

Section – T8

Technical specification for 11 kV XLPE cables

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Technical specification for 11 kV XLPE cables

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Section – T8

Technical specification for 11 kV XLPE cables

1. Scope

This specification covers the requirements of design, manufacture, inspection, testing and supply of 11 KV XLPE (E) Armoured aluminium Cables.

2. Electrical system

Nominal Voltage	: 11 KV $\pm$ 6%
Frequency	: 50 Hz. $\pm$ 3%
No. of phases	: 3 phases, 3 W

3. Standards

- 3.1. The Cables shall comply with conform to the latest editions of the following Indian Standard Specifications.

IS 7098 (Part II)	:	Cross-linked polyethylene insulated PVC sheathed cables for working voltages from 3.3KV up to and including 33 KV.
IS 3975	:	Mild steel wires, strips and tapes for armouring of cables.
IS 10418: 1982	:	Drums for electric cables
IS 10810	:	Methods of test for cables
IS 1554 (Part I)	:	PVC Cables for voltage up to and including 1100 volts.
IS 8130	:	Conductors for insulated electric cables
IS : 1255	:	Code of practice for installation & maintenance of power cables upto & including 11 KV rating
IS 5831	:	PVC insulation and sheath of electric cables
IS 3975	:	Mild steel wires, strips and tapes for armouring of cables.

4. General construction

- 4.1. The 11 KV XLPE (E) cables shall be suitable for laying in trays, trenches, ducts, conduits and buried underground installation with uncontrolled backfill and possibility of flooding by water. These shall have following constructional features.
- 4.2. Cables for 11 KV system shall be with Aluminium Conductor, XLPE insulated, screened, sheathed, armoured and overall PVC sheathed as detailed below:
- 4.3. The construction of the conductors shall be stranded and compacted circular for all cables.
- 4.4. All cables rated 11 KV shall be provided with both conductor shielding, insulation shielding / screening. The conductors shall be provided with non-metallic extruded semi-conducting shielding.
- 4.5. The core insulation shall be with cross-linked polyethylene unfilled insulating compound. It shall be free from voids and shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.
- 4.6. The insulation shielding shall consist of non-metallic extruded semi-conducting compound in combination with a non-magnetic metallic screening of copper. The insulation screen shall be strippable without application of heat.
- 4.7. The conductor screen, XLPE insulation and insulation screen shall all be extruded in one operation by 'Triple Extrusion' process to ensure perfect bonding between the layers. The core identification shall be with coloured strips or by printed numerals.
- 4.8. The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of Type ST2 compound of IS : 5831. The extruded inner sheath shall be of uniform thickness of size not less than 0.7 mm for all sizes of cables
- 4.9. The armouring shall be by galvanised steel strips type.

- 4.10. The outer sheath for the cables shall be applied by extrusion over the armouring and shall be of PVC compound conforming to the requirements of Type ST2 compound of IS 5831. To protect the cable against rodent and termite attack, suitable chemicals shall be added into the PVC compound of outer sheath.
- 4.11. The dimensions of the insulation, armour and outer sheathing materials shall be governed by values given in Tables 1, 3 and 4 of IS 7098 Part – II
- 4.12. HV cable termination should be heat shrink type with adequate suitable size and joining of main conductor cores using suitable size of ferrules / mechanical connectors with range taking feature should be provided.
- 4.13. The heat shrinkable component shall be light in weight and shall be made of specially formulated cross linked polymeric material with excellent tracking & erosion resistance characteristic. Environmentally sealed system for splicing dielectric shielded power cable
- 4.14. Heat shrinkable stress control tube to be provided over conductor to reduce stress, The stress control tube has to be in electrical contact with the outer insulation screen of the cable.
- 4.15. Earth Continuity between armoured wires to be provided using tinned copper braid of adequate cross section to endure proper earthing of the connection along with armoured wire support ring. The material of support ring to be steel (G.I.) for 3 core Cable and aluminium for 1 core cable, the clip should be worm drive type for securing the earthing braid tightly with adequate size & quantity.
- 4.16. The insulation over the conductor area should be maximum three layers of heat shrinkable insulating tube are to be provided. The thickness of the heat shrinkable tube after installation should not be less than 1.2 times the insulation thickness of the cable. For outer semi conductor screening of the joint suitable heat shrinkable dual wall tubes which are co-extruded are to be provided

5. Inspection & testing

- 5.1. Representative of the Owner shall have free access to vendor's works to inspect, expedite and witness shop tests. Any materials or works found to be defective or which does not meet the requirements of this specification will be rejected and shall be replaced at Vendor's cost.
- 5.2. All routine tests shall be carried out on the cables as per relevant Indian Standard Specifications and will be witnessed by the Owner.
- 5.3. Routine test certificates shall be submitted for all the cable drums also copy Type test certificates for the type tests carried out on identical cables shall be furnished to the Owner for reference and records.

6. Data & Information

- 6.1. Vendor shall furnish with the bid full constructional data along with ratings and other parameters of the cables. Deviations, if any, shall be brought out clearly in the bid.

7. Packing

- 7.1. The cables shall be supplied in standard drum lengths duly wound on non-returnable wooden / Steel drums.
- 7.2. Vendor shall ensure that the bending radius of cables are not less than 12 times their overall diameters when wound on drums. Both ends of the cables shall be sealed.
- 7.3. Following information shall be printed on the flange of each cable drum
 - a) Type
 - b) Size
 - c) Voltage grade
 - d) Length in meters
 - e) ISI mark
 - f) Gross weight
 - g) Direction of rolling

7.4. Guaranteed technical particulars - Power cables

Sl.No	Description	Particulars
1	Type of cable	To be provided by vendor
2	Voltage grade	
3	Max. Conductor temperature	
4	Material of construction	
a	Conductor	
b	Conductor insulation	
c	Inner sheathing	
d	Armouring	
e	Outer sheating	
5	Size of conductor	
	Cable parameters	
a	Resistance of the conductor	
b	Impedance of the conductor	
c	Capacitance of the conductor	
d	Short circuit rating for 1 sec.	
e	Thermal resistivity of the insulation	
6	Size of insulation	
a	Conductor insulation	
b	Inner sheathing	
c	Outer sheating	
d	Over all diameter of the cable	
7	Shape of conductor	
8	Standards IS / IEC	
9	Number of Core	
10	Method of identification	
a	Colour	
b	Numbering	
c	Cable drum	
d	Method of Packing	
11	Make	
12	Weight	

Section – T9

Technical specification for 1.1 kV XLPE cables

Section – T9

Technical specification for 1.1 kV XLPE cables

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Section – T9

Technical specification for 1.1kV XLPE armoured U.G cables

1. Scope

- 1.1. This specification covers the requirements of design, manufacture, inspection, testing and supply at site of 1.1KV grade XLPE insulated Armoured power and control cables.

2. Electrical system

Nominal Voltage	: 415V + 6%
Frequency	: 50 Hz. + 3%
No. of phases	: 3 phase, 4 W

3. Standards

- 5.0. The 1.1KV grade Power & Control Cables conform to the requirements of the latest Indian Standard Specifications including but not limited to the following:

IS 7098 (Part I)	:	Cross-linked polyethylene insulated PVC sheathed cables for working voltages from up to and including 3.3 KV.
IS 1554	:	PVC Insulated (heavy-duty) electric cables: Part 1 for working voltages up to and including 1100 V
IS 3975	:	Mild steel wires, strips and tapes for armouring of cables.
IS 10418: 1982	:	Drums for electric cables.
IS 10810	:	Methods of test for cables
IS 1554 (Part I)	:	PVC Cables for voltage up to and including 1100 volts.
IS 8130	:	Conductors for insulated electric cables

IS : 1255	:	Code of practice for installation & maintenance of power cables upto & including 11 KV rating.
IS 5831	:	PVC insulation and sheath of electric cables
IS 3975	:	Mild steel wires, strips and tapes for armouring of cables

4. General construction

- 4.1. The cables shall be suitable for laying in trays, trenches, ducts, conduits and buried underground installation with uncontrolled backfill and possibility of flooding by water. These shall have following constructional features.
- 4.2. All power and control cables for use on low voltage system shall be heavy duty type, 1100V grade with aluminium / copper conductor, XLPE / PVC insulated, PVC inner sheathed, armoured and overall PVC sheathed as detailed below:
- 4.3. The construction of the conductors shall be SOLID for aluminium conductor cables up to 10 mm sq. and for copper conductor cables up to 2.5 mm sq. For cables above 10 mm sq. and for copper cables above 2.5 mm sq. the conductor shall be STRANDED. Conductors of nominal cross sectional area less than 10 sq.mm shall be circular only. Conductors of nominal cross section area 16 sq.mm and above may be circular or sector shaped.
- 4.4. The core insulation shall be with PVC applied over the conductor by extrusion and shall conform to the IS 1554.
- 4.5. The core insulation with XLPE applied over the conductor by extrusion and shall conform to the IS 7098 part – I.
- 4.6. Control cables having 6 cores and above shall be identified with prominent and indelible arabic numerals on the outer surface of the insulation. Colour of the numbers shall be white with a spacing of maximum 500 mm between two consecutive numbers.

- 4.7. The inner sheath shall be applied over the laid-up cores by extrusion and shall be of PVC conforming to the requirements of type ST2 PVC compound per IS 5831. The extruded inner sheath shall be of uniform thickness of size not less than 0.5 mm up to 16 sq.mm, 0.8 mm from 25 sq.mm upto 120 sq.mm and 1.0 mm above 120 sq.mm conductor size. Taped inner sheath shall also be acceptable.
- 4.8. For multi core cables, the armouring shall be by single round galvanised steel wires where the calculated diameter below armouring does not exceed 13 mm and galvanised steel strips where this dimension is greater than 13 mm. Requirement and methods of tests for armour material and uniformity of galvanisation shall be as per IS 3975 and IS 2633.
- 4.9. The outer sheath for the cables shall be applied by extrusion and shall be of PVC compound and conforming to the requirements of type ST 2 compound per IS 5831. To protect the cables against rodent and termite attack, suitable chemicals shall be added into the PVC compound of the outer sheath.
- 4.10. The dimensions of the insulation, armour and outer sheath materials shall be governed by values given in IS 1554 (Part I).

5. Inspection & testing

- 5.1. Representative of the Owner shall have free access to vendor's works to inspect, expedite and witness shop tests. Any materials or works found to be defective or which does not meet the requirements of this specification will be rejected and shall be replaced at Vendor's cost.
- 5.2. All routine tests shall be carried out on the cables as per relevant Indian Standard Specifications and will be witnessed by the Owner.
- 5.3. Routine test certificates shall be submitted for all the cable drums also copy Type test certificates for the type tests carried out on identical cables shall be furnished to the Owner for reference and records.

6. Data & information

- 6.1. Vendor shall furnish with the bid full constructional data along with ratings and other parameters of the cables. Deviations, if any, shall be brought out clearly in the bid.

7. Packing

- 7.1. The cables shall be supplied in standard drum lengths duly wound on non-returnable wooden drums.

- 7.2. Vendor shall ensure that the bending radii of cables are not less than 12 times their overall diameters when wound on drums. Both ends of the cables shall be sealed.

- 7.3. Following information shall be printed on the flange of each cable drum.

- a) Type
- b) Size
- c) Voltage grade
- d) Length in meters
- e) ISI Mark
- f) Gross weight
- g) Direction of rolling

- 7.4. Guaranteed technical particulars - Power cables

Sl.No	Description	Particulars
1	Type of cable	To be provided by vendor
2	Voltage grade	
3	Max. Conductor temperature	
4	Material of construction	
a	Conductor	
b	Conductor insulation	
c	Inner sheathing	
d	Armouring	

e	Outer sheating	
5	Size of conductor	
	Cable parameters	
a	Resistance of the conductor	
b	Impedance of the conductor	
c	Capacitance of the conductor	
d	Short circuit rating for 1 sec.	
e	Thermal resistivity of the insulation	
6	Size of insulation	
a	Conductor insulation	
b	Inner sheathing	
c	Outer sheating	
d	Over all diameter of the cable	
7	Shape of conductor	
8	Standards IS / IEC	
9	Number of Core	
10	Method of identification	
a	Colour	
b	Numbering	
c	Cable drum	
d	Method of Packing	
11	Make	
12	Weight	

Section – T10

Technical specification for 11 kV Ring Main Unit (RMU)

Section – T10

Technical specification for 11 kV Ring Main Unit (RMU)

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Section – T10

Technical specification of 11 kV Ring main unit (out-door)

The 11 kV Ring Main Units (RMU) should be SCADA COMPATIBLE for our future-use be self-contained totally insulated unit constitutes the MV component of the MV/LV transformer substation or the branching point of an MV network. The RMU regroups, in a single Epoxy enclosure, all the medium voltage functions enabling transformers to be connected, supplied and protected.

Ringmaster, should be covering a wide range of options with an outdoor IP54 design and ranting up to 12 kV, 630A; 21 KA, 3 sec, and for all applications, from basic transformer protection to sectionalising with remote control using FTU and tele control & automation can be added in future without and modifications

It also provides the control and monitoring of networks from remote central point. Location of problems and re-configuration is completed with minimum downtime & without manual intervention.

1. Standards

The equipment proposed be designed, manufactured and tested in compliance with IEC recommendations but not limited to the following standards:

- | | |
|--|---------|
| ♦ Common clause for high voltage switchgear and low voltage switchgear | IEC 694 |
| ♦ Self-contained medium voltage apparatus | IEC 298 |
| ♦ High voltage circuit breakers | IEC 56 |
| ♦ AC switches and ear thing switches | IEC 129 |
| ♦ Switches and disconnectors | IEC 265 |
| ♦ Combined switch/disconnectors | IEC 420 |
| ♦ Current transformer | IEC 185 |
| ♦ Voltage transformer | IEC 186 |
| ♦ High voltage fuses | IEC 282 |
| ♦ Classification of degrees of protection for enclosures | IEC 529 |

2. General characteristics in accordance with the IEC standards

Description	
Self-contained unit	
Degree of protection - Enclosure - Operating mechanism	IP 54 IP 2X

3. Electrical characteristics

A. Description		
Rated voltage	kV rms	12kV
Operating voltage	kV rms	11kV
B. Insulation level:		
Rated withstand voltage at power frequency: 50Hz/1 min	kV rms	38kV
Rated impulse withstand voltage: 1.2/50µs	kV peak	95kV
C. Network and bus bars		
Rated current	A	630A
Rated short-time current	kA 3 sec	21kA
Making capacity for switch-disconnectors and earthing switches		52.5kAp
Internal arc withstand	kA 1 sec	16kA
Transformer Tee-Off		
Rated current	A	Up to 630 A

The RMU should be suitable to operate in the ambient temperature between -25°C and +40°C.

All breaking units, including earthing switches, are contained in enclosure filled with SF6, sealed for life according to the IEC standard EE Appendix Class III.

4. Site condition

The equipment covered under this specification is for **outdoor installation** and should be suitable for use at the sites for the prevailing climatic conditions.

a) Temperature: The reference ambient temperature is to be taken as 48°C as per IS 9676.

- | | | |
|--|---|------|
| i) Maximum ambient air temp | : | 50°C |
| ii) Maximum daily average ambient temp | : | 40°C |

b) Relative Humidity

- | | | |
|---------|---|---------------------|
| Maximum | : | 100% non condensing |
| Minimum | : | 10% |

c) Average Annual rainfall : 750mm

d) Average no of rainy days/annum : 50

e) Average no of thunderstorm days/annum : 40

f) Altitude : suitable up to 1000 m

The atmosphere is heavily polluted, laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. Heavy lightening occurs in the area during rainy months.

All equipments are to be designed to withstand seismic forces, corresponding to an acceleration of 0.1g.

5. Technical specification

The Ring Main Master to feed units is equipped with manually operated VCB panel without metering and outgoing circuit breakers and isolators, as per B.O.Q.

5.1. Isolators

The isolators offered shall conform to IEC-265 as amended to date. The isolator shall be SF6 insulated, triple pole, spring assisted hand operated type with quick break contacts. The isolator shall be contained in sealed SF6 enclosure made of Metallised Epoxy / Stainless Steel. SF6 gas pressure gauge shall be provided for pressure indication purpose.

Each of the Isolators shall be provided with **LEDs for “Live Cable” Indication.**

The operating handle shall have the three positions “ON”, “OFF”, and “EARTH” which shall be clearly marked with suitable arrangement to padlock in any position. A safety arrangement for locking shall be provided by which the isolator operation shall be prevented from “ON” position to “EARTH” position or vice versa in a single operation.

Integral cable test terminals for test plug with clear identification mark shall be provided. The interlocks shall be so arranged that, the cable test terminals will be accessible only in the “EARTH” position of the isolator.

To facilitate testing of cables, it shall be possible to bring the isolator to OFF position while the test plugs are kept inserted, but operation to ON position shall be prevented so long the cable testing is in progress.

Cable testing shall be possible without disconnecting the Cables or opening the Cable compartment.

The isolator shall be capable of breaking full load current and a fault making of 52.5KA peak.

Isolators are to be operated manually. However, there must be **provision** in the isolator to fix motor to operate the isolator electrically via 24V DC batteries in a Remote Terminal Interface.

5.2. SF6 circuit breaker

- 5.2.1. The tee-off unit shall consist of 11KV, 630 Amps SF6/Vacuum Breaker (for controlling transformer), load breaking and fault breaking and fault making type fitted with three 200 Amps continuously rated air insulated bus bars and arrangement for cable to the primary side of the transformer.
- 5.2.2. The Tee-off circuit breaker shall be suitable for manual closing and opening and also for provision for remote tripping in future. The Circuit Breaker mechanism shall be co-related with a self-powered OC/EF relay.
- 5.3. The operating mechanism shall be direct hand operated trip free with a mechanically operated indicator, positively coupled to the operating mechanism to indicate whether the breaker is in the closed or in the open position.
- 5.4. The tee-off Circuit Breaker unit shall be provided with accessories for tripping such as CT operated series trip coils for over current and earth fault protection.
- 5.5. Breaker shall be provided with a shunt trip coil suitable for 230V AC supply.
- 5.6. Current Transformer: The Ratio of the CTs will be suitable for controlling transformer as to be specified in consultation with State Vidyut Nigam. The VA burden of the CTs shall be sufficient to supply the energy required by the relay for normal operation and tripping of the circuit breaker.
- 5.7. Protection System: The protection system should be provided with the provision of suitable self-powered relays having scheme for both over current & earth fault. The protection system shall be a self-powered relay which shall require no external power source or batteries. It must have improved operation and control with the Relay settings clearly displayed on the front of the panel. Manual reset flag shows separate tripped on fault for either phase or earth fault conditions. It should have the

provision for the trip test on circuit breaker. The 'trip inhibit' facility should allow the Relay to be tested without tripping the circuit breaker.

- 5.8. The free standing metal housing shall be designed to withstand internal pressure and external mechanical loads without distortion. Where required the SF6 gas insulated switchgear housing shall have an over pressure relief device vented to the rear side of the equipment. An operating mimic diagram shall be provided on the front side of Ring Main Unit. Each unit shall be provided with lifting facility of proven design for easy handling.
- 5.9. Handle operated 'spring charged' mechanical operation be provided.
- 5.10. Local operation selector switch be provided.
- 5.11. **SF6 Insulation:** Switchgear housing be completely gas tight. In the power compartment provision be made for filling up the gas at site.
- 5.12. A manometer should be provided to indicate the healthy state of SF6 gas pressure inside the tank. SF6 gas pressure inside the tank shall not be more than 1 bar at 20 Deg Centigrade

5.13. General finish

- 5.13.1. The equipment be totally enclosed, metal clad, vermin and dust proof suitable for tropical climate use as detailed above.
- 5.13.2. **Painting:** The surface of all metallic parts shall be thoroughly cleaned, scrapped and degreased preferably by shot blasting or any other treatment. The exterior surface shall be given two coats of rust resisting red oxide primer conforming to IS 2074:1992 and final two coats of weather resisting battleship grey enamel paint. The paint shall withstand the operating conditions described above and equipment shall not show any sign of the rust formation.

6. Operation and interlocking

- 6.1. All operations shall be from front of the equipment via spring assisted mechanism. The Ring Main Unit and SF6/Vacuum Circuit Breaker for Tee-off should be provided with a series trip coil for tripping. It shall be possible to operate the switches and circuit breaker manually and spring assisted mechanism shall ensure speed of operation of switches.
- 6.2. Operation handle shall be considered as part of the unit and should be provided with each Ring Main Unit.
- 6.3. Load break switches and earthing switches be fully interlocked to ensure that operation is carried out in correct sequence. Movement of operating handle against interlock shall not by any means originate, store or activate the energy mechanisms. Padlocking facility be provided for operation of load switch and earthing switch. Safety of operation be ensured by interlocks.
- 6.4. Simultaneously closing of the main switch and earth switch: This interlock be integral part of the operating mechanism. Also separate operating shafts be provided for operation of earthing switch and main switch for the same purpose.
- 6.5. The fully interlocked integral test facilities are to be provided underneath the units, so that access to the test terminals is achieved only by removal of a cover.
- 6.6. The SF6 insulated isolators and SF6 breaker operating mechanisms be totally enclosed and self lubricating type. The manually operated handle be mounted in front of the isolators and so designed that the operation is complete by one movement without any undue strain on the operator.
- 6.7. All mechanical interlock shall be robust so as not to give any way during normal operation.
- 6.8. The tripping of breaker unit should be provided with push button.

7. Secondary wiring

- 7.1 The secondary wiring supplied for the equipment shall consist of non-deteriorating fire proof superior grade stranded copper PVC wires suitably colored and fitted with numbered ferrules at both ends.
- 7.2 Wiring be terminated with ring type ferrules with ferrule numbers marked at both ends of wiring. CT wiring be marked with additional distinct Red tags on both ends. All secondary wiring be terminated by using reputed make terminal blocks.

8. Earthing arrangement

- a) It should be easily possible to test the cables including the Tee-off (in case of RMU) by a simple earthing arrangement.
 - b) Equipment earthing of GI / Copper strips of adequate size be provided
- 8.1 A mechanical 'ON/OFF' indicator be provided on SF6 insulated isolators and SF6 Breaker to indicate whether switch is ON or OFF.
 - 8.2 SF6 insulated switches be fitted with correct sequence device having "ON/OFF" and re-set and test position and shall have provision for padlocking operating handle.

9. Cable boxes

- 9.1 The isolators and SF6 Breaker should be provided with suitable and identical cable boxes for connection 3 core, 11KV XLPE cables of size up to 400 mm² approaching vertical from below. The cable boxes be so located at convenient height to facilitate easy cable jointing work.
- 9.2 The access for the isolator cable box be from side and the access for the Tee-Off SF6 Breaker cable box be from rear side and distanced of bottom level of wiping gland from ground shall be maintained at 310 mm (minimum).

- 9.3 The cable boxes be with detachable front cover for ease of termination & be interlocked with switch position (i.e. when isolator is in Earth / OFF position).
- 9.4 The design of the cable box shall be such that any type of jointing methods such as heat shrinkable/push on type/cold shrinkable type termination's can be adopted.

10. Earthing

- 10.1 All ring main units should have a special earth bar with a sectional area of not less than 100 mm² run along the whole of metal enclosed switch structure, each end being connected to the main earthing system where metal cases are used on instruments these shall be connected to this bar by conductors of not less than 16 mm² section

11. Guaranteed technical particulars for 11 kV outdoor RMU

Sl.No	Description	Particulars
1	General :	To be furnished by contractor
1.1	Applicable Standard.	
1.2	Type	
1.3	Rated Voltage.	
1.4	Highest System Voltage	
1.5	Phase	
1.6	Frequency.	
1.7	Rated Normal Current.	
1.8	Rated Short Circuit Current Capacity	
1.9	Rated Breaking Current Capacity (min)	
1.1	Rated Making Capacity	
1.11	Insulation Level :	
1.12	Minimum Gas Pressure	
1.13	Dimension of RMU (H X W X D)(Maximum Limit)	
1.14	Material	
a	Tank	
b	Outer Structure	
c	Outdoor enclosure	
1.15	Degree of Protection	
a	High Voltage live parts, SF6, VCB	
b	Front Cover Mechanism	

Sl.No	Description	Particulars
c	Cable Compartment	
1.16	Internal Arc for main Tank & Cable Chamber	
1.17	Temperature Category	
1.18	Whether RMU has provision for sensors for temperature compensated pressure measurement the relevant gas compartment to monitor the pressure of SF6 gas	
1.19	Weight of RMU complete with operating mechanism	
1.20	Position of the Power Cable entry of the RMU	
2	Vacuum Circuit Breaker	
2.1	Normal Voltage	
2.2	Highest System Voltage	
2.3	Frequency	
2.4	No. of Poles	
2.5	Rated Current	
2.6	Short Time Current	
2.7	Breaking Capacity (min)	
2.8	Making Capacity	
2.9	Single Phase Capacitor Breaking Capacity	
2.10	Cable Charging Breaking Capacity	
2.11	Duty Cycle	
2.12	Closing time	
2.13	Breaking time	
2.14	Minimum Phase to Phase Clearance	
2.15	Minimum Phase to Ground Clearance	
2.16	Type of operating mechanism	
2.17	Mechanical Safety Interlock	
2.18	No of Break per Phase	
2.19	Mechanical Endurance Capacity	
2.20	Thickness of the Steel Tank	
2.21	Thickness of enclosures	
3.00	Load Break Switch	
3.1	Reference Standard	
3.2	Rated Voltage	
3.3	Highest System Voltage	
3.4	Rated PF Withstand Voltage(To Earth & between Poles)	
3.5	Rated PF Withstand Voltage(Across the Isolating Distance)	
3.6	Rated Impulse Withstand Voltage(To Earth & between Poles)	
3.7	Rated Impulse Withstand Voltage(Across the Isolating	

Sl.No	Description	Particulars
	Distance)	
3.8	Frequency	
3.9	No. of Poles	
3.10	Material	
3.11	Insulation	
3.12	Rated Current	
3.13	STC	
3.14	Rated Making Current	
3.15	Load Breaking Current	
3.16	Opening Time	
3.17	Type of Operating Mechanism	
3.18	Interlocking Arrangement	
3.19	Fault Passage Indicator	
3.20	Make	
3.21	Type	
3.22	Provision of Live Line Detector(Y/N)	
3.23	Spacing between Live part to Earth	
3.24	Spacing between Phases	
3.25	Spacing between Fixed & Moving Contacts position	
4.00	Mechanical Endurance Capacity	
4.1	Temperature Rise	
4.2	Type of Operating Mechanism for closing	
4.3	LBS provided with Earth Switch (Y / N)	
4.4	Earth Switch	
4.5	Reference Standard	
4.6	Rated Voltage	
4.7	Highest System Voltage	
4.8	Rated PF Withstand Voltage(To Earth & between	
4.9	Rated PF Withstand Voltage(Across the Isolating Distance)	
4.10	Rated Impulse Withstand Voltage(To Earth Poles)	
4.11	Rated Impulse Withstand Voltage(Across Distance)	
4.12	Frequency	
4.13	No. of Poles	
4.14	Material	
4.15	Insulation	
4.16	Rated Current	
4.17	STC	
4.18	Rated Making Current	
4.19	Opening Time	

Sl.No	Description	Particulars
4.20	Type of Operating Mechanism	
4.21	Interlocking Arrangement	
4.22	Spacing between Fixed & Moving Contacts in open position	
5.00	Current Transformer	
5.1	Make	
5.2	Type	
5.3	Voltage Grade	
5.4	Reference Standard	
5.5	Primary Insulation level (PF rms / impulse peak)	
5.6	One minute PF withstand Voltage on Secondary	
5.7	Class of Insulation	
5.8	Frequency	
5.9	Ratio	
5.10	Class of Accuracy	
5.11	Rated burden	
5.12	STC for 1 second	
5.13	Continuous Over Load in percentage	
6.00	Bus Bar	
6.1	Material	
6.2	Maximum Current Density	
6.3	Minimum clearance (Phase to Phase)(AIS portion)	
6.4	Minimum clearance (Phase to Ground)(AIS portion)	
6.5	Cross sectional area of the Bus	
6.6	Current Rating of Bus	
6.7	Type of Insulation	
6.8	Minimum Creepage Distance of Bus support	
6.9	Insulator(AIS portion)	
7.00	Vacuum Interrupter	
7.1	Make	
7.2	Type & Model	
7.3	Current Rating	
7.4	STC	
7.5	Breaking Capacity	
7.6	Mechanical Endurance Capacity	
7.7	Electrical Endurance Capacity	
7.8	Minimum Electrical Life at STC	
8.00	Earth Bus	
8.1	Material	
8.2	Size (Minimum)	

Sl.No	Description	Particulars
9.00	Numerical Relay	
9.10	Applicable Standard	
9.2	Make	
9.3	Type	
9.4	Model No	
9.5	Current setting range for Over Current(IDMTL)	
9.6	Current setting range for Earth fault(IDMTL)	
9.7	Instantaneous Current setting range for Over	
9.8	Instantaneous Current setting range for Earth	
9.9	O/C & E/F Characteristic	
9.10	No. of Element	
9.1	Secondary Current	
9.1	Type of Display unit	
9.1	Burden	
9.1	Whether Draw out type(Y/N)	
10.0	Painting	
10.1	Support Structure	
10.2	Mimic	
10.3	Outdoor part	
10.4	Thickness	
11.0	Control Wire	
11.1	Make	
11.2	Voltage Grade	
11.3	Size	
11.4	(i) CT Circuit	
11.5	(ii) Other Circuit	
11.6	Colour	
11.7	Accessories	
11.8	Spring Charging Handle	
11.9	VCB operating Handle	
11.10	Guarantee of the total equipment including any	
11.11	integral part of the equipment	

TECHNICAL

SPECIFICATIONS FOR

COMPACT INDOOR

TYPE 33/11KV VCB

PANEL

2.1 ERECTION shall mean installation of EQUIPMENT covered under this specification, under supervision of Supplier as per approved drawings in coordination with PMC Site Manager and Client project team.

2.2 MECHANICAL COMPLETION : The Plant/unit/system is considered mechanically complete when all the construction work is completed in accordance with the drawings, specifications, instructions, codes & regulations all equipment's and machines erected and aligned, all Electrical & Instruments installed and pipelines hooked-up.

When plant/unit/system is declared mechanically complete, it will mean that w.r.t. that particular plant/unit/system.

- a) All the mechanical erection work is completed and a preliminary check is made in accordance with all engineering drawings.
Supplied Equipment's are firmly; grouted
 - b) All the mechanical erection work is completed and a preliminary check is made in accordance with all engineering drawings.
 - c) Supplied Equipment's are firmly; grouted.
 - d) All permanent gaskets are installed unless specified otherwise.
 - e) Initial charge of lubricants is filled, as required.
 - f) All electrical fittings and connections are installed, completed and tested.
 - g) All instruments are installed; calibrations and loop checking are completed.
 - h) No load trial run of all electrical motors in decoupled condition.
 - i) All painting and thermal insulation work is completed.
- After Mechanical completion declared by Supplier, PMC & Client will prepare checklist, check list to be attended by respective Supplier / contractors for Pre-Commissioning.

1.1 START UP shall mean start of the COMMISSIONING, which shall occur after completion of ERECTION.

1.2 PRE-COMMISSIONING: The state when the plant/unit/system have been erected in accordance with the drawings, specifications, instructions and applicable codes and regulations; all other specific contractual construction activities are completed with respect to the plant/unit/system including compliance of check list and all the relevant technical documents are handed over to SBL. Pre-tests / Dry tests for the installed units are completed and certified by the supplier.

- 1.3** The Plant/Unit/system is considered ready for pre-commissioning when all the construction activities (including but not limited to the activities mentioned under “mechanical completion”) are completed, all the check list points are attended and all the relevant technical documents like alignment record/test reports/fabrication drawings etc. are handed over to the SBL.

However, with prior agreement with client / PMC, construction may continue completion of check list points including residual area grading, paving, clean up, removal of temporary construction facilities, painting, insulation and correction of miscellaneous errors or omissions etc. that do not interfere with pre-commissioning activities.

Pre-commissioning activities are operational activities performed in order to make the plant/unit/system ready for commissioning.

- 1.4** COMMISSIONING: shall mean putting the total Erected equipment supplied and erected as per the specifications has been put at full operating load and all the performance parameters has been established and the system has been operating satisfactorily at least for 60 days.
- 1.5** EQUIPMENT shall mean all EQUIPMENT & their ancillaries and Package Units of the PROJECT & PLANT.
- 1.6** SUPPLIER/ CONTRACTOR shall mean a person/company appointed by SBL for the supply /supply-cum-Erection of EQUIPMENT, Construction & Erection Contracts based on PROCUREMENT SERVICES to be performed by Project Consultant.
- 1.7** Words imparting singular shall also include plural and vice versa wherever the context so requires.

COMPACT INDOOR TYPE 33/11 KV VCB PANELS

1.1 General

This specification covers design, engineering, manufacture, shop testing, inspection, Painting, packing, supply, forwarding, delivery to site, erection, testing and commissioning of 33/11 kV Ring Main Units complete with all accessories. The above scope of work also includes statutory clearances from the relevant authorities.

It is not the intent to specify completely herein all details of the equipment; nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

Shall the bidder wish to deviate from this specification in any way, he shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which his offer will be considered in conformity with the specification in all respects.

The design of the switchgear shall be based on safety to personnel and equipment during operation and maintenance, reliability of service, ease of maintenance, mechanical protection of equipment, interchange ability of equipment and ready addition of future loads.

1.2 Codes and Standards

In order to be accepted, the switchgear shall comply with the requirements stated in the latest editions of the following recommendations, standard and specifications:

IEC standards

IEC 62271 MV metal-enclosed switchgear,

IEC 60265 MV switches,

IEC 60129 AC disconnectors and earthing switches,

IEC 60694 common clauses for MV switchgear standards,

IEC 60056 MV AC circuit breakers,

IEC 60801 monitoring and control

IEC 60529 degrees of protection procured by enclosures (IP code).

1.3 Scope of Work

1.3.1 Supply

Ring main unit shall be of 33/11 KV, 3 phase, 50 Hz, 3 wire, 630 amps Bus Bar Indoor type floor mounted, non-extensible, having hinged arc proof cable doors, Cable termination from the front, breaking capacity 26.3kA Sec. Ring Main Unit shall have breaker/isolator enclosed in SF6 filled robotically laser welded stainless steel tank having IP67 degree of protection, Leak rate of SF6 gas shall be less than 0.1% and tested as per IEC 60056/60694/62271. This stainless steel tank shall accommodate at least five modules in one tank to avoid multiple extension:-

1.4 Special Maintenance Tools & Tackles

The Bidder shall provide a list of recommended spare parts with their individual prices for equipment to be supplied against this specification. This list shall identify all essential spares items for any recommended maintenance for a period of five years after commissioning.

The Client may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works. The Client may order additional spares at any time during the contract period at the rates stated in the Contract Document.

A spare parts catalogue with price list shall be provided and this shall form part of the drawings and literature to be supplied.

The Bidder shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment, which shall be 25 years minimum. However, the Contractor shall give a minimum of 12 months' notice in the event that the Contractor or any sub-contractors plan to discontinue manufacture of any component used in this equipment.

Any spare apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the plant and must be suitably marked and numbered for identification.

Spare parts shall be delivered suitably packed and treated for long periods in storage. Each pack shall be clearly and indelibly marked with its contents, including a designation number corresponding to the spare parts list in the operation and maintenance instructions,

Spanners and other maintenance equipment provided under this contract shall not be used for the purpose of erection.

Any special devices, slings or shackles necessary for the maintenance shall be handed over to the Purchaser in working order on completion of the installation and commissioning of the equipment.

1.5. General Technical Requirements

- **Service conditions:**

- The RMU shall be capable of operating normally within the following temperature range:

Maximum air temperature: + 45° C

Minimum air temperature: - 0° C

Manufacturer shall declare whether the RMU is able to operate in air temperature higher than + 45°C over the ambient of 35 deg centigrade and if current derating is necessary.

- The RMU shall be capable of being operated in outdoor or indoor locations.

- The RMU shall be capable of being exposed to high relative humidity and ambient air pollution.

System Parameters	
Network	Three phases - Three wires
Rated Voltage	33/11 kV
Service Voltage	33/11 kV
System Frequency - Hz	50 Hz
Bus bar Rating- A	630

Min Gas pressure - BarG	0.05
Filling pressure- BarG	0.3
Min operating temperature – Deg c	- 25
IP Rating	IP 3X / 67
Internal Arc test	IEC62271
Lightning Impulse withstand Voltage	95 kV Peak
Power Frequency withstand voltage	28 kV RMS - 1 min
Rated Normal Current Incomer Load Break Switch Feeder Circuit-breaker	630 A 630A
Rated Short time current withstand (1 sec)	26.3 kA
Rated Short circuit making capacity of line switches and earthing switches	52.5 kA peak at Rated Voltage
Rated load interrupting current Incomer Load Break Switch	630 A rms
Rated cable charging interrupting current Incomer Load Break Switch	30 A
Rated magnetizing interrupting current Incomer Load Break Switch	16 A

No.	General Requirements - RMU		
1	Standard to which Switchgear complies		IEC
2	Type of Ring Main Unit		Metal-Enclosed Non-Extendible
3	Number of phases		3
4	Type test on RMU		Shall be type tested.
5	Facility for pressure relief		To be provided
6	Insulating gas		SF6
7	Nominal operating gas pressure		1.4 bar abs. 20° C
8	Gas leakage rate / annum	%	0.1
9	Expected operating lifetime		30 years
10	Facilities for gas monitoring		To be provided. With temperature compensated manometer
11	Material for tank construction		Stainless steel sheet, 3 mm

No.	General Requirements – Circuit Breaker / switch	
1	Means of switch operation	separate handle
2	Means circuit breaker operation	separate handle and push buttons
3	Rated operating sequence of Circuit Breaker	O –3min-CO-3min-CO
4	Total opening time of Circuit Breaker	approx. 45ms
5	Closing time of Circuit Breaker	approx. 40ms

7	Principle switch / earth switch	3position combined switch / earth switch
	Degree of protection:	
8	High Voltage live parts, SF6 tank	IP 67
9	Front cover mechanism	IP 55
10	Cable covers	IP 55
	Colours:	
11	Front cover	RAL 7012
12	Side and cable cover	RAL 7035

1.6 Design Requirements

1.6.1 The RMU shall meet the criteria for compact, metal-enclosed outdoor switchgear in accordance with IEC 62271.

1.6.2 Switchboards

The RMU shall be of the fully arc proof metal enclosed, free standing, floor mounting, flush fronted type. Each unit is made of a cubicle sealed-for life with SF6 and contains all high voltage components sealed off from the environment.

The switchgear and busbar shall all be contained in a stainless steel enclosure filled with SF6gas. The enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271 standard (i.e a system for which no handling of gas is required throughout the 30 years of service life) , so that refilling is not required .In addition, manufacturer shall confirm that maximum leakage rate is lower than 0,1 % / year. It shall Provide full insulation, making the switchgear insensitive to the environment (temporary flooding, high humidity...), IPX7 degrees of protection in accordance with recommendation IEC 60529 . The active parts of the switchgear shall be maintenance-free and the switchboard shall be low-maintenance.

The overall design of the switchgear shall be such that front access only is required. It shall be possible to erect the switchboard against a substation wall, with HV and LV cables being terminated and accessible from the front. The switchboards shall be suitable for mounting on a trench, utilities space or base.

The cubicle shall have a pressure relief device. In the rare case of an internal arc, the high pressure caused by the arc will release it, and the hot gases is allowed to be exhausted out at the bottom of the cubicle. A controlled direction of flow of the hot gas shall be achieved.

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

The switchgear and switchboards shall be designed so that the position of the different devices is visible to the operator on the front of the switchboard and operations are visible as well.

In accordance with the standards in effect, the switchboards shall be designed so as to prevent access to all live parts during operation without the use of tools.

1.6.3 Dielectric medium

SF6 gas is the preferred dielectric medium for MV RMUs. SF6 gas used for the filling of the RMU shall be in accordance with IEC 60376.

It is preferable to fit an absorption material in the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption.

1.6.4 Earthing of metallic parts

There shall be continuity between the metallic parts of the switchboard and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people.

The substation frames shall be connected to the main earth bus bar without dismantling any bus bars.

1.6.5 Earthing of the main circuit

The cables & feeders shall be earthed by an earthing switch with short-circuit making capacity, in compliance with IEC 60129 standard. The earthing switch can only be operated when the main Load break switch / Circuit Breaker is open.

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 action.

Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earthing switch when the switch is closed.

11.6.6 Incomer Load Break Switches

It shall consist of an SF6 cubicle housing a switch disconnecter and an earthing switch. They shall be maintenance-free, with breaking in low pressure SF6 gas. Busbars and all electrical connections are located inside the tank. The operating shafts for the switches shall have rotary seals where they enter the SF6 cubicle. The operating mechanisms shall be located outside on the front of the SF6 tank.

The position of the power contacts and earthing contacts shall be clearly visible on the front of the switchboard. The position indicator shall provide positive contact indication in accordance with IEC 60265-1 standard. In addition, manufacturer shall prove reliability of indication in accordance with IEC 60129 .

The switches shall be of the "increased operating frequency" in accordance with IEC 60265-1. They shall have at least 2 positions, open-disconnected & closed and will be constructed in such a way that natural interlocking prevents unauthorized operations. Earthing of the cable shall be either through a three position switch or a separate snap action type Earth Switch having fault making capacity. The Mechanism shall be constructed in such a way that natural interlocking prevents unauthorized operations.

The switches shall be fully mounted and inspected in the factory.

Manual opening and closing will be driven by a fast-acting mechanism, independent of operator action.

Each switch can be fitted with an electrical operating mechanism in a specially reserved location, without any modification of the operating mechanism and without de-energizing the switchboard.

1.6.7 Circuit-breaker feeders

The T-off circuit breaker module shall consist of an SF6 cubicle housing a vacuum circuit breaker unit and a disconnecter-earthing switch. The operation between circuit breaker and disconnecter-earthing is interlocked. An integrated relay and related CTs is used for tripping of the circuit breaker. Bus bars and all electrical connections are located inside the tank. The operating shafts for the switches shall have rotary seals where they enter the SF6 cubicle. The operating mechanisms are located outside on the front of the SF6 tank.

The circuit breakers shall be of the maintenance-free, vacuum type. The position indicator shall provide positive contact indication in accordance with IEC 60265-1 standard. In addition, manufacturer shall prove reliability of indication in accordance with IEC 60129.

The circuit breakers shall have 2 positions: open-disconnected & closed and shall be constructed in such a way that natural interlocks prevent all unauthorized operations. The earthing of the feeder shall be by a Fault Making Earth Switch. The earth switch shall be mechanically interlocked with the isolators / breaker to prevent any unauthorised operation.

They shall be fully mounted and inspected in the factory.

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 by an integrated push button. There will be no automatic reclosing.

The circuit breaker shall be associated with an integrated protection unit that will operate without any auxiliary power supply and shall include:

- Three current transformers
- An electronic relay,
- A low energy release,
- A "fast-on" test receptacle for protection testing (with or without CB tripping)

The protection system will ensure circuit breaker tripping as of a minimum operating current (Is) which is the rated current of the undergrounded network to be protected and may be set to following ratings from 12 to 600 A. Following settings shall be available:

Range 1 - 16 to 56 A :
 Range 2 - 32 to 112 A :
 Range 3 - 64 to 224 A
 Range 4 – 128 to 448 A

The phase protection shall have two separately adjustable settings:

- The low setting may be chosen with definite time or IDMT. The IDMT curves shall be in compliance with the IEC 255-3 standard. They are of the standard inverse, very inverse and extremely inverse types.
 The low setting may also be used with the RI curve.
- The high setting shall be of the definite time type earth protection
- The earth fault protection shall operate by residual current measurement: it uses the sum of the sensor secondary currents.
- Like phase protection, earth protection shall be fitted with two separately adjustable settings.
- There shall be provision of flag Relay on each outgoing vacuum breaker module for indication of Trip on Fault.
- Provision for testing of cable by suitable arrangements with following to be confirmed and provided:

Doors can be opened only with the Earth Switch in Closed position.

A cable test rod has to be provided which can be fixed on the terminations to facilitate testing.

Termination boots shall have a proper opening to facilitate the same. The opening shall be covered by means of removable protection cap.

MECP / Raychem or boots used in terminations must have this facility.

In case of front door opened, it shall not be possible to operate the load break switches / isolators or breaker.

- The cable cover door shall be pad lockable and shall be Tamper and Arc proof as per IEC 62271.
- Cable charge indication shall be provided for Each RMU.
- One No Phase Comparator must be provided with each RMU (4 function or 3 function RMU)
- Provision for cable door interlocks such that the doors cannot be opened unless the Earth switch is closed
- There shall be provision of hinged doors in the RMU.

1.6.8 RMU bushings and Cable terminations

- **Bushing**

The bushing shall be conveniently located for working with cables specified and allow for the termination of these cables in accordance with the instructions supplied.

The profiles of the cable connection bushings shall be in compliance with EN-50181 standard.

- **Cable clamps**

A non ferro-magnetic cable clamp arrangement must be provided for all network cables

terminated on the RMU

- **Padlocking facilities**

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

- **Voltage indicator lamps and phase comparators**

Each function shall be equipped with a voltage indicator box on the front of the device to indicate whether or not there is voltage in the cables. The capacitive dividers will supply low voltage power to the lamps.

Three inlets can be used to check the synchronization of phases.

This device shall be in compliance with IEC 61958 standard.

1.6.9 Safety of people

Any accidental overpressure inside the sealed chamber will be limited by the opening of a pressure limiting device in the rear part of the enclosure. Gas will be released to the rear of the switchboard away from the operator. Manufacturer shall provide type test report to prove compliance with IEC 62271 appendix AA 'Internal fault'.

1.6.10 Operating lever

An anti-reflex mechanism on the operating lever shall prevent any attempts to reopen 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 250 N for the circuit breaker.

1.6.11 Front plate

The front plate shall have an IP2XC degree of protection. The front shall include a clear mimic diagram which indicates the 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.

1.6.12 Fault Passage Indicators

Fault Passage Indicators shall be installed on the Ring Main Unit. The Bidder shall supply One FAULT INDICATOR per Load Break Disconnect Switch.

These devices shall be electronic devices with their own energy source and shall be provided with bright LEDs / flag Indicators, which shall be clearly visible in the daytime. They shall have the following resetting facilities:

Manual reset and

Resetting after a set time duration and

Resetting on restoring of LV

The unit shall have Short Circuit adjustable to different settings and Earth fault setting with separate Current transformer.

It should be possible to Test these indicators at site thru "Test" push button.

The Fault Passage Indicators should also be provided with a SCADA output contact.

They should confirm to the following standards:

IEC 60068-2-6, IEC 60068-2-9 & IEC 60529 : Mechanical Test

IEC 60950 : Electrical Security

IEC 1000-4 and IEC 1000-6 : EMI / RFI

IEC 1000-4-2 : Air Discharges

They should have CE marking.

1.6.13 Bus bars

Bus bars for the connections to the switch or circuit breaker shall be of copper and shall be suitable for the 3 single phases. The bus bar shall be integrated in the cubicle

Bus bars shall be rated to withstand all dynamic and thermal stresses for the full length of the switchgear.

1.6.14 The cable switch

It shall be a switch-disconnector and earthing switch using SF6 gas as an arc-quenching medium. The switch positions are closed – open – earthed. In the open position the switch satisfies the disconnector requirements.

1.6.15 Earthing Switch

Earthing switches shall be rated equal to the switchgear rating.

Earthing switches shall be quick make type capable of making Rated Fault Current.

Earthing switch shall be operated from the front of the cubicle by means of a removable handle.

1.6.16 The Mechanisms

All mechanisms shall be situated in the mechanism compartment behind the front covers outside the SF6-tank.

The mechanism for the switch and the earthing switch shall operate both switches via one common shaft. The mechanism shall provide independent manual operation for closing and opening of the switch, independent closing of the earthing switch and dependent opening of the earthing switch.

The mechanism for the T-off switch and earthing switch shall operate both switches via one common shaft. The mechanism shall have stored spring energy and provide independent manual operation for closing and opening of the switch, independent closing of the earthing switch and dependent opening of the earthing switch. The mechanism has fuse tripping device.

The mechanism for the vacuum circuit breaker (VCB) and disconnector-earthing switch shall operate the VCB and the disconnector-earthing switch via two separate shafts. The mechanism for the VCB shall have stored spring energy and provide independent manual operation for closing and opening of the VCB. The mechanism shall have a relay with related CT's and/or remote tripping device. The mechanism for the disconnector-earthing switch shall provide independent manual operation for closing and opening of the disconnector, independent closing of the earthing switch and dependent opening of the earthing switch.

1.6.17 Cable compartment

It shall be possible to terminate up to a maximum of two single core HV cables per phase.

The access to the compartment will be possible by removing the cable cover, bolted to the main frame.

Removable steel covers shall close the cable compartments. Arc proof cable covers shall be available as option. Each module shall have a separate cable compartment that is segregated from each other by means of a partition wall. A partition wall shall be fitted to divide the cable compartment from the rear side of the switchgear. In case of an arc inside the tank, followed by the opening of the pressure relief, the partition wall shall prevent the hot gases flowing out from the pressure relief to enter the cable compartments. All covers shall be removable. The ground continuity shall be achieved when the covers are in place by means of bolted connections.

1.6.18 Power connection,

The cables are installed in the dedicated compartment below the mimic front cover. At the bottom of the cable compartment, an earthing bar system made of copper with a minimum cross section of 150 mm² shall be fitted. In each compartment the earthing bar shall be fitted with 4 screws M10. The earthing system is connected to the tank by a copper bar, which rises up to the connecting point of the tank behind the rear partition wall on the middle of the switchgear.

1.6.19 Inter Locking

The mechanism for the cable switch shall provide a built in interlocking system to prevent operation of the switch when the earthing switch is closed, and to prevent operation of the earthing switch when the switch is in the closed position.

The mechanism for the T-off switch shall provide a built in interlocking system to prevent operation of the switch when the earthing switch is closed, and to prevent operation of the earthing switch when the switch is in the closed position. In addition an interlocking device allows access to the fuses only when the earthing switch is in the earthed position and opening of the earthing switch is only possible when the fuse cover is closed and secured.

The mechanism for the VCB and the disconnecter-earthing switch shall have a built in interlocking system to prevent operation of the disconnecter-earthing switch when the VCB is in the closed position.

1.6.20 Current Transformers

All current transformers shall comply with IEC 60185.

Current transformers shall be of dry type, with ratings and ratios as required.

Cable current transformers used in circuit breaker modules shall be maximum 100mm wide.

Current transformers used in metering cubicles shall have dimensions according to DIN 42600, Narrow type.

1.7 Tests

Routine Tests shall be conducted on the Ring Main Units in accordance with the latest versions of IEC. Type Test certificates for tests conducted earlier on similar equipment shall be furnished.

Type Tests

Units shall be type tested in accordance with IEC standards 60056, 60129, 60265, 62271, 60420, 60529 and 60694. The following type tests have been performed and available if required

- Short time and peak withstand current test
- Temperature rise tests
- Dielectric tests
- Test of apparatus i.e. circuit breaker and earthing switch
- Arc fault test

Routine Tests

Routine tests shall be carried out in accordance with IEC 62271 standards. These tests shall ensure the reliability of the unit.

Below listed test shall be performed as routine tests before the delivery of units;

- Withstand voltage at power frequency
- Measurement of the resistance of the main circuit
- Gas leakage test
- Withstand voltage on the auxiliary circuits
- Operation of functional locks, interlocks, signalling devices and auxiliary devices
- Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism
- Verification of wiring
- Visual inspection

Tests shall be performed in the presence of Purchaser's representatives. The Contractor shall give at least fifteen (15) days advance notice for witnessing the tests. Copies of certified reports of all tests carried out at works shall be furnished. The equipment shall be dispatched from works, only after receipt of Purchaser's written approval of the test reports.

Each completely wired Ring Main Unit shall be tested to ensure that all of its protective, control and interlock systems are satisfactorily functioning in the manner as required.

The Bidder shall indicate tests recommended to be carried out at site during installation and commissioning to ensure satisfactory performance of all the equipment supplied.