an English translation of the same shall also be furnished.

### **4.0 DESIGN:**

4.1 The compact RMU shall be designed to operate at the rated voltage of 12 kV. It shall consist of Two numbers of 630 Amps SF<sub>6</sub> Insulated Load Break Switches as Incomers and The required numbers of 400 Amps Vacuum or SF<sub>6</sub> Circuit Breakers suitable for 630 Amps main network for control of 11 kV loop circuits consisting of several distribution transformers; total load of which do not exceed 3500 kVA. It shall also include, within the same metal enclosure,

earthing switches for each Load Break Switch and Circuit Breaker for earthing each of the devices. Suitable fool-proof interlocks shall be provided to these earthing switches to prevent its inadvertent or accidental closing when the circuit is live and the concerned Load Break Switch/Circuit Breaker is in closed position. Provision should be made for extension of few more Circuit Breakers or Load Break Switches on a future date. In case of gas filled units, the switchgear and busbars shall be contained in stainless steel enclosure filled with gas at relative pressure between 0.2 and 0.8 bar to ensure adequate insulation and safe operation. The assembly should not require further gas processing during its expected life of operation of 30 years as per Clause GG 2.3 and 3.3 of IS 3427. The degree of protection required against environment shall be not less than IP 54 of IS 12063. The Compact RMU shall have atleast an IP54 Protection Index as per IS 12063 against dust and splashing of water. The active parts of the switchgear shall be maintenance free and the Compact RMU shall be of low-maintenance type.

- 4.2 The tank shall be made of suitable stainless steel of minimum 2 mm thickness or Metallised Cast Resin of adequate thickness and shall be internal arc tested.
- 4.3 The Compact RMU shall be suitable for mounting on its connecting cable trench. A suitably sized nameplate clearly indicating its functional units and their electrical characteristics shall identify each unit. The positions of the different devices shall be clearly visible to the operator on the front of the compact RMU and the operations shall be clearly visible. The compact RMUs shall be such that access to live parts shall not be possible without the use of tools.
- 4.4 All the associated switchgear shall be assembled on an outdoor panel with suitable housing arrangement and interconnection for busbars, Current Transformers, relays etc. The cubicle shall be metal enclosed with sheet of not less than 2-5 mm thickness and fitted with pressure relief arrangement directed away from the operator. The individual panel shall have a separate front door, which can be locked with a padlock. The scope of supply includes panel interconnecting bus strip bolts and nuts, insulating compounds. The ends of the busbars shall be fully insulated to prevent flashover to panel cover. The side cover shall be insulated and suitable gasket shall be provided and

made waterproof and vermin-proof. The outdoor panel shall have to be provided with housing having rainwater sheds and tropicalized.

- 4.5 The fabricated parts shall be initially degreased using an alkaline degreaser. They shall then be picked and dipped in phosphating solution. The surface shall be painted with zinc chromate primer and dried for about 24 hours. Dents and scratches, if any, shall be smoothened out with suitable compound. After the surface has been hardened, the compound shall be dry0scrubbed with emery cloth to remove any unevenness. The compound shall then be wet flattened using water proofing emery and dried. The first coat of paint shall then be spray painted and all the above procedure shall be repeated till a perfect surface is achieved. Three coats of paint of the required shade shall then be sprayed finally.
- 4.6 The exterior finish shall be Grey colour and the shade shall be got approved before taking up manufacture. Due regard shall be given the climatic conditions under which the equipment has to work. The ambient temperature may vary from 10°C to 45°C and due to exposure directly to sun the panel temperatures will be much higher than this. For this purpose, an additional temperature rise of 10°C shall be designed to prevent ingress of dust and moisture and accidental contact with live parts and conform to IP54 and IP2X of IS12063.
- 4.7 The following accessories shall be provided for each RMU:
- i. Locks for all the doors with two sets of keys and one master key
  - ii. Earth bus of GI earthing plates 50x6mm run throughout the panel
  - iii. Base channel with foundation bolts.
  - iv. Wire guard mesh on front door and rear side for preventing pasting of papers etc.
  - v. Ventilating louvers with weld mesh
  - vi. Danger plate, caution boards, nameplates, rating plates, protection for live parts etc.
  - vii. All the required items for the satisfactory operation whether specifically mentioned or not.

- 4.8 The design shall incorporate such features to prevent any accidental opening of the earth switch when it is in closed position. Similarly accidental closing of Circuit Breaker or Load Break Switch shall be prevented when the same is in open position from the release of any latch or spring in tension due to vibrations caused externally or internally and shall prevent accidents.

## **5.0 EARTHING:**

- 5.1 There shall be continuity between metallic parts of the Compact RMUs and cables so that there is no dangerous electric field in the surrounding air and safety of the personnel is ensured. The frames should be connected to the main earth bars. The cables should be earthed by an Earthing Switch having the specified short circuit making capacity. The Earthing Switch shall be operable only when the main switch is open and suitable mechanical fail-proof interlock shall be provided for the same.
- 5.2 The Earthing Switch shall be provided with a reliable earthing terminal for connection to an earthing conductor having a clamping screw, suitable for the specified earth fault conditions. The diameter of the clamping screw shall be atleast 12 mm. The connection point shall be marked with the earth symbol. The flexible connections between the earthing blade and the frame shall have a cross section of atleast 50 square mm copper or equivalent in aluminum.
- 5.3 The Earthing Switch shall be fitted with its own operating mechanism and manual closing shall be driven by a fast acting mechanism, independent of operator's action. Mechanical interlocking system shall be such that the operating staff shall be prevented from closing the Earthing Switch when the main switch is closed.

## **6.0 INCOMER LOAD BREAK SWITCHES:**

- 6.1 The Load Break Switches shall be maintenance free. The position of power contacts and earthing contacts shall be clearly visible on the front of the Compact RMU. The position indicator shall provide positive contact indication in accordance with IS 9920. In addition, the manufacturer shall prove the reliability of indication in accordance with IS 9921. These switches shall have three positions, viz. Open, Closed and Earthed and shall be constructed in such a way that natural interlocking prevents unauthorized operations. The

switches shall be fully assembled in the factory. Manual opening and closing shall be driven by a fast-acting mechanism, independent of operator's action.

#### **7.0 CIRCUIT BREAKERS:**

- 7.1 The Circuit Breakers shall be maintenance free. The position shall be clearly visible on the front of the Compact RMU. The position indicator shall provide positive contact indication in accordance with IS 9920. In addition, the manufacturer shall prove the reliability of indication in accordance with IS 9921. These switches shall have three positions, viz. Open, Closed and Earthed and shall be constructed in such a way that natural interlocking prevents unauthorized operations. They shall be fully assembled, tested and inspected in the factory.
- 7.2 An operating mechanism can be used to manually close the Circuit Breaker and charge the mechanism in a single movement. It shall be fitted with a local system for manual tripping. There should be no automatic reclosing. The Circuit Breaker shall be capable of closing fully and latching against the rated making current. Mechanical indication of the "OPEN" and "CLOSED" position of the Circuit Breaker shall be provided. The breakers of the same type and rating shall be interchangeable.
- 7.3 When the Circuit Breaker closing mechanism is of the spring operated type, it should not be possible for the Circuit Breaker to close until the spring is fully charged and the associated charging mechanism is fully ready for closing. Wherever external spring charging handle is required to charge the spring, it should be ensured that the same is not allowed to move during the release of its spring energy. Alternately, it should not be possible to release the spring energy till the charging handle is completely disengaged from the mechanism. A visual mechanical indicating device shall be provided to indicate the status of spring viz., "SRING CHARGED" or "SPRING FREE". It shall be possible to charge the spring when the Circuit Breaker is closed and if the spring is released the Circuit Breaker should not open; nor this operation result in any mechanical damage to the component of the Circuit Breaker or its operating mechanism. Alternatively, fast acting reflex mechanism for Circuit Breakers is also acceptable.

- 7.4 The Circuit Breaker shall be provided with a suitable protection system that will operate without any auxiliary power supply under fault conditions. The protection system shall comprise of three numbers of Current Transformers and a self-powered electronic relay. The Current Transformers and Numerical Self-powered Relay with display Relays shall conform to IS 2705 and IS 8686 respectively. The over current protection shall have two separate settings, one low setting with IDMT and the other high setting of definite time type. The earth fault protection shall operate by residual current measurement using the sum of sensory secondary currents. The relay shall be self-powered to operate and trip the Circuit Breaker. The relay shall be provided with a testing port in front of the relay. The OC Relay shall have current settings 10% to 120% in steps of 10%. OC & EF relays shall have 'Inrush bypass facility' to avoid nuisance tripping due to transformer inrush current. The EF relays shall have current settings 5% to 40% in steps of 5%. The relays shall atleast support 3 sec, 1.3 sec & extremely inverse curves along with adequate high-set facility. Self-powered Electronic/Numerical relays shall be used.

#### **8.0 CABLE TERMINATION:**

- 8.1 The bushing should be conveniently located for workings with cables specified and allow for the termination of these cables in accordance with the prevailing practice and guidelines of cable manufacturers. The dimensions of the terminals shall be in accordance with IS 10601. A non Ferro-magnetic cable clamp arrangement shall be provided for each cable to be terminated in the Compact RMU. Suitable locking arrangement of the Circuit Breakers, Earthing Switches and Load Break Switches with padlocks in the "Open" or "Closed" position shall be provided.
- 8.2 A permanent "Cable Alive" indication as per IEC 61958 shall be provided for each cable using a capacitance voltage divider.
- 8.3 It must be possible to test the core or sheath insulation of the cables without deenergizing the remaining section of the Compact RMU without accessing the cable compartment and without disconnecting the cable.



## **9.0 SAFETY OF EQUIPMENT:**

- 9.1 In case of SF<sub>6</sub> filled equipment, any accidental overpressure inside the sealed chamber shall be limited by the opening of a pressure-limiting device in the rear part of the enclosure so that the gas will be released away from the operator.
- 9.2 All manual operations shall be carried out on the front of the Compact RMU. The effort required to be exerted on the lever by the operator shall not exceed 250 N.

## **10.0 FRONT PLATE:**

- 10.1 The front plate should include a clear mimic diagram indicating the functions. The position indicators shall correctly depict the position of the main contacts and shall be clearly visible to the operator. The lever operating direction shall be clearly indicated.

## **11.0 Current Transformers**

A panel shall be provided in each load break switch enclosure to mount a three-phase, single-core, CT for metering purposes. A similar panel shall be provided in each circuit breaker enclosure to mount a three-phase, single-core, CT for protection purposes. CT access for maintenance or any other purpose shall be from the front, back, or top of these panels.

The CTs shall conform to IS 2705. The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitably to a terminal block, which will be easily accessible for testing and terminal connections.

Further characteristics and features distinguishing CTs used for metering from CTs used for protection are listed as follows:

### CTs for Metering:

- Material: Epoxy resin cast
- Burden: 2.5VA
- Ratio: 400-200-100/1 A
- Accuracy Class: 0.5

#### CTs for Protection:

- Material: Epoxy resin cast
- Burden: 2.5VA
- Ratio: 400-200-100/1 A
- Accuracy Class: 5 P 10

The RMU's other CTs, i.e., those used by Fault Passage Indicators (FPIs), shall be supplied by the FPI manufacturer. These CTs shall be an integral part of the FPI's design to ensure that they properly match the requirements of the FPI.

### **12.0 Potential Transformers**

Three (3) potential transformers shall be provided. The burden per transformer shall be no more than 50 VA and the voltage ratio shall be 11000/110 V. The accuracy class shall be 0.5. HRC fuses shall be provided on the HV side.

The PTs shall be of cast epoxy-resin construction, and they shall conform to IS 3156. Their design and construction, in particular, shall be sufficiently robust to withstand the thermal and dynamic stresses during short circuits.

### **13.0 FAULT PASSAGE INDICATORS (FPI):**

These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU, shall be capable of indicating the passage for both phase and earth faults. The FPI shall have **LCD/LED display** and automatic reset facility.

### **14.0 Multi-Function Meter**

The RMU main incoming and outgoing OD circuits shall be equipped with Intelligent Electronic Devices (IEDs) in the form of communicable multi-function meters capable of providing distribution system voltage, current, power factor, power, and energy readings.

## Operational Features

The multi-function meters shall have an accuracy class of 0.5 and shall provide data on an RS 232/485 communications port using the MODBUS protocol.

Each multifunction meter shall have the following minimum features:

- Measurement, display, and communications capability of up to 31 parameters
- THD measurement and power quality data
- True rms measurement
- Digital communications
- Fully programmable PT and CT ratios
- Simple menu driven interface
- High quality LED display
- Able to monitor:
  - Voltage: line-to-line and line-to-neutral
  - Current: phase and neutral
  - Frequency
  - Power factor
  - Power (active, apparent, and reactive)
  - Energy (active and reactive)
  - Total harmonic distortion

## Specifications

The following table summarizes the specifications applicable to the multi-function meter.

**Table Error! No text of specified style in document.-1: Multi-Function Meter Specifications**

Parameter	Value
Input Voltage: Nominal input voltage (AC rms) Max continuous input voltage	57.7 – 277 V L-N, 100 - 480 V L-L  120% of nominal value
Input Current: Nominal input current System CT primary values Max continuous input current	1 or 5A AC rms (programmable on site) Standard values up to 4 kA (1 or 5 A) 120% of rated value
Overload Withstand: Voltage  Current	2 x rated for 1 sec, repeated 10 times at 10 sec intervals  20 x rated for 1 sec, repeated 5 times at 5 minutes
Operating Measuring	5 to 120% of rated value

Ranges	
Current	5 to 120% of rated value
Frequency	40 to 70 Hz
Power Factor	0.5 lag to 0.8 lead
Accuracy Reference Conditions:	
Reference temperature	23°C ± 2°C
Input waveform	Sinusoidal (distortion factor 0.005)
Input frequency	50 or 60 Hz ±2%
Auxiliary supply voltage	Rated Value ±1%
Auxiliary supply frequency	Rated Value ±1%
Power Factor	0.866 lag to 0.866 lead
Accuracy:	
Voltage	±0.5% over 50 to 100% of rated value
Current	±0.5% over 10 to 100% of rated value
Frequency	0.15% at mid frequency
Active Power	±0.5% over 10 to 100% of rated value
Re-Active Power	±0.5% over 10 to 100% of rated value
Apparent Power	±0.5% over 10 to 100% of rated value
Active Energy (kWh)	1% (IEC 62053-21) from 0.866 lag to 0.866 lead
Reactive Energy (kVARh)	1% (IEC 62053-21) from 0.866 lag to 0.866 lead
Apparent Energy (kVAh)	1%
Phase Angle and Power Factor	1 %
Applicable Standards:	
EMC	IEC 61326
Immunity	IEC 61000-4-3 (10V/m minimum, Level 3)
Safety	IEC 61010-1-2001 (permanently connected use)
IP for water and dust	IEC 60529
Environmental:	
Operating temperature	-10 to +55°C
Relative humidity	0 to 90% non-condensing

### 15.0 NAME PLATE:

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

- Name of manufacturer
- Type, design and serial number
- Rated voltage and current
- Rated frequency
- Rated symmetrical breaking capacity

- (f) Rated making capacity
- (g) Rated short time current and its duration
- (h) Purchase Order number and date
- (i) Month and Year of supply
- (j) Rated lighting impulse withstand voltage
- (k) D.C. component of current.
- (l) Feeder name(Incoming and Out going),DTs Structure name,11000Volts Dangers etc.

NOTE: i) The word rated need not appear on the name plate. Recognized abbreviations may be used to express the above particulars.

ii) Whether the circuit breaker is fitted with closing/tripping devices necessitating an auxiliary supply shall be stated either on the circuit breaker name plate or any other acceptable position.

## **16.0 TESTS:**

16.01 Type test reports for all the type tests required to be conducted as per the standards mentioned in these specifications shall be furnished along with the bid.

16.02 Routine tests and acceptance tests shall be conducted in accordance with these standards in presence of the purchaser's representatives. The contractor shall give atleast 15 days advance notice for witnessing these tests. Copies of test reports of all these tests shall be furnished to the purchaser for approval. Each completely wired Compact RMU shall be tested to ensure all of its protective; control and interlock systems operate satisfactorily. The bidder shall indicate the tests to be carried out in the field after the installation and before commissioning.

## **17.0 INSTRUCTION MANUALS:**

17.01 Six copies of installation, operation and maintenance manuals shall be supplied along with the equipment. Two additional copies of these manuals shall be supplied at the time of commencement of works before the materials are supplied. These manuals shall be complete in all respects furnishing the constructional and operational features of the equipment. The same shall contain all the details and required drawings and/or illustrations along with the overall procedures to enable to identify all the parts and consumable spares, which may have to be identified readily for ordering, purpose.

## **18.0 DRAWINGS:**

- 18.01 The contractor/supplier shall submit complete sets of drawings and diagrams for approval within 15 days of receipt of the order before proceeding with manufacture. After approval of these drawings, a complete set of reproducible of all the drawings shall be submitted along with six copies of each of the drawings.

## **19.0 FORMATION OF COMPACT RMU:**

- 19.01 The compact RMU shall be of single busbar outdoor, tropicalized and metal enclosed type in accordance with the relevant clauses mentioned in these specifications. FPI using a core balance Current Transformer shall be provided for the Incomers to assist in identifying the faulty cable section in order to isolate the same.

The RMU is with 2 nos incomers(IN/OUT) are load break switches and one SF6/Vacuum circuit breaker are in a single SF6 chamber as per the specifications. Each RMU shall have the provision for extension on both sides by adding circuit breakers in future at site. The extensible circuit breakers shall be individually housed in separate SF6 gas enclosures. Multiple numbers inside a single gas chamber enclosure are not acceptable.

- 19.02 The Incomers panel (OD) shall comprise of, but not limited to the following:

1. A triple pole SF<sub>6</sub> Load Break Switch rated 630 Amps or higher, with a rated making capacity
2. Core balance Current Transformer and fault passage indicators.

These shall not require any external Power Supply and must be suitable for unattended places.

- 19.03 The transformer loop circuit control panels (VL) shall consist of but not limited to the following:

1. A triple pole Vacuum/SF<sub>6</sub> Circuit Breaker rated 400 Amps or higher, with a rated making capacity under fault conditions with short circuit levels of 20 kA or above at 11 kV
2. Manually closing mechanism
3. Numerical relay with display and self powered protection system.
4. Mechanical "ON", "OFF" "Earth" position indication.
5. Manual tripping mechanism
6. Mechanical "Spring Charged", "Spring Free" indicator in case of stored energy devices.

## **20.0 ACCESSORIES:**

- 20.01 The following accessories shall be provided for each compact RMU:

1. Pad locks for all doors with one set (3 Nos.) Master keys
2. Earth bus formed out of 50X6 mm GI earthing flats
3. Base channel with foundation bolts
4. Danger plates, caution boards, name plates, rating plates etc. as per requirements.
5. Ventilating louvers with weld mesh.
6. Live parts shrouds danger, plates, caution boards, name plates, rating plates etc., as per requirements.
7. Bus bar supports(Porcelain insulator supports) as required
8. All other components, even though not specifically mentioned, but required for the safe operation of the unit.

**21.0 INFORMATION TO BE FURNISHED ALONG WITH THE BID:**

The following information shall be furnished along with the bid:

1. Completely filled in the "Guaranteed Technical Particulars" as per Appendix 1.
2. Catalogues describing the equipment duly indicating the model.
3. Literature describing the operational features.
4. Typical GA drawings.
5. Type Test Certificates.
6. List of utilities where similar equipments are working.
7. Details of experience.
8. Foundation drawings.

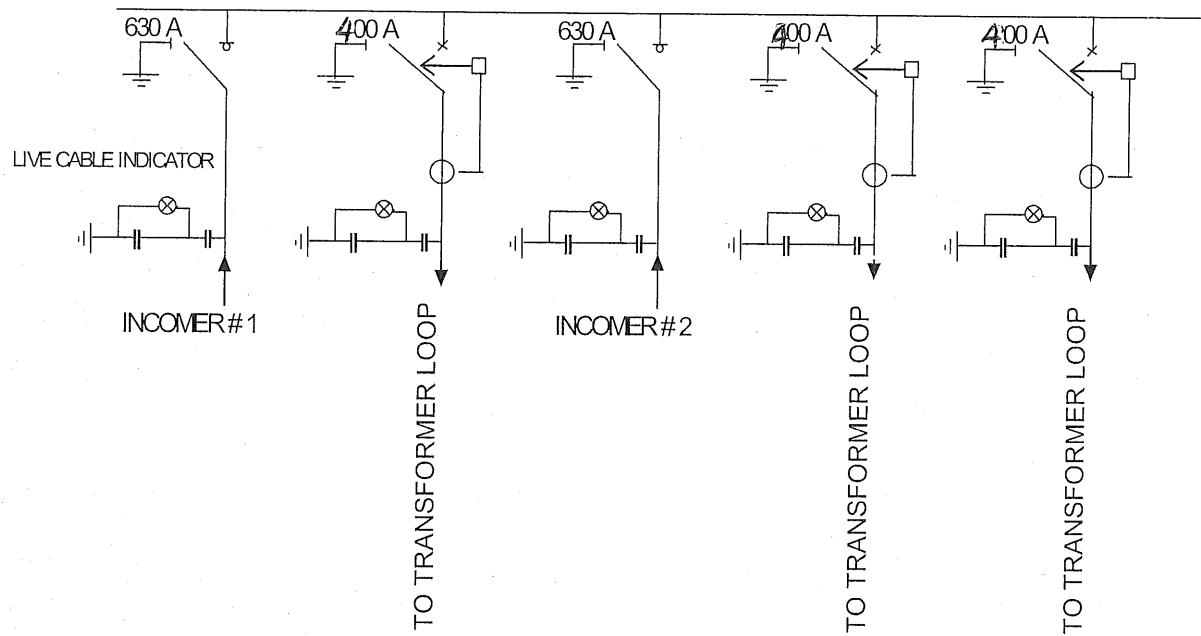


FIG 1 : -SINGLE LINE DIAGRAM OF TYPICAL 11 KV (2+3) COMPACT RING MAIN UNIT

BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED



**ANNEXURE – 1**  
**SCHEDULE OF GUARANTEED PARTICULARS FOR OUTDOOR RMU**

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

## ANNEXURE – 2

### SCHEDULE OF GUARANTEED PARTICULARS FOR BREAKER

01.	Manufacturer's Name and Country of origin	
02.	Manufacturer's Design / Type ref/Model.	
03.	Material used for making the body of the breaker	
04.	Standards of manufacturing	
05.	Whether the breakers are manufactured as per IEC/IS standards	
06.	Maximum temperature with stand of the breakers	
07.	1)Spacing between live part to Earth inside the breaker 2)Spacing between poles	
08.	Period of guarantee of the breaker	
09.	Rated frequency	
10.	Rated voltage	
11.	Highest system voltage	
12.	Rated current	
13.	Short time current rating with duration	
14.	Certificate or report of short circuit type test	
15.	Rated operating duty cycle	
16.	Short circuit breaking current (a)Symmetrical (b)Symmetrical at rated voltage (c)Asymmetrical at rated voltage (i)Per Phase (ii)Average (d)DC Component	
17.	Arcing time (At rated breaking current) in ms.	
18.	Opening time	
19.	Total break time in milli sec. (a)At 10% rated interrupting capacity (b)At rated interrupting capacity	
20.	Breaking Current (a)Rated out of phase current (b)Rated cable charging current (c)Rated kilometric fault level (d)Rated capacitor breaking current	
21.	Make time in ms.	
22.	Maximum temperature rise over ambient (a)Main contacts Terminals	
23.	Rated restriking voltage at 100% and 50%	

	<p>rated capacity.</p> <p>(a)Amplitude factor</p> <p>(b)Phase factor</p> <p>©Natural frequency</p> <p>(d)R.R.R.V.(Volts/micro sec.)</p>	
24.	<p>Dry 1 minute power frequency withstand test voltage</p> <p>(a)Between line terminal and earth KV RMS</p> <p>(b)Between terminals with breaker contacts open KV RMS.</p>	
25.	<p>1.2/50 full wave impulse withstand test voltage</p> <p>(a)Between line terminal and earth KVp.</p> <p>(b)Between terminals with breaker contacts open KVp.</p>	
26.	SF6 /VCB interrupter make	
27.	Contact separation distance	
28.	Type of main contacts	
29.	Contact pressure	
30.	Contact resistance	
31.	Life of the interrupter (in number of operations)	
32.	<p>(i)Tripping at rated current</p> <p>(ii)Tripping at maximum fault current. (Allowable maximum erosion 3 mm)</p> <p>(iii)Mechanical operations.</p>	
33.	Details of main contacts making contact with the breaker truck with the panel	
34.	Control circuit voltage AC/DC.	
35.	Whether trip free or not	
36.	Whether all the interlocks provided	

**ANNEXURE – 3**  
**SCHEDULE OF GUARANTEED PARTICULARS FOR LOAD BREAK ISOLATORS & EARTHING ARRANGEMENTS**

Sl.No.	Description	Isolators	Earthing switch for dt & isolator
01.	Manufacturer's Name and Country of origin		
02.	Manufacturer's Design / Type ref/Model.		
03.	Material used for making the body of the isolators .		
04.	Standards of manufacturing		
05.	Whether the isolators & earth positions are manufactured as per IEC/IS standards		
06.	Maximum temperature with stand of the isolators & earth switches		
07.	1)Spacing between live part to Earth 2)Spacing between fixed and moving contacts in the open position.		
08.	Period of guarantee of the isolators		
09.	Rated frequency		
10.	Rated voltage		
11.	Highest system voltage		
12.	Rated current		
13.	Short time current rating with duration		
14.	Certificate or report of short circuit type test		
15.	Rated operating duty cycle		
16.	Short circuit breaking current		
17.	Arcing time (At rated breaking current) in ms.		
18.	Opening time		
19	Whether all the interlocks provided		
20	Fault passage indicator 1)Type/Model 2)Self powered Yes/No 3)Fault currents 4)Phase currents		

**ANNEXURE – 4**  
**SCHEDULE OF GUARANTEED PARTICULARS FOR CURRENT TRANSFORMERS**

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

**ANNEXURE – 5**  
**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR SELF POWERED**  
**MICRO PROCESSOR BASED NUMERICAL RELAYS**

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