MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

SPECIFICATION NO.MMC/MSC-II/GIS/18.10.2017

TECHNICAL SPECIFICATION

For

33 KV,22 KV& 11 KV Gas Insulated Switchgear

A) 33 KV,22 KV Switchgear in SF6, Busbar in SF6 or Silicon coated and 11 kV Switchgear in SF6, Busbar in SF6 or Silicon coated.

OR

B) 33 KV,22 KV Switchgear in SF6, Busbar in SF6 or Silicon coated and11 kV Air Insulated Switchgear & Busbar.

FOR

DISTRIBUTION SYSTEM

IN

MSEDCL

INDEX

Technical Specifications for A) 33 KV,22 KV Switchgear in SF6, Busbar in SF6 or Silicon coated and 11 kV Switchgear in SF6, Busbar in SF6 or Silicon coated B)33 KV,22 KV Switchgear in SF6, Busbar in SF6 or Silicon coated and 11 kV Air Insulated Switchgear & Busbar

1.00Scope:

1.1. This specification covers design, manufacture, assembly, testing before supply, inspection, packing and delivery of metal clad partitioned,SF6 gas insulated switchgear confirming to IEC-62271-200.The GIS type switchgears shall be complete with all the accessories and auxiliary equipment's required for their satisfactory operation such as switchboard panels for line bays, bus coupler/bus section bays etc. shall be fitted with vacuum circuit breakers, three position disconnector and earthing switches, voltage transformers, current transformers, metering instruments ,protection relays, cable terminal ends/plugs for incoming & outgoing cable feeders etc. as per forgoing specification in various sub-stations of the MSEDCL.

1.2. It is not the intent to specify, completely here in all the details of design and construction of the GIS type Switchgear. However, the switchgear shall conform, in all respects to high standards of engineering, design and workmanship with recent editions. It shall be capable of performing in continuous commercial operation up to the supplier's guaranteed life of equipment in a manner acceptable to the purchaser who will interpret the meanings of drawings and specifications and shall have power to reject any work or material which, in his judgment, is not in accordance therewith. The switchgear offered shall be complete with all components necessary for its effective and trouble free operations. Such components shall be deemed to be within the scope of supplier's supply, irrespective of whether those are specifically brought out in this specification and/or in the commercial order or not.

1.3 The Tenderer/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

2. Objective of Work & Tolerances :

It is intended to have

a. Enhanced safety and reliability

b. Maintenance free switchgear

c. Reduction in space requirement

d. Integrated remote control and monitoring-SCADA compatible

Tolerances*:- Tolerances on all the dimensions shall be in accordance with provisions made in the relevant IS/IEC standards and in these specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality of the product.*

3. SERVICE CONDITIONS:

3.1 System particulars:

a.	Nominal system voltage	...	33 Kv 22Kv 11Kv
b.	Corresponding highest system voltage	...	36 Kv 24Kv 12Kv
c.	Frequency	...	50 Hz±3%
d.	Number of phases	...	3
e.	Neutral earthing	...	Solidly grounded
f.	Short Current Rating	...	25 kA

3.2 Equipment supplied against the specification shall be suitable for satisfactory Operation under the following tropical conditions:-

3.2.1	Max. ambiant température	: 45 Deg. C
3.2.2	Min ambiant température	: -5 °C
3.2.3	Max daily average ambiant température	: 40°C
3.2.4	Min yearly average ambient temperature	: 30°C
3.2.5	Max. relative humidity	: 100 %
3.2.6	Max. annual rainfall	: 1450 mm
3.2.7	Max. wind pressure	: 150 kg/sq.m.
3.2.8	Max. altitude above mean sea level	: 1000 mtrs.
3.2.9	Isoceraunic level	: 50
3.2.10	Seismic level (Horizontal acceleration)	: 0.3 g.
3.2.11	Climatic Condition:	Moderately hot (exposed to sun) and Humid tropical climate Conducive to rust and fungus growth

3.3) The climatic conditions are prone to wide variations in ambient conditions and hence equipment shall be of suitable design to work satisfactorily under these conditions.

3.4) Auxiliary supplies available at the various sub-stations are as follows:-

i.	A. C. Supply	240 volts with ± 10% variation
ii	D.C. Supply	30 V DC with +10% to – 15% variation
iii	Frequency	50 Hz with ± 3% variation

4 REFERENCE STANDARDS:

4.1 The metal-enclosed gas-insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be designed, manufactured, assembled and tested in accordance with the relevant standards, specification and codes of practices, referred to herein and shall be the latest editions including all applicable official amendments and revisions.

The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes.

Unless otherwise specified, the equipment offered shall confirm to the latest applicable Indian, IEC, British or U.S.A Standards and in particular, to the following:-

IEC 62271-200	AC metal-enclosed switchgear & control gear for rated voltage above 1 KV and up to and including 52 KV
IEC 622271-1	High Voltage switchgear and controlgear-Part-1: Common specification
IEC 622271-100	High voltage Alternating current circuit breakers.
IEC 60694	Common clauses for high voltage switchgear and control gear standards
IEC 622271-103	High voltage switches for rated voltages above 1 KV and less than 52 KV.
IEC 60071	Insulation coordination
IEC 61936-1	Power installations exceeding 1 KV.
IEC 61128	Alternating current disconnectors bus transfer current switching by disconnectors
IEC 61129	Alternating current earthing switches-induced current switching
IEC 60265	High voltage switches
IEC 60137	Bushings for alternating voltages above1000 V
IEC 60233	Tests for hollow insulators for use in electrical equipment
IEC 61259	Requirements for switching of bus charging current by GIS disconnectors
IEC 60059	IEC Standard current Rating
IEC 62271-102	A.C. disconnectors (isolators) and earthings switches for voltages above 1000 V
IEC 62271-207	Seismic qualification for gas –insulated switchgears assemblies for rated voltages above 52 KV
IEC 60376	New sulpher hexafluoride (SF6)
IEC 60480	Guidelines for checking and treatment of sulphar hexafluoride (SF6)
IEC 61633	High voltage Alternating Current Circuit Breakers-Guide for Short Circuit and Switching Test-Procedure for Metal Enclosed and Dead tank Circuit Breaker.
IEC 61634	High voltage Switchgear and Control gear use and handling of SF6 in High voltage Switchgear and Control gear
IEC 62215	Guide for Asymmetrical Short Circuit Breaking Test Duty T10 IEC 60529 Degree of protection of enclosures
IEC 61243-5	Voltage detection systems
IEC 60044-1	Current Transformers
IEC 60044-2	Potential transformers
IEC 62271-209	Cable connections for gas insulated switch gears
IS 5621:1980	Hollow Insulators for use in electrical equipment
IS:2544/1973	Porcelain Post Insulators / Resin cast insulators
IS 8828/1996	MCB

IS 12063/1987	Degree of protection provided for enclosures for electrical equipment.
IS 5/2005	Colors for ready mixed paints and enamels. Code no. 694 (Dove Grey)
IS 5578/1984	Marking of insulated conductor.
11353/1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals
IS 1248/2003	Indicating instruments.
IS 14697/1999 amended up to date & as per updated technical specifications of MSEDCL	HT Static tri vector TOD Energy meters
IS 6875 amended up to date	Control switches.
IS 3231/1986 & 87 amended up to date	Electrical Relays for Power System Protection.
IEC 60255 amended up to date	Numerical protection relays.
IS 8686/1977	Static protective relays.
IS 4794/68 & 86	Push button.
IS 9431/1979	Indoor post insulator of organic material
IEC 60529 / EN 60529	Protection against accidental contact, foreign Objects and water

4.2 The components and devices which are not covered by the above standards shall confirm to and comply with the applicable standards ,rules, codes, and regulations of the internationally recognized standardizing bodies and professional societies as may be approve by the Employer and the manufacturer shall list all such applicable standards, codes etc

4.3 Equipment conforming to any other internationally accepted standards, will also be considered if they ensure performance and constructional features equivalent or superior to the standards listed above. In such case, two copies of such standards in authentic English translation, if the language of the standard is other than English shall be provided. In case of dispute, the stipulations in the English translation, submitted by the manufacturer ,shall prevail. Further, in the event of conflict between the stipulations of standard adopted by the manufacturer and the corresponding IEC/Indian Standard Specification, the stipulation of Indian Standard Specification shall prevail.

5.0 GENERAL TECHNICAL REQUIREMENTS :

5.1 Switchgear Panel

5.1.1TheGas insulated Metal clad switchgear shall be complete with all the accessories for efficient and trouble free operation. The equipment offered shall be safe, reliable and compact to install. The workmanship shall be high order. The circuit breaker, switches and protective device etc shall be latest design so as to ensure rapid and efficient interruption of fault current low arc energy, small arching time and freedom from fire hazards

5.1.2 The GIS shall be designed, manufactured and tested in accordance with the best international engineering practices under strict quality control to meet the requirement stipulated in the technical specification. Adequate safety margin with respect to thermal, mechanical, dielectric stress ,dynamic short circuit fault and insulation coordination is to be maintained during design, selection of raw material, manufacturing process etc. so that the GIS provides long life with least maintenance.
The complete switchgear shall be designed to manage the risks associated with it such that there shall not be any safety hazard to the employees in normal service and during inspection and maintenance.

5.1.3 The workmanship shall be of the highest quality and shall conform to the latest modern practices for the manufacture of high technology machinery and electrical switchgear.

5.1.4 The switchgear panel shall be fully arc proof, free standing, floor mounted, fully compartmentalized, metal enclosed construction complying requirements of IEC 62271-200. Each circuit shall have a separate vertical panel with required compartments for circuit breaker, cable termination, main bus-bars and auxiliary control devices.

5.1.5 The SF6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch (by human/animal) of any of it's constituent live parts.

5.1.6 The design should be such that all parts subjected to wear and tear are easily accessible for maintenance purposes. The Service Class Continuity of Switchgears shall be LSC-2 (as per IEC 622771-200), LSC 2B-PM (as per IEC 622771-200) will be preferable.

5.1.7 All necessary equipment required for Gas handling at site (if any), shall be arranged by the supplier at their own cost during commissioning and further servicing in GP.

5.1.8 All louvers (if provided), shall have very fine brass or GI mesh screen. Tight fitting gourmet / gaskets are to be provided at all openings in relay compartment. Relays shall be fully flush mounted on the switchgear panels at a suitable height from operator point of view.

5.1.9 Switchgear shall have an Internal Arc Classification of IAC-A-FLR 25 KA,1 sec.(as per EI guidelines all switchgear shall be at least 1.2 meters away from wall) The switchgear construction shall be such that the operating personnel are not endangered by breaker operation and internal explosions, and the front of the panels shall be specially designed to withstand these. Gas Pressure relief device/Explosion Vent/Pressure relief duct shall be provided for each SF6 gas compartment, so that in case of a fault in a compartment, the gases produced are safely vented out, thereby minimizing the possibility of it's spreading to other compartments and panels. The pressure relief device/Explosion Vent/Pressure relief duct shall not however reduce the degree of protection of panels under normal working conditions.

5.1.10 The switchgear shall be cooled by natural air flow.

5.1.11 Total height of the switchgear panels shall be finalized during detail engineering in line with building design. The height of switchgear panel shall not be less than 2300 mm.

5.1.12 Suitable interlock & Indications shall be provided to prevent opening of any HT compartment doors, in case the incoming HT supply is ON.

5.1.13 Suitable base frames made out of steel channels shall be supplied along with necessary anchor bolts and other hardware, for mounting of the switchgear panels. These shall be dispatched in advance so that they may be installed and leveled when the flooring is being done, welding of base frame to the insert plates shall be in Bidder's scope. The bidder may offer panels with built in base frame ready for dispatch and suitable for installation on indoor cable trenches.

5.1.14 The switch board shall have the facility for extension on both sides. The facility of extension of additional breakers (to existing set up) for future expansion shall be provided.

5.1.15 The manufacturer shall give guarantee for maximum leakage rate of SF6 gas will be lower than 0.1 % per year. In case of Gas leakage the GIS should have the capability to withstand di-electric strength at 1bar pressure. Separate gas monitoring sensors should be available for all the gas filled chambers.

5.1.16 The minimum operating SF6 gas pressure shall be 1.2 bar. Alarm shall be generated if the SF6 gas pressure drops to 85% of the minimum operating pressure and if it further drops below 80% the Circuit breaker shall trip & go into lockout mode.

5.1.17 The SF6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch of any of it's constituent live parts

5.1.18 Thermostatically controlled space heater with common MCB shall be provided for various compartments.

5.1.19 A) GIS SWITCHGEAR WITH BUS BAR IN SF6 GAS:

The SF6 gas insulated metal enclosed switchgear shall be constructed from corrosion-resistant stainless steel sheet of min 2 mm thickness, filled with SF6 accommodating the primary switching devices(Busbar ,VCB and Three position disconnector cum earthing switch) and all live parts. This panel complying ingress protection min IP 65 .

B) GIS SWITCHGEAR WITH SILICON COATED BUS BAR :

The SF6 gas insulated metal enclosed switchgear shall be constructed from corrosion-resistant stainless steel sheet of min 2 mm thickness, filled with SF6 accommodating the primary switching devices (VCB and Three position disconnector cum earthing switch) and all live parts. This panel complying ingress protection min IP 65 .
Busbar placed outside the gas chambers then this will be silicon coated solid insulated touch proof bus bar (zero potential) and will be housed in closed chamber. The chamber shall be constructed from CRCA/ AluZinc sheet of min 2 mm thickness or galvanized sheet/ stainless steel sheet of min 1.6 mm thickness. This panel complying ingress protection min IP 4X.

5.1.20 The interconnection of individual panels shall not require any gas work neither for installation at site nor for extension of the panel board. It shall be possible to extend the panel board on either side.

5.1.21 All the mechanical parts shall be surface treated to prevent corrosion.

5.1.22 The panels must be suitably treated and powder coated with 60-70 micron thickness, to achieve indoor worthiness and corrosion protection and should pass salt spray test as per DIN EN ISO 9227-2006.

5.1.23 It shall be with pressure relief device with controlled direction of flow of the hot gasses generated in rare event of internal arc

5.1.24 The panel board with minimum gas pressure shall withstand the rated highest system voltage.

5.1.25 To take care of any gas leakage during operation, the GIS manufacturer shall supply a gas

refilling kit comprising gas cylinder, manometer, reduction valve adopter, pressure measuring device, connecting and filling hose, etc shall be also be supplied under the scope of work.

5.1.26 Temperature compensated gas density monitor shall be provided on the front side to monitor SF6 gas and for interlock purpose.

5.1.27 No any special tools shall be required for installing the equipment.

5.1.28 The design of the panel should be such that no permanent or harmful distortion occurs either when being lifted by eyebolts or when moved into position by rollers.

5.1.29 Paint shade of Indoor Switchgear shall be 694 as per IS:5(Dove Grey).

5.1.30 SF6 gas pressure and density should maintained as per relevant IS and IEC, if gas pressure or density goes below specified limits, breaker should go in lockout mode. Non-Return Valve shall be provided for SF6 gas filling at site.

5.2 11KV INDOOR AIS SWITCHGEAR PANEL

Switchgear for Indoor installation shall be metal clad, draw-out type and fully compartmentalized having 25 kA short time current rating. All panels shall be of unitized construction providing facility for extensions on both sides. Three types of switchgear panels are required, viz. the incomer panel, the bus section panel and the feeder (outgoing) panel. Circuit Breakers used shall be VCBs of specified rating for the various types. The design of the breaker truck shall be such that there will be flexibility of interchanging between incomer, bus-section and feeder trucks, where similar rated breakers are offered. These panels shall be constructed from CRCA/ AluZinc sheet of min 2 mm thickness or galvanized sheet/ stainless steel sheet of min 1.6 mm thickness. These panels complying ingress protection min IP 4X.

6. Busbar and Insulators

6.1 33KV, 22 KV busbar

33 Kv, 22 KVbusbar can be housed in SF6 gas chamber or outside the gas chambers. If placed outside the gas chambers then this will be silicon coated solid insulated touch proof bus bar and will be housed in closed chamber.

33 KV and 22 Kv bus bars shall be made of electrolytic copper and shall be rated for 1250 Amps continuous current, Cross sectional area shall not be less than 785 sq.mm. and bus bar size calculation / supporting type test report shall be submitted for approval. Current density of copper shall not exceed more than 1.6Amps/sq. mm. Bus bar cross-section shall be uniform throughout the length of switchgear panel. The bus bar edges/ends shall be rounded off/chamfered so that there will not be any sharp edges/projections.

6.2 11KV busbar.

6.2.1 11KV bus bar can be housed in SF6 gas chamber or outside the gas chambers. If placed outside the gas chambers then this will be silicon coated solid insulated touch proof bus bar and will be housed in closed chamber.

11 kV bus bars shall be made of electrolytic copper and shall be rated for 800 Amps continuous current. Cross sectional area shall not be less than 500 sq.mm. and bus bar size calculation / supporting type test report shall be submitted for approval. Current density of copper shall not exceed more than 1.6Amps/sq. mm. Bus bar cross-section shall be uniform throughout the length of switchgear panel. The bus bar edges/ends shall be rounded off/chamfered so that there will not be any sharp edges/projections

6.2.1 11 KV Busbar can be housed in air insulated closed chamber. The bus bar edges/ends shall be rounded off/chamfered so that there will not be any sharp edges/projections. 11 kV bus support insulators and other equipment insulators shall have a minimum creepage distance of 127 mm. These insulators shall be of solid core porcelain or epoxy resin cast, with suitable petticoat design. Insulators shall have a cantilever strength of

not less than 1200 KgF. All fasteners (Nuts Bolts) used for bus bar connections shall be of non magnetic stainless steel. Only belleville type washers shall be provided for each nut bolt. If the fasteners used are not of stainless steel the tenderer shall state in their offer the material used and confirm that the same is non-magnetic and is superior to stainless steel. The bus bars along with their supporting insulators etc. shall have a short time current rating of 25 KA for 3 sec. This shall be confirmed by the manufacturers in their technical offer.

6.3 Busbar shall be of made of electrolytic high grade Copper of adequate size and bus bar size calculation / supporting type test report shall be submitted for approval (current density of copper shall not exceeded more than 1.6 Amp/sq.mm). They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents.

6.4 Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators **and should withstand electrical and mechanical stresses due to specified short circuit currents**. (IS)

6.6 All piping for SF6 gas shall be made of copper & their fittings shall be made of non-magnetic stainless steel.

6.7 Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. In case of organic insulator partial discharge shall be limited to 50 pico coulomb at rated Voltage X 1.1/√3 as per IS 3156

6.8 All busbars shall have suitable phase identification. Bus switching scheme shall be as per Single Line diagram attached with bidding documents.

6.9 The temperature of the busbars and all other equipment, when carrying the rated current continuously shall be limited 60deg C above ambient temperature 45deg C as per the relevant Standards

6.10 Clearances between phases and between phase and earth shall be kept liberally so as to obtain high reliability. However minimum clearances for 33Kv, 22Kv and 11KV bus bar chamber as shown below shall be kept :

Sr. No.		33KV/22KV for busbar in gas Chamber	33KV/22KV for busbar in air Chamber	11KV for busbar in gas Chamber	11KV for busbar in air Chamber
1.	Phase to Phase	78 mm	90 mm	60mm	70mm
2.	Phase to earth	78 mm	90 mm	60mm	70mm

6.11 If any special insulating material is proposed to achieve the effect of above clearances details of the same shall be furnished in the technical offer.

6.12 Test certificate of bus bar for rated STC rating shall be submitted, along with offer, otherwise necessary confirmation shall be given in the offer for submitting the same for approval of competent authority prior commencement delivery.

7.0 Circuit Breaker

7.1 Vacuum circuit breaker shall be used for 33 KV, 22 KV GIS (Gas Insulated Switchgear) and Vacuum Circuit Breaker can be used for 11KV GIS or 11 KV AIS (Air Insulated Switchgear).

For GIS:- 33 KV, 22 KV or 11 KV Vacuum circuit breaker shall comprise of three single pole interrupting units or 3-pole interrupting unit, operated through a common shaft by a sturdy operating mechanism.

For AIS :- 11KV Vacuum Circuit Breaker shall be horizontal draw out , Horizontal Isolation type. Breakers shall be of 3 pole design for use in 11 kV indoor switchgear.

7.2 Circuit breaker shall be re-strike free, stored energy operated and trip free type. Motor wound closing spring charging shall only be acceptable. Anti-pumping features shall be provided for each breaker. An arrangement of two breakers in parallel to meet a specified current rating shall not be acceptable. (No parallel interrupter).

7.3 Circuit breaker shall be provided with two trip coils.

7.4 Suitable indicators shall be provided on the front of panel to indicate OPEN / CLOSED conditions of the circuit breaker, and CHARGED / DISCHARGED conditions of the closing spring, SF6 gas density monitor for all gas compartments.

7.5 The rated control supply voltage shall be as mentioned elsewhere under Technical parameters. The closing coil shall operate satisfactorily at all values of control supply voltage between 80-110% of the rated voltage. The trip coil shall operate satisfactorily under all operating conditions of the circuit breaker up to its rated short circuit breaking current at all values of control supply voltage between 70-110% of the rated voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by indicating lamps and trip coil supervision relay.

7.6 The time taken for charging of closing spring shall not exceed 30 seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation. As long as power supply is available to the charging motor, a continuous sequence of closing and opening operations (CO) shall be possible. Spring charging motors shall be capable of starting and charging the closing spring twice in quick succession without exceeding acceptable winding temperature when the supply voltage is anywhere between 80-110% of rated voltage. The initial temperature shall be as prevalent in the switchgear panel during full load operation with 55 deg. C ambient air temperature. The motor shall be provided with over load protection.

7.7 Motor windings shall be provided with class E insulation or better. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in a hot, humid and tropical climate.

7.8 For 33kv, 22kv & 11kv incomer :

Tripping time : 60-70 ms (Including Relay Time) Closing Time < 80 ms.

For 11kv feeder :Tripping time:45-50 ms (Including Relay Time) Closing Time: 40-60 ms.

7.9 Manual Spring Charging shall be provided. All the basic mechanical ON/OFF of Circuit breaker, Disconnector& earth switch operation, manual spring charge of Circuit Breaker must be possible without opening the door to ensure the operator safety.

7.10 Breaker operations (Mechanical Endurance) as per relevant IS/IEC Amended up to date.

7.11 The circuit-breaker has to control at least 10,000 Make-Break cycles without maintenance. The mechanical life and operating cycles of the vacuum interrupter shall confirm relevant IS/IEC amended up to date.

7.12 Tripping coil, closing coil and motor mechanism shall be easily accessible for maintenance purpose.

7.13 The circuit breaker shall be provided with motor operated spring charged closing. Spring charging motor shall be suitable for 240V, 50 Hz, single phase AC. **Suitable rating starter shall be provided for Motor protection.** Spring release coil for closing shall be suitable for 30V DC.

7.14 Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC auxiliary supply. It shall be possible to trip the breaker manually in case of necessity.

8 Disconnector and earthing switch:

8.1 Each Switchgear panel shall be provided with three (3) position disconnecting-cum-earthing switch of required rating.

8.2 It shall be possible to control these switches from front of the panel & remotely from SCADA/SAS through IED.

8.3 Necessary indication shall be provided on the front of the panel for Close/Open status of the three position switches.

8.4 The safe, positive and foolproof interlocks shall be provided for personnel safety and equipment safety.

8.5 Key interlocks shall be provided for local manual operations.

8.6 Mechanical interlocks shall be provided for following conditions Three position disconnector cum earth switch cannot be operated when circuit breaker is closed.

8.7 The operating handle /lever cannot be removed until the switching operation has been completed.

8.8 Earthing shall be additionally secured against" de-earthing" by providing a padlock.

8.9 The cable compartment cover can only be opened if the panel is earthed.

8.10 In addition to above, relevant all electrical interlocks shall also be provide.

8.11 Disconnecting switches shall be motor operated where SCADA is implemented)Isolators or isolators combined with earthing switches (3 position switches) shall be motor operated. In cases of emergency, manual operation must be possible.

8.12 The earthing position for all 3 phases must be visible via a mechanical position indicator (MIMIC) directly connected to the drive shaft on panel front Fascia. The mechanical operation of isolator / 3 position disconnector switch must be possible with door closed for operator safety.

8.13 The large view ports to be provided to make it easy to visually check the switching position and to ensure safety of operations thereof.

9) Control and Interlocks

9.1 The circuit breaker shall normally be controlled remotely from SAS/SCADA system through closing and trip coils. However, it shall also be designed to control locally from Indoor Switchgear panel. Suitable mimic on Panel shall be provided.

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

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

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

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

10 **Earthing and Earthing Devices**

10.1 The grounding system for GIS shall be designed and provided as per IEEE-80-2000 and CIGRE- 44to protect operating staff against any hazardous touch voltages and electro-magnetic interferences.

10.2 The earth busbar made of electrolytic high grade copper with cross sectional area of minimum 240 sq mm shall be provided at the bottom in all the panels and interconnected with adjacent panels in the panel board through a connecting link to form a common earth busbar for the entire panel board ready to connect to the substation earthing grid. It shall be welded to the framework of each panel and each breaker earthing contact bar. The earth bus shall have sufficient cross section (minimum 240 sq mm) to carry the momentary short-circuit and short time fault currents to earth without exceeding the allowable temperature rise.

10.3 Suitable arrangement shall be provided at each end of the earth bus for bolting to station earthing grid. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.

10.4 All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical continuity of the whole switchgear enclosure frame work and the truck shall be maintained even after painting.

10.5 All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering shall not be acceptable. Looping of earth connections which would result in loss of earth connection to other devices, when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths of earth bus is acceptable.

10.6 PT and CT secondary neutral point earthing shall be at one place only on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit may be removed without disturbing the earthing of other circuits.

10.7 The panel shall have **Voltage Presence Indicator (VPI)** to warn the operator against earthing of live connections.

10.8 All hinged doors shall be earthed through flexible earthing braid.

10.9 Separate earthing for switchgear and C&R panel shall be provided.

11.0 CURRENT TRANSFORMERS:

11.1 The C.Ts. being prone to failure due to various reasons, the quality and reliability of the CTs are of vital importance. C.T. shall be rated for 25 kA for 3 sec. short time current. Insulation used shall be of very high quality, details of which shall be furnished in the technical offer.

11.2 The instrument security factor for metering core shall be low enough but not greater than 5 at lower ratio. This shall be demonstrated on metering core in accordance with the procedure specified in relevant IS/IEC.

11.3 Primaries shall be wound or bar type, rigid, high conductivity grade copper conductor. Unavoidable joints on the primary conductor shall be welded type, preferably lap type. The current density at any point shall not exceed 1.6 A/sq. mm.

11.4 Suitable insulated copper wire of electrolytic grade shall be used for CT secondary winding. Multi ratio in CT shall be achieved by reconnection of secondary winding tapping.

11.5 Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud, nut and washer shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be at least 10 mm.

11.6 The CTs shall be resin/epoxy cast. Contact tips on primary terminals shall be silver plated. Correct polarity shall be invariably marked on each primary and secondary terminal.

11 7 All current transformers for GIS shall be ring type (Tape wound / resin cast) .

12.0 POTENTIAL TRANSFORMER

12.1 Potential transformers shall be single phase units connected to the line side in the respective incomer. H.V side shall be connected in star formation and L.V. side in star/open delta formation.

12.2 PT may be provided in a separate compartment. The primary and secondary contacts (moving & fixed type) shall have firm grip while in service. Service position locking mechanism shall be provided and indicated by bidder in relevant drawing. Rigidity of primary stud point with earth bus in service position shall be confirmed.

12.3 P.T. shall be epoxy/resign cast. Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal.

12.4 Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud, nut and washer shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be at least 10 mm.

12.5 Each secondary core will be protected by suitable MCB.

12.6 In case of 2 Power Transformers are in parallel, 2nd core of PTs shall be used for directional protection.

Note : Instrument transformers shall be suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated load and the outside ambient temperature is 55 deg. C. The class of insulation shall be E or better.

All instrument transformers shall withstand the power frequency and impulse test voltage specified for the switchgear assembly. The current transformer shall further have the dynamic and short time ratings at least equal to those specified for the associated switchgear and shall safely withstand the thermal and mechanical stress

produced by maximum fault currents specified when mounted inside the switchgear for circuit breaker modules.

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

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

13 POWER CABLE TERMINATION

13.1 Cable termination compartment shall receive the stranded Aluminum conductor, XLPE insulated, shielded, armored, PVC jacketed, single core / three core, unearthed / earthed grade HT power cable(s) as specified in Section -Project.

13.2 Adequate clearance shall be kept between the cable lug bottom ends and gland plates for stress cone formation for XLPE cables. Inter-phase clearance in the cable termination compartment shall be adequate to meet electrical and mechanical requirement besides facilitating easy connections and disconnection of cables. Dimensional drawing of cable connection compartment showing the location of lug, glands, gland plates etc. and the electrical clearances available shall be submitted during detail engineering.

13.3 Cable termination compartment shall have provision for termination of power cables of sizes indicated in the bidding documents. Cable entry shall generally be from the bottom; however, this shall be finalized during detail engineering.

13.4 Necessary cable termination plugs shall be part of Indoor switchgear panel supplier for all panels. Scope also includes Panel terminal ends jointing/connection with HT cables.

13.5 Bushings and arc-resistant cable covers/cable boot shall be provided in cable compartment to receive /connect 2 no's of 3X300 sq.mm Aluminum XLPE Power Cable for outgoing feeders and 3 no's of 3X 300 sq.mm Aluminum XLPE power cable for incoming feeders or as per requirement.

13.6 Indoor cable terminations kits to connect the above mentioned cables to the panel cable connections shall be in the scope of the tender.

13.7 For 33KV, 22 KV end termination required for XLPE cable should be plug in type touch proof type for eg. Pfisterer, Euromould, Tyco etc

13.8 On 11KV side the end cable termination required will be conventional heat shrinkable

14 Low voltage Compartment (Instrument Chamber)

14.1 The panels shall be with low voltage compartment consisting control switches, indication and metering instruments, protection relays and other secondary equipment's. The dynamic mimic shall be provided on the front fascia and not on the LV chamber.

14.2 The front side shall have Mimic as per single line diagram with control switches and mechanical and electrical 'Position indicators' circuit breakers, disconnectors and earth switch

14.3 Control switches/Pushbuttons shall be provided adjacent to respective equipment position indicators in Mimic for ON-OFF operation of circuit breakers, disconnectors and earth switches.

14.4 The SCADA compatible Trivector Meters (TVM) shall be provided *and to be integrated with substation Automatic System*(either RS232 or RS 485)

14.5 Live line Indicators :- Capacitive voltage indicators shall be provided on feeder side in outgoing feeders, on bus side & feeder side in incoming feeders and on both the sides in Bus coupler to indicate the voltage presence in each phase and to prevent the closing of

earth switch in case the part is live. It shall have sufficient output contacts for substation Automation System and interlock purpose.

14.6 Panel interlocking wiring cables shall be supplied with panels.

15.0 SCADA Compatibility

The panels shall be fully SCADA compatible

16.0 Numerical Protection Relays (IEDs)

Indoor switchgear panels shall have communicable numerical protection relays (IEDs) complying with IEC-61850on all feeders which shall be networked on Ethernet to communicate with substation SAS/SCADA system on IEC-61850.Relay shall have redundant RJ45 ports complying to PRP redundancy of IEC 61850. These IEDs shall also be used for control & monitoring the switchgear from SAS. In addition to status of devices (CBs/Isolators/Earth Switches) and equipment alarms, Metering data shall also be made available to SAS/SCADA station from protection IEDs. Further, Trivector meters with Modbus / IEC 103 protocol are also envisaged, which will be connected in daisy-chain-link to communicate to station SAS. Modbus /IEC 103to IEC 61850 converters shall be provided for integration with SAS.

The Bidder's scope shall include the followings:

a) Communicable Numerical Protection Relays (with IEC 61850 in each of the feeders & Bus-section/Bus coupler

b) IED's / Numerical Relays shall have digital display, display to facilitate settings, relay operations and to view measurement, event and alarm etc.

c) Cat5e Ethernet cable for connection of Numerical Relays (IEDs) to Ethernet switches and Optical cable between Ethernet switch (for indoor switch gear IEDs) and ring/ redundant network of Substation LAN switch shall be used.

d) Required number of Ethernet switches mounted in Indoor Switchgear panels for communication with IEDs on IEC 61850 / protocol.

e) The SAS/SCADA system has been envisaged as part of main substation. Bidder shall facilitate in successful Integration of Numerical Relays to the SAS/SCADA system through Ethernet switches.

16.1 All Numerical relays shall be of proven design for the application satisfying requirements specified elsewhere and shall be subject to Employer's approval. Numerical Relays shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity for the intended application.

16.2 All numerical relays shall be rated for control supply voltage as mentioned elsewhere under system parameters and shall be capable of satisfactory continuous operation between 80-110% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Heavy duty binary output contacts of IEDs to be used for breaker close and trip commands shall be so rated as to be used directly used in the closing and tripping circuits of breaker without the need of any interposing / master trip relays.

16.3 Threshold voltage for binary inputs shall be suitably selected to ensure avoidance of mal-operation due to stray voltages and also to fulfill trip circuit supervision functionality for pre-trip & post-trip.

16.4 All IEDs shall have freely programmable optically isolated binary inputs (Minimum 16BI) and potential free binary output (Minimum 10 BO) contacts as per scheme configuration. These I/O points shall be used for wiring of status of devices (CB/Isolator/Earth switch) and equipment alarms etc.(list & Requirement)

16.5 Failure of a control supply and de-energization of a relay shall not initiate any circuit breaker operation.

16.6 Relays shall have event recording feature with Date &time stamping. Event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.
Relay shall have disturbance recorder.

16.7 All Numerical relays shall have features for electrical measurements of current.

16.8 Directional numerical relays shall have provision of both current (CT) and voltage (PT) inputs as required for protection & measurement purposes using protection cores.

16.9 All numerical relays shall have built-in key pad / keys to allow relay setting from relay front. Resetting of relay shall be possible from remote SCADA.

16.10 Relays shall have suitable output contact for circuit breaker failure protection (LBB: Local Breaker Backup) logic.

16.11 Relays shall have self diagnostic feature on display with continuous self check for power failure, program routines, memory and main CPU failures and a separate output contact for indication of any failure.

16.12 Contractor shall submit applicable Type Test reports for Numerical relays as per IEC including report for IEC 61850 protocol from accredited lab.

17 Control & Protection System

All numerical relays shall communicate to station SCADA / SAS on IEC-61850 communication protocol. It is envisaged that these protection IEDs shall be used for CB control & monitoring of bay equipments. The type test reports along with communication protocol shall be submitted as per relevant IS/IEC amended up to date.

18 Numerical Transformer Protection Relay

18.1 The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements. with standard inverse characteristics (1.3 and 3 Sec) IDMT.

18.2 The over current element should have the minimum setting adjustable between 20-200% of CT secondary rated current with increment/decrement by 1 % and high set setting 100-2000%.

18.3 The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current (IDMT) and high set 100-1000%.

18.4 The relay shall have selectable directional & non-directional feature.

18.5 For transformers of rating 5MVA and above, definite time delayed Stand by earth fault protection shall be provided having a pick up setting range of 10% to 40% with a timer delay of 0sec to 3 sec. in step of 0.01 s

18.6 The relay shall allow higher setting during transformer charging (inrush) and lower setting during normal operating condition.

18.7 Transformer troubles like Buchholz, Winding temperature, Oil temperature & Pressure Relief Device trips etc. (as applicable) shall be wired independently to separate binary inputs of the relay and shall be configured to issue trip command to the breaker. Similarly alarm points shall be wired separately to binary inputs of the relay.

18.8 Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

19 Numerical Line Protection Relay:

19.1 The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements. with standard inverse characteristics (1.3 and 3 Sec) IDMT.

19.2 The over current element should have the minimum setting adjustable between 20-200%(in step of 1%)of CT secondary rated current.

19.3 The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current.

19.4 The relay shall have selectable directional & non-directional feature

19.5 Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

20 Numerical Bus Coupler/Bus-Section Protection Relay:

20.1 The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements.

20.2 The over current element should have the minimum setting adjustable between 20-200%(in step of 1%) of CT secondary rated current.

20.3 The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current.

20.4 No bus volt signal shall be configured in the relay for use in control logics and other Protections and Control functions in the Relays.

20.5 Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

21 Other Control and Protections features:

21.1 Control of breakers, three position Isolators & Earth switches shall be carried out from the station HMI of SAS/SCADA system through the LAN and the numerical relays.

21.2 The station HMI shall have a graphical dynamic Plant Key Single Line Diagram to view the complete system status. This shall include the status of the switchgears, measurement values, operation counters, graphical alarm representation, etc. Spontaneous changes of a state, typically opening of a circuit breaker from a protection, shall have a specific colour code. All the Breakers with the status shall be clearly displayed along with values of currents, voltages, and frequency, active and reactive powers etc.

21.3 Schematics requiring auxiliary relays / timers for protection function shall be part of numerical relay. Timer functions shall be configurable for on & off delays as per requirement.

21.4 The numerical relay shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a Date & time stamping using the internal real time clock. Battery backup for real time clock in the event of power supply failure shall be provided.

21.5 At least 100 time tagged events / records shall be stored with date & time stamping. Details of at least 5 previous faults including the type of protection operated, operating time, all currents & voltages and time of fault.

21.6 Automatic testing, power on diagnostics with continuous monitoring shall be provided in the IED to ensure high degree of reliability. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be available on the user interface

21.7 The alarm/status of each individual protection function and trip operation including measurement values shall be communicated to the SAS/SCADA system.

21.8 Sequence of events shall have 1ms resolution at device level.

21.9 It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.

22 ETHERNET SWITCH:

22.1 Ethernet switches shall be 'substation hardened', and shall comply with IEC61850 for communications with IEDs. The Ethernet switches shall be of managed type with two (2) No. of Fiber optic cable ports and at least Sixteen (16) Copper ports to achieve the LAN configuration. More no. of switches or higher ports switch can also be supplied to meet all IEDs & Multi-function meters requirements for the LAN. The Ethernet switches shall have features to support the redundant rings. These switches shall be mounted in the switchgear Panels. The FO ports shall be Single-mode 1000 Mbps ports. Copper ports shall be 10/100Mbps ports.

22.2 Necessary software for configuration and real-time network monitoring shall be provided along with the Ethernet switches.

23 GENERAL REQUIREMENTS FOR ERECTION

23.1 Contractor shall move all equipment into the respective rooms through the regular door or openings specifically provided for this purpose. No parts of structure shall be utilized to lift or erect any equipment without prior permission of Engineer-in-charge.

23.2 Switchgear shall be installed on finished surfaces, concrete or steel sills. Contractor shall be required to install and align any channel sills which form part of foundations. Minor modifications to foundations shall be carried out by the Contractor. Contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments and relays are supplied loose along with switchgear, they shall be mounted only after the associated switchgear panels have been erected and aligned. The blocking materials, employed for safe transit of instrument and relays shall be removed after ensuring that panels have been completely installed and no further movement of the same would be necessary. Any damage shall be immediately reported to Engineer.

23.3 Contractor shall include all special tools required for regular operation & routine maintenance of switchgear.

24 CONTROL WIRING

24.1 All wiring shall be carried out with 1100 volts grade with ISI mark single core, multistrand flexible tinned copper wires with non flammable, fire resistant PVC insulation. The conductor size shall be 4 sq mm for CT's and 2.5sq mm (minimum) for other circuits. Wiring trough may be used for routing the cables. Wire numberings and colour code for wiring shall be as per IS:5578/1984. The wiring diagram for various schematics shall be made on thick and durable white paper in permanent black ink and same should be encased in plastic cover, thermally sealed. It should be kept visibly in a

pocket of size 350 x 400 mm of MS sheet of 1 mm thickness, on the interior surface of the door of C & R Panel.

24.2 All front mounted as well as Internally mounted items including MCBs shall be provided with individual identification labels. Labels shall be mounted directly below the respective equipment and shall clearly indicate the equipment designation.

24.3 Further it shall be ensured that any control wiring if at all routed through the H.T chamber is properly insulated and provided with metallic barriers to prevent damages due to heat.

25 Wiring and control wiring terminals:-

25.1 Terminal blocks shall be of clip-on design made out of non-trackable insulating material of 1100 V grade. All terminals shall be stud type, with all current carrying and live parts made of tinned plated brass. The studs shall be of min 4 mm dia. brass. The washers, nuts, etc. used for terminal connectors shall also be of tinned plated brass.

25.2 The terminal connector/blocks shall be disconnecting type terminal connectors with automatic shorting of C.T. secondary terminals shall be provided in CT secondary circuit. All other terminal connectors shall be Non- disconnecting type. Terminal should be shock protected in single moulded piece. Terminal block should have screw locking design to prevent loosening of conductor.

25.3 At least 20% spare terminals shall be provided. All terminals shall be provided with ferrules indelibly marked or numbered and identification shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity which shall not be less than 10 Amps for control circuit. For power circuit it shall not be less than 15 Amps.

25.4 All front mounted as well as internally mounted items shall be provided with individual identification labels. Labels shall be mounted directly below the respective equipment and shall clearly indicate the equipment designation. Labeling shall be on aluminum anodized plates of 1 mm thickness, letters are to be properly engraved.

25.5 All fuses used shall be of HRC type. The fuse base and carrier shall be plug-in type moulded case kitkat of backelite/DMC. All current carrying and live parts shall be of tinned/nickel plated copper. No fuse shall be provided on DC negatives and AC neutrals. Tinned copper links shall, however, be provided on DC negatives and AC neutrals and easily accessible for changes.

25.6 All MCBs as per IS:8828/1993 (amended upto date) of adequate rating shall be used.

26(A) BILL OF MATERIAL FOR 33kV / 11kV & 22/11 KV, 2 x 10 MVA Substation
The materials given below shall confirm the technical specifications of MSEDCL and relevant IS/IEC as per requirement of IPDS

Sr.No.	Equipment	Unit	33 KV, 22 KV 2 I/C+1B/C+ 2 O/G			11KV 2I/C+1B/S + 8 O/G			
			I/C (P)	B/C (P)	Power Trf (P)	I/C (P)	B/C (P)	O/G (P)	Station TR(P)
1	Circuit label	No.	2	1	2	2	1	8	1
2	CB, Three position Isolator & Earth Switch (3-Ph)	Set	2	1	2	2	1	8	1
3	Motor for spring charge	No.	2	1	2	2	1	8	1
4	Single phase current transformer	No.	6	3	6	6	3	24	3
5	Universal motor shall be provided with MCB	No.	2	1	2	2	1	8	1

6	Single phase PT having 2 cores secondary (Meter, protection, open delta) only in case of 11 KV incomer	No		6	-	-	6	-	-
7	Numerical 3 O/C +1 E/F protection relay on bus coupler with IEC 61850 communication protocol.	Set.	2	2	2	2	1	8	1
8a	Numerical directional relay	No	-	3	-	-	3	-	-
8b	Numerical diff protection relay with IEC 61850	No	-	-	2	-	-	-	-
10	HT static tri vector TOD energy Meter with RS 232 port suitable for AMR and SCADA a) IS 14697/1999 amended up-to-date b) Secure/L&T /Elster or equivalent	No.	2	-	2	2	-	8	1
12	CB Spring charge indicator	No.	2	1	2	2	1	8	1
13	ON/OFF indicators for CB	Set	2	1	2	2	1	8	1
14	ON/OFF Indicators for three position GIS Isolator & Earth Switch.	Set	2	2	2	-	-	1	1
15	ON/OFF indicators for AIS Line Isolator & Line Earth Switch	Set	-	-	2	2	1	-	-
16	Control Switches for Three position GIS /AIS Isolator & Earth switch (Electrical)	Set	2	2	2	2	1	1	1
17	DC healthy lamp (white)	Nos.	2	1	2	2	1	1	1
18	SF6 Gas Density indicator for each compartment (set)	Set	2	1	2	2	1	1	1
19	Mimic to represent SLD	Set	2	1	2	2	1	8	1
20	Control switch for circuit breaker.	No.	2	1	2	2	1	8	1
21	Local/Remote selector switch.	No.	2	1	2	2	1	8	1
22	Auto/Manual selector Switch.	No.	2	1	2	2	1	8	1

23	Indicating LED (Amber colour) for 'Trip Circuit Healthy'	No.	2	1	2	2	1	8	1
24	Push button for 'Trip circuit Healthy Test'	No.	2	1	2	2	1	8	1
25	Indicating LED (White colour) for 'spring charged'	No.	2	1	2	2	1	8	1
26	Indicating LED (Red colour) for C.B. 'ON"	No.	2	1	2	2	1	8	1
27	Indicating LED (Green colour) for C.B. 'OFF"	No.	2	1	2	2	1	8	1
28	Indicating LED for Auto Trip	No.	2	1	2	2	1	8	1
29	Capacitive Voltage Detection system (CVD)	No.	2	1	2	2	1	8	1
30	Annunciation System	No.	2	1	2	2	1	8	1
31	Alarm scheme consisting of alarm relay(s), indicating LED and Accept/Reset push button(s)	Set	2	1	2	2	1	8	1
32	Alarm bell	No.	-	1	2	-	1	-	-
33	Voltage selection Scheme consisting of auxiliary relays and PT-1/PT-2 fail indicating LEDs.-	Set	-	1	-		1	-	-
34	Space heater alongwith MCB	No.	2	1	2	2	1	8	1
35	Thermostat	No.	2	1	2	2	1	8	1
36	Toggle switch for Heater	No.	2	1	2	2	1	8	1
37	Cubicle illumination lamp alongwith door operated control switch.	Set	2	1	2	2	1	8	1
38	Power plug alongwith control switch.	Set	2	1	2	2	1	8	1
39	Wiring alongwith MCBs, terminal blocks and terminal connectors	Set	2	1	2	2	1	8	1
40	Three element Auxiliary tripping relay	Set	-	-	8		-	-	-
41	Annunciation scheme for Power Transformer(16 Window)	Set	-	-	2		-	-	-
42	LAN Switches and LAN/FO Cables	Set	As per Requirement						

43	Cable Termination Arrangement including cable and plugs	Set	As per Requirement
44	Battery set along with battery charger panel	Set	As per Requirement
45	SCADA Panel	Set	As per Requirement

1. I/C(P) : Panel for Incomer feeder
2. LT TR(P): Panel for LT Transformer feeder (Should be provided on 11 KV)
3. B/S (P): Panel for Bus Sectionalizer
4. Power Trf(P): Power Transformer HV IC/OG/Breaker
5. Numerical protection relay (IED) for all type of panels shall preferably be interchangeable to optimize mandatory spare.

26 (B) Scheme Configuration

a) For 33 and 22 KV GIS
1) 2 I/C+ 1 B/C+1 O/G
2) 2 I/C+ 1 B/C+ 2 O/G
b) For 11 KV GIS
1) 1 I/C+ 3 O/G
2) 1 I/C+ 4 O/G
3) 2 I/C+1B/C + 6 O/G
4) 2 I/C+ 1 B/C+ 8 O/G

C) For 11 KV AIS
1) 1 I/C + 3 O/G + 1 Stn Trf
2) 1 I/C + 4 O/G + 1 Stn Trf
3) 2 I/C + 1 B/C+ 6 O/G + 1 Stn Trf
4) 2 I/C + 1 B/C+ 8 O/G + 1 Stn Trf

27 SYSTEM PARAMETERS:

1	Nominal System voltage	33 KV, 22Kv	11 KV
2	Highest System voltage	36 KV, 24Kv	12 KV
3	Rated Frequency	50 Hz with ± 3% variation	50 Hz with ± 3% variation
4	Number of phases/ poles	Three	Three
5	System neutral earthing (As per requirement)	As per Vector Group of Transformers	As per Vector Group of Transformers
6	One minute power frequency withstand voltage	70	28
7	1.2/50 microsecond Impulse withstand Voltage	170 kV (peak)	75 kV (peak)
8	Short time rating for bus bars, CB, CT and switchgear Assembly.	25 kA (rms) for Three 3 Sec	25 kA (rms) for Three 3 Sec

9	Dynamic withstand rating	62.5 kA (peak)	62.5 kA (peak)
10	IAC Rating	25 KA ,1.0 sec	25 KA ,1.0 sec
11	Control supply voltage:		
a	Trip and closing coils	30 V DC with +10% to – 15% variation	30 V DC with +10% to – 15% variation
b	Spring charging motor	240 volts with ± 10% variation	240 volts with ± 10% variation
12	Maximum ambient air temperature	50 deg. C	50 deg. C
13	Degree of Protection		
a	GIS -live parts	IP65	IP65
b	AIS compartments	IP4X	IP4X

a) CIRCUIT BREAKER

1	Rated Voltage	33KV	11 KV
2	CB rated Current		
A	Incomer Breaker	1250 A	800 A
B	Outgoing feeder Breaker	1250 A	400 A
3	Short circuit breaker Current:		
A	A.C. component	25kA for 3 sec	25kA for 3 sec
B	D.C. component	As per IS:13118 or IEC62271	As per IS:13118 or IEC62271
4	Short Circuit making current	62.5kA(peak)	62.5 kA (peak)
5	Out of phase breaking Current capacity	As per IEC	As per IEC
6	Rated line/cable charging Interrupting current at 90° Leading power factor Angle	As per IEC	As per IEC
7	Maximum allowable switching voltage under any switching Condition	As per IEC	As per IEC
8	Rated small inductive current Switching capability with over Voltage less than 2.3Pu	As per IEC	As per IEC
9	First pole to clear factor	1.5	1.5
10	Operating Duty	O-0.3 Sec-CO-3 Min-CO	O-0.3 Sec-CO-3 Min-CO
11	Total break time	60-70ms	For incomer :50-60ms and for feeder:45-50ms
12	Total make time	Less than 80ms	40-60ms
13	Reclosing	3 phase auto reclosing	3 phase auto reclosing
14	Max. difference in the instants of closing/opening contact between poles at rated control Voltage and rated operating and quenching media pressures	As per IEC	As per IEC
15	Auxiliary contacts	8NO+6NC for Future use besides scheme requirement	8NO+6NC for Future use besides scheme requirement

16	Operating Mechanism	Motor wound Spring charged stored energy type as per IEC-62271	Motor wound Spring charged stored energy type as per IEC-62271

b) CURRENT TRANSFORMER (Incomer, Bus coupler and Feeder)

1	Rated primary voltage	33 KV,22 KV	11KV
2	Rated primary current	800 A	800 A
3	Type of CT	1-Phase	1-Phase
4	Max temp rise	As per IEC:60044-1	As per IEC:60044-1
5	Class of Insulation	Class E or better	Class E or better
6	One minute power frequency withstand voltage between secondary terminal & Earth	3 kv	3 kV
7	No. of Secondary cores	3	3

c) CURRENT TRANSFORMER (Line Feeder)

1	Rated primary voltage		11KV
2	Rated primary current		400 A
3	Max temp rise		As per IEC:60044-1
4	Class of Insulation		Class E or better
5	One minute power frequency withstand voltage between secondary terminal & Earth		3 kV
6	No. of Secondary cores		2

d) CURRENT TRANSFORMER (Transformer Feeder)

1	Rated primary voltage	22 KV	11KV
2	Rated primary current	100-50/5-5 A	100-50/5-5 A
3	Max temp rise	As per IEC:60044-1	As per IEC:60044-1
4	Class of Insulation	Class E or better	Class E or better
5	Class of Accuracy	0.5 s	0.5s
6	Rated output Burden (Min)	15 VA/5VA for GIS	15 VA/5VA for GIS
7	One minute power frequency withstand voltage between secondary terminal & Earth	3 kV	3 kV
8	No. of Secondary cores	2	2

e) VOLTAGE TRANSFORMERS

1	Rated primary voltage	33 KV,22 KV	11KV
2	Type	1-phase	1-phase
3	Voltage ratio (kV)	(33 KV,22 KV /√3)/(0.11/√3)	(11/√3)/(0.11/√3)
4	Rated voltage factor	1.2 continuous and1.5 for 30 seconds	1.2 continuous and1.5 for 30 seconds
5	Nos. of Secondary cores	2	2
6	Accuracy of Secondary core	0.5	0.5
7	Class of insulation	Class E or better	Class E or better
8	Rated output burden (Minimum) or to cater all connected burdens of meters & relays.	50 VA or cater to connected burden as per clause no.11.4	50VA or cater to connected burden as per clause no.11.4

f) Bus-Bar Rating

1	Current rating of Bus bars	1250 A	800A
2	Current rating of Bus Coupler	1250 A	800A

REQUIREMENT FOR 33KV , 22 KV CURRENT RATIO FOR
INCOMER , BUS COUPLER,LINE FEEDER AND TRANSFORMERFEEDER

A. INCOMER AND BUS COUPLER

		Metering	**O.C and E/F Protection**	**Differential Protection**
1	Current ratio	800-400/5 A	800-400/5A	800-400/1 A
2	Accuracy class	0.5S class	5P10	PS
3	Knee point voltage (at minimum ratio)	-	-	300V,Imax <100mA
4	Rated burden	10 VA(or to cater connected burden of relays & meters as per clause no.11.4)	10VA(or cater all connected burdens)	-

CT ISF Value should be < 5 for metering

B. LINE FEEDER

		Metering	O/C and E/F Protection
1	Current Ratio	400-200/5A	400-200/5 A
2	Accuracy Class	0.5s	5P 10
3	Knee point voltage (at minimum ratio	-	-
4	Rated burden	10 VA(or to cater connected burden of relays & meters as per clause no.11.4)	10 VA(or cater all connected burdens)

C. TRANSFORMER FEEDER

		Metering	O/C and E/F Protection
1	Current Ratio	100-50/5A	100-50/5 A
2	Accuracy Class	0.5s	5P10
3	Knee point voltage (at minimum ratio	-	-
4	Rated burden	10 VA (or to cater connected burden of relays & meters as per clause no.11.4)	10VA(or cater all connected burdens)

Notes: The ratings indicated for instrument transformers are tentative only and may be changed to meet the functional requirements.

REQUIREMENT FOR 11KV CURRENT TRANSFORMERS
INCOMER , BUS COUPLER,LINE FEEDER , TRANSFORMER FEEDER

A. INCOMER and BUS COUPLER

		Metering	O/C and E/F Protection	
1	Current Ratio	800-400/5 A	800-400/5 A	
2	Accuracy Class	0.5S	5P10	
3	Knee point voltage (at minimum ratio	-	-	
4	Rated burden	10 VA (or to cater connected burden of relays & meters)	10VA (or cater all connected burdens)	-

B.LINE FEEDER:

		Metering	O/C and E/F Protection
1	Current Ratio	400-200/5A	400-200/5A
2	Accuracy Class	0.5s	5P10
3	Knee point voltage (at minimum ratio	-	-
4	Rated burden	10 VA(or to cater connected burden of relays & meters)	10VA(or cater all connected burdens)

B. TRANSFORMER FEEDER

		Metering	O/C and E/F Protection
1	Current Ratio	100-50/5 A	100-50/5A
2	Accuracy Class	0.5s	5P10
3	Knee point voltage (at minimum ratio	-	-
4	Rated burden	10 VA(or to cater connected burden of relays & meters)	10VA (or cater all connected burdens)

Notes: The ratings indicated for instrument transformers are tentative only and may be changed to meet the functional requirements

28) INPUT SIGNAL TO SAS (Statistical Analysis System) SYSTEM

The following digital input of 33kV & 11kV Indoor switchgear bays shall be provided through IEDs in the SAS system:

i) Status of CB, Isolator, Earth switch
ii) CB trouble
iii) CB operation/closing lockout
iv) Trip circuit faulty
v) Bus VT FUSE Fail
vi) Back-up over current & earth fault protection Operated
vii) DC source fail

29) Scheme features:

1. Trip circuit supervision scheme shall be provided for each circuit breaker.
2 When two or more incomers are required at one station, suitable voltage selection scheme to select the correct PT supply will be essential . Voltage selection scheme offered shall be suitable to select (automatically) the PT supply as follows

a. Both incomers 'ON' and both PTs healthy- PT supply from respective incomer shall feed all circuits in that section.

b. Both incomers 'ON' and one PT fails : PT supply shall change over, provided the bus-section breaker is closed.

c. One incomer out, P.T. supply shall change over, provided the bus-section breaker is closed.

d. PT supply to all the panels including the incomer shall be routed through the voltage selection scheme. When one of the PTs fails, the same shall be indicated automatically by the respective PT fail indicating LED. All necessary relays/contacts for above schemes shall be accommodated in empty chamber of adopter panel inside front door.

30) Annunciator

Annunciator facia units shall have translucent plastic windows for each alarm point.

Annunciator facia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective facia LED is glow.

Annunciator facia units shall be suitable for flush mounting on panels. Replacement of individual facia inscription plate and LED shall be possible from front of the panel.

Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, coloured red, yellow and blue respectively.

Special precaution shall be taken by the supplier to ensure that spurious alarm conditions do not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighboring circuits within the panels.

In case 'RESET' push button is pressed before abnormality is cleared, the LEDs shall continue to glow steady and shall go out only when normal condition is restored.

Any new annunciation appearing after the operation of 'Accept' for previous annunciation, shall provide a fresh audible alarm with accompanied visual, even if the process of "acknowledging" or "resetting" of previous alarm is going on or is yet to be carried out.

Provision for testing healthiness of visual and audible alarm circuits of annunciator shall be available.

Mounting	Flush
No. of facia windows	8
No. of windows per row	4
Supply voltage	30 V DC

No. of LEDs per window	2
Lettering on facia plate	Properly engraved

12 Window Annunciation Scheme to indicate following functions for Incomer 1, Incomer 2 and Bus coupler

1	Main protection (O/C) Trip for incomer 1	1 no.
2	Main protection (E/F) Trip for incomer 1	1 no.
3	Main protection (O/C) Trip for incomer 2	1 no.
4	Main protection (E/F) Trip for incomer 2	1 no.
5	Main protection (O/C) Trip for Bus coupler	1 no.
6	Main protection (E/F) Trip for Bus coupler	1 no.
7	Spare (low gas pressure)	1no.
8	Spare(Fault passage Indicator)	1no
9	Spare	1no.
10	Spare	1no.
11	Spare	1no.
12	Spare	1no.

20 Window Annunciation Scheme to indicate following functions for Power Transformer

1	Protection (O/C) Trip	1 no.
2	Protection (E/F) Trip	1 no.
3	Spare (low gas pressure)	1 no.
4	Spare (Fault passage Indicator)	1 no.
5	Transformer Differential Relay Trip	1 no
6	Transformer Buchholz Relay	1 no
7	Transformer Buchholz Relay Trip	1 no
8	Transformer WTI Trip	1 no
9	Transformer WTI Alarm	1 no.

10	Transformer OTI Alarm	1 no.
11	Transformer OTI Trip	1 no.
12	Transformer PRV Trip	1 no.
13	OLTC Buchholz Relay Trip	1 no.
14	Transformer MOG Alarm	1 no.
15	Spare	1 no.
16	Spare	1 no.
17	Spare	1 no.
18	Spare	1 no.
19	Spare	1 no.
20	Spare	1 no.

12 Window Annunciation Scheme to indicate following functions for Outgoing Feeder 1,2,3 & 4		
1	Main protection (O/C) Trip for feeder 1.	1 no.
2	Main protection (E/F) Trip for feeder 1.	1 no.
3	Main protection (O/C) Trip for feeder 2.	1 no.
4	Main protection (E/F) Trip for feeder 2.	1 no.
5	Main protection (O/C) Trip for feeder 3.	1 no.
6	Main protection (E/F) Trip for feeder 3.	1 no.
7	Main protection (O/C) Trip for feeder 4.	1 no.
8	Main protection (E/F) Trip for feeder 4.	1 no.
9	Spare	1 no.
10	Spare	1 no.
11	Spare	1 no.
12	Spare	1 no.

12 Window Annunciation Scheme to indicate following functions for Outgoing Feeder 5,6,7 & 8		
1	Main protection (O/C) Trip for feeder 5.	1 no.
2	Main protection (E/F) Trip for feeder 5.	1 no.
3	Main protection (O/C) Trip for feeder 6.	1 no.
4	Main protection (E/F) Trip for feeder 6.	1 no.
5	Main protection (O/C) Trip for feeder 7.	1 no.

6	Main protection (E/F) Trip for feeder 7.	1 no.
7	Main protection (O/C) Trip for feeder 8	1 no.
8	Main protection (E/F) Trip for feeder 8.	1 no.
9	Spare	1 no.
10	Spare	1 no.
11	Spare	1 no.
12	Spare	1 no.

31 Type TESTS

The panel shall be fully type tested as per relevant latest IEC standards 60056,62271-102,60265,62271-200,62271-105,60529 and 60694 following type test reports shall be submitted with the technical bid. These tests must have been conducted on the offered item in the NABL approved laboratory within last seven years prior to date of validity of the offer.

LIST OF TYPE TESTS

Sr. No	Name of Test
A	**Switchgear Panel(With Circuit Breaker installed)**
a)	Short Circuit Duty test
b)	Short time and peak withstand current test
c)	Power frequency withstand test
d)	Lightening impulse withstand test
e)	Temperature rise test
f)	Internal Arc test as per IEC 62271-2009for 1 second)
g)	Measurement of resistance main circuit
h)	Test to verify pressure relief operation of the panel (During internal arc test)
i)	Cable charging test
j)	Short circuit withstand test of earthing device
k)	Dielectric test
l)	Capacitor bank current switching test
m)	Single phase making and breaking test
B	**Circuit Breaker**
a)	Mechanical Endurance Test

C	**Current Transformer**
a)	Short time current test
b)	Temperature Rise test
c)	Lightning impulse withstand test
D	**Potential Transformer**
a)	Temperature Rise test
b)	Lightning impulse withstand test
E	**Switchgear panel Degree of protection**
a)	IP 4X test for LV and IP 65 for HV live Part.
F	**Trivector Meter** The Trivector meter shall conform all the requirements and type test reports as per relevant IS/IEC amended upto date and as per technical specifications of MSEDCL.
G	**Protection Relays** The Protection Relays shall conform all the requirements and type test reports as per relevant IS/IEC amended upto date.

31.1 All the equipment's offered shall be fully type tested as per the relevant standards, amended up-to-date. The supplier shall furnish the type test reports and certificate of accreditation issued by the testing authority along with the offer. These tests must not have been conducted earlier than seven years from the date of opening of bids.

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

31.3 The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of his representative. For this purpose the supplier may quote unit rates for carrying out each type test.

31.4 For any change in the design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of tests without any extra cost before commencement of supply. In this case the bidder shall bring out in his offer all such changes made in components, materials, design etc. as the case may be.

31.5 The company shall have the option to carry out various tests including type tests as per specification on the samples selected at random from the supplies effected, to ensure that the supplies conform in quality and workmanship to the relevant specification. The testing shall be done at an independent laboratory at company's cost. Due notice shall be given to supplier for such sample selection and such testing thereof to enable him to be present for the same if so desired by him. If the supplier or his authorized representative fails to attend the sample selection and testing, the same shall be carried out unilaterally by the company and the result thereof shall be binding upon the

supplier. In case the sample selected from the supplies fails to withstand the required tests, then:-

a. For first time failure of sample, supplier shall have to replace the full quantity of the respective inspected lot supplied to various Stores and lying unused at Stores.

b. For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.

AND

c. In respect of further supplies made against the order, if failure of samples is noticed (i.e., second time failure against the order) then the quantity lying unused at various Stores shall be rejected.

d. For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.

e. Balance quantity against the order including the rejected qty. shall be cancelled without any liability on either side.

f. The firm will be debarred from dealing with the company upto a period of three years from the date of rejection.

32 Installation/Commissioning Checks / Tests

The installation/commissioning of the 33 kV GIS are to be supervised by original manufacturer, providing the manufacturer's specialist for the above shall be supply contractors responsibility and in accordance with contract specification, scope of supply and price schedule.

After installation of panels, power and Control wiring and connections, Contractor shall perform commissioning checks as listed below to verify proper operation of switchgear / panels and correctness of all equipment in all respects. In addition, the Contractor shall carry out all other checks and tests recommended by the manufacturers.

32.1 General

a. Check name plate details according to specification.

b. Check for physical damage

c. Check tightness of all bolts, clamps and connecting terminal

d. Check earth connections

e. Check cleanliness of equipment

f. Check heaters are provided

g. H.V. test on complete switchboard with CT & breaker in position.

h. Check all moving parts are properly lubricated.

i. Check for alignment of busbars

j. Check continuity and IR value of space heater.

k. Check earth continuity for the complete switchgear board.

32.2 Circuit Breaker

a. Check alignment

b. Check correct operation

c. Check control wiring for correctness of connections, continuity and IR values.

d. Manual operation of breakers completely assembled.

e. Power closing / opening operation, manually and electrically

f. Closing and tripping time.

g. Trip free and anti-pumping operation.

h. IR values, resistance and minimum pick up voltage of coils.

i. Simultaneous closing of all the three phases.

j. Check electrical and mechanical interlocks provided.

k. Checks on spring charging motor, correct operation of limit switches and time of charging

l. All functional checks.

32.3 Current Transformers

a. I R test between windings and winding terminals to body.

b. Polarity tests.

c. Ratio identification checking of all ratios on all cores by primary injection of current.

d. Magnetization characteristics & secondary winding resistance.

e. Spare CT cores, if any to be shorted and earthed.

32.4 Voltage Transformers

a. Insulation resistance test.

b. Ratio test on all cores.

c. Polarity test.

b. Line connections as per connection diagram.

32.5 Cubicle Wiring

a. Check all switch operations

b. It should be made sure that the wiring is as per relevant drawings. All interconnections between panels shall similarly be checked.

c. All the wires shall be IR Tested to earth.

d. Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component / equipment.

e. Check terminations and connections.

f. Wire ducting.

g. Gap sealing and cable bunching for vermin proof.

32.6 Relays

a. Check internal wiring.

b. IR of all terminal body.

c. IR of AC to DC terminals

d. Check operating characteristics by secondary injection.

e. Check operation of electrical/ mechanical targets.

f. Relay settings.

33 INSPECTION

a. The inspection may be carried out by the purchaser at any stage of manufacture. The successful Tenderer shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

b. The supplier shall keep the purchaser informed in advance, about the manufacturing program so that arrangement can be made for stage inspection.

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

34. FACTORY ACCEPTANCE & ROUTINE TESTS:

34.1 All acceptance and routine tests of equipment given in bill of material as per relevant IS/IEC standards shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser.(Note:- All measuring/testing equipment's shall be of appropriate class of accuracy and shall have valid calibration certificates which shall be produced to the Inspecting Officer for verification.)

34.2 After finalization of the program of type/acceptance/routine testing, the supplier shall give three weeks advance intimation to the purchaser, to enable him to depute his representatives for witnessing the tests.

34.3 The following Factory Acceptance Tests shall be carried out during inspection

1. Withstand Voltage at power frequency
2. Measurement of resistance of main circuit
3. Partial discharge test
4. Withstand voltage on the auxiliary circuits
5. Operational checks as per schematics
6. Operations of interlocks, signaling devices and auxiliary devices
7. Operation of VCB and three position Disconnector cum earth switch
8. Verification of wiring
9. Visual inspection

35. QUALITY ASSURANCE PLAN

35.1 The tenderer shall invariably furnish information along with his offer, failing which his offer shall be liable for rejection. Information shall be separately given for individual type and current rating of circuit breaker/CTs/PTs/Panel mounting & accessories.

35.2 Statement giving information about names of sub-suppliers, list of testing standards, list of tests normally carried out in presence of tenderer's representative and copies of test certificates in respect of following items of raw-materials.

a. Contact material
b. Porcelain

35.3 Information and copies of test certificates in respect of bought out accessories.

35.4 List of areas in manufacturing process, where joint stage inspections are normally carried out by the tenderer/purchaser for quality control and details of such tests and inspections.

35.5 Special features provided in the equipment to make it maintenance free.

35.6 List of testing equipment's available with the tenderer for final testing of breakers vis-à-vis. the type, special, acceptance and routine tests specified herein. The limitations in testing facilities shall be very clearly brought out in schedule-E i.e. schedule of deviation from specified test requirement.

The successful tenderer shall, within 30 days of placement of order, submit following information to the purchaser.

List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with the offer.

a. Type test certificates of the raw material and bought out accessories.
b. Quality assurance plan (QAP) with hold points for purchaser's inspection.

The quality assurance plan and purchaser's hold points shall be discussed between the purchaser and supplier, before it is finalized.

The successful tenderer shall submit the routine test certificates of bought out accessories at the time of routine testing of the fully assembled breaker for the goods manufactured within purchaser's country. The supplier shall also submit the central excise passes for the raw material at the time of routine testing of the fully assembled breaker.

36) PERFORMANCE GUARANTEE:

The equipment's offered shall be guaranteed for satisfactory performance for a period of 66 months from the date of receipt of complete equipment at destination store/site in good condition or 60 months from the date of satisfactory commissioning of equipment whichever is earlier. The equipment's found defective/failed within the above guarantee period shall be replaced/repaired by the supplier free of cost within one month of receipt of intimation. If the defective/failed equipment's are not replaced/repaired as per the above guarantee clause, the company shall recover an equivalent amount plus 15 % supervision charges from any of the supplier's bills.

37) DOCUMENTATION:

All drawings shall conform to international standards organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in System International Units.

38) DRAWINGS:

38.1 The tenderer shall furnish four sets of relevant descriptive and illustrative published literature/pamphlets and the following drawings for preliminary study:

a. General outline drawings showing outside dimensions, shipping dimensions, weights, and quantity of insulating media air receiver capacity and such other prominent details.

b. Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance.

c. Schematic diagrams of the scheme for control, supervision and reclosing.

d. Structural drawing, design calculations and loading data for support structures.

e. Foundation drilling plan and loading data for foundation design.

f. Technical specifications of equipment and special tools explaining construction features, principle of operation, special features etc.

g. Comprehensive QAP,GA,SLD/BOQ ,Gas schematic diagram, technical broachers, building requirements, earth mat design, list of recommended spares, special tools or fixtures, O&M manuals, environmental guide for handling SF^ gas & decommissioning, estimated time schedule for installation & commissioning & operation of complete GIS

h. Type test reports of circuit breakers along with a separate list showing all the tests carried out with date & place of test.

i. Test reports, literatures and pamphlets of bought out items and raw materials.

38.2 The successful tenderer shall, within 6 weeks of placement of order, submit THREE sets of final versions of all the above said drawings in A-3 size, bill of material, packing list & all type test reports for purchaser's approval to the office of Chief Engineer (MM Cell). The purchaser shall communicate his comments/approval on the drawings to the supplier within reasonable period. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for purchaser's approval within two weeks from the date of purchaser's comments. After receipt of purchaser's approval, the supplier shall, within three weeks, submit 10 prints &two good quality reproducible of the approved drawings and 10 sets of instructions manuals in respect of Circuit breaker to the office of Chief Engineer (MM Cell).

38.3 The successful tenderer shall furnish in the form of nicely bound volumes, the manuals covering erection, commissioning, operation and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices. Marked erection drawings shall identify the component parts of the equipment as shipped to enable Engineer/Purchaser to carry out erection with his own personnel. Each manual shall also contain one set of all the approved drawings type test reports as well as acceptance test reports to corresponding consignment dispatched. The total quantity of the operating manuals/approved drawings sets to be supplied by the supplier shall be equal to the number of three phase breakers of rating, ordered.

38.4 The manufacturing of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the supplier's risk.

38.5 Approval of drawings/work by the purchaser shall not relieve the supplier of any of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revisions of applicable standards, rules and codes of practices.

39. PACKING AND FORWARDING:

39.1 The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper lifting arrangement such as lifting hooks

etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

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

a. Name of the consignee.

b. Details of consignment.

c. Destination.

d. Total weight of consignment.

e. Sign showing upper/lower side of the crate.

f. Handling and unpacking instructions.

g. Bill of materials indicating contents of each package and spare materials

The supplier shall ensure that the packing list and bill of materials are approved by the purchaser before dispatch.

40) SUPERVISORY ERECTION AND COMMISSIONING;

The erection and commissioning of the breakers shall be supervised, if required by the Purchaser, through one work-trained Engineer/foreman who shall direct the sequence of erection and make necessary adjustments to the apparatus and correct in the field any errors or omissions on the part of the tenderer in order to make the equipment and material properly perform in accordance with the intent of this specification. The representative shall also instruct the plant operators in the operation and maintenance of equipment furnished. Skilled workers, all the ordinary tools, equipment and cranes required for breaker erection, shall be provided by the purchaser. Apart from the above, the purchaser shall not be responsible for any other expenses incurred by the tenderer and expenses such as Erector's salary, insurance against personal injuries to the Erector etc., shall be to tenderer's account. Special tools, if required for erection and commissioning shall be arranged by the supplier at his cost. The supplier shall be responsible for any damage to the breaker on commissioning, if it results from faulty or improper assembly unless the erector can conclusively prove that the damage has occurred on account of intentional mistake on the part of the skilled workers provided by the purchaser.

41) Training to the MSEDCL staff

Onsite training as well as factory training should be provided by the manufacturer/supplier to the operating staff of field and testing Engineers at free of cost.

If any miscellaneous accessories required for commissioning at site, no additional cost will be paid.

BIDDING SCHEDULE (To be filled in and signed by the Bidder)

SCHEDULE 'A'

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR GAS INSULATED SWITCHGEAR.

Sr No	Particulars	To be Filled by BIDDER
1	**General:**	
`i	Name of manufacturer	
ii	Factory address	
iii	GIS	
iv	Type /Model	
v	Indoor Installation	
vi	Standards applicable	
vii	Voltage level 33kv/11kv	
2	**Configuration:**	
i	Number of 33kv/22 kV Incomer bays	
ii	Number of 33kv/ 22 kV Bus coupler	
iii	Number of transformer bays	
iv	Number of 11 kv Incomer bays	
v	Number of 11 kv Bus coupler	
vi	Number of 11 kv Feeder bay	
vii	Number of Current transformer	
viii	Number of Potential transformer	
ix	Future extension possibility	
3	**System particulars:**	
i	Nominal system voltage	
ii	Corresponding highest system voltage	
iii	Frequency	
iv	Number of phases	
v	Neutral earthling	
vi	Short Current Rating	
4	**Auxiliary supplies:**	
i	A. C. Supply	
ii	D.C. Supply	
5	**Service conditions:**	
i	Max. ambiant température in Deg. C	
ii	Min ambiant température in Deg. C	
iii	Max daily average ambient temperature in Deg. C	
iv	Min yearly average ambient temperature in Deg. C	
v	Max. relative humidity in %	
vi	Max. annual rainfall in MM	
vii	Max. wind pressure in kg/sq. m.	
viii	Max. altitude above mean sea level in mtrs.	
ix	Isoceraunic level	
x	Seismic level (Horizontal acceleration)	
6	**GIS SWITCHGEAR PANEL:**	
i	Material used for SF6 gas insulated metal enclosed switchgear	
ii	Size of Material	
iii	Minimum operating SF6 gas pressure in Bar	
iv	Alarm and trip pressure of SF6 in Bar	
v	Maximum leakage rate of SF6 gas per year in %	

vi	SF6 accommodating the primary switching devices (Busbar, VCB and Three position disconnector cum earthing switch) and all live parts.	
vii	Ingress protection min	
viii	Non-Return Valve shall be provided for SF6 gas filling at site	
ix	Height of switchgear panel in MM	
x	Powder coated with thickness in micron	
xi	Paint shade of Indoor Switchgear	
xii	Short time current rating	
7	**Busbar:**	
A)	**33 KV /22KV busbars:**	
i	Continuous current rating of busbar in Amps	
ii	Short time current rating of busbar in KA	
iii	Material of busbar	
iv	Size of busbars	
v	Cross sectional area of busbars in sq.mm	
vi	Current density of busbar in Amps/sq. mm	
vii	Space between busbar in mm	
viii	Silicon coating if busbar is placed outside the gas chambers	
ix	Support insulator Kv rating	
x	Material of support insulator and Creepage distance	
xi	Cantilever strength of support insulator in KgF	
B)	**11Kv busbars :**	
i	Continuous current rating of busbar in Amps	
ii	Short time current rating of busbar in KA	
iii	Material of busbar	
iv	Size of busbars	
v	Cross sectional area of busbars in sq.mm	
vi	Current density of busbar in Amps/sq. mm	
vii	Space between busbar in mm	
viii	Silicon coating if busbar is placed outside the gas chambers	
ix	Support insulator Kv rating	

x	Material of support insulator and Creepage distance	
xi	Cantilever strength of support insulator in KgF	
8	**Circuit Breaker :**	
A)	**33 KV/22KV Circuit Breaker:**	
i	Make of Vacuum Circuit Breaker	
ii	Make of Vacuum Interrupter	
iii	Rated voltage of Circuit Breaker	
iv	Maximum continuous voltage of Circuit Breaker	
v	Rated Continuous current of Circuit Breaker	
vi	Total break time	
vii	Total make time	
viii	Rated Symmetrical Short Circuit Breaking Current of Circuit Breaker for 3 seconds	
ix	Rated Operating Sequence of Circuit Breaker	
x	First pole to clear factor of Circuit Breaker	
xi	Peak Voltage of transient recovery voltage of Circuit Breaker	
xii	Rated Symmetrical Short Circuit Making Current of Circuit Breaker	
xiii	Power frequency withstand voltage for 1 min of Circuit Breaker	
xiv	Impulse withstand voltage of Circuit Breaker	
xv	Type of closing mechanism	
xvi	Voltage rating and Burden of spring released coil	
xvii	Voltage rating and watts of spring charging motor	
xviii	Voltage rating and Burden of tripping coil used in Circuit Breaker	
B)	**11 Kv Circuit Breaker:**	
i	Make of Vacuum Circuit Breaker	
ii	Make of Vacuum Interrupter	
iii	Rated voltage of Circuit Breaker	
iv	Maximum continuous voltage of Circuit Breaker	
v	Rated Continuous current of Circuit Breaker	
vi	Total break time	
vii	Total make time	

viii	Rated Symmetrical Short Circuit Breaking Current of Circuit Breaker for 3 seconds	
ix	Rated Operating Sequence of Circuit Breaker	
x	First pole to clear factor of Circuit Breaker	
xi	Peak Voltage of transient recovery voltage of Circuit Breaker	
xii	Rated Symmetrical Short Circuit Making Current of Circuit Breaker	
xiii	Power frequency withstand voltage for 1 min of Circuit Breaker	
xiv	Impulse withstand voltage of Circuit Breaker	
xv	Type of closing mechanism	
xvi	Voltage rating and Burden of spring released coil	
xvii	Voltage rating and watts of spring charging motor	
xviii	Voltage rating and Burden of tripping coil used in Circuit Breaker	
xix	For AIS Switchgear Circuit Breaker shall be horizontal draw out	
9	**CURRENT TRANSFORMERS:**	
A	**Current Transformer for 33kv /22 KV incomer/ bus coupler panel:**	
i	Make of Current Transformer	
ii	Type of Current Transformer	
iii	Designation of Current Transformer.	
iv	Rated Insulation level of Current Transformer	
v	Current Transformer Ratio	
vi	VA Burden of core 1 of Current Transformer in VA	
vii	VA Burden of core 2 of Current Transformer in VA	
viii	Accuracy class for core 1	
ix	Accuracy class for core 2	
x	Limitation of exciting current of Current Transformer	
xi	Material use for primary/secondary winding of Current Transformer	
xii	Cross section of primary winding of Current Transformer	

xiii	Size of primary winding of Current Transformer	
xiv	Cross section of secondary winding of Current Transformer	
xv	Size of secondary winding of Current Transformer	
xvi	Short Time Current rating of Current Transformer	
xvii	I. S. F. at lower ratio of Current Transformer	
xviii	Type of Insulation Housing of Current Transformer	
B	**Current Transformer for 11 kv incomer/ bus coupler panel:**	
i	Make of Current Transformer	
ii	Type of Current Transformer	
iii	Designation of Current Transformer.	
iv	Rated Insulation level of Current Transformer	
v	Current Transformer Ratio	
vi	VA Burden of core 1 of Current Transformer in VA	
vii	VA Burden of core 2 of Current Transformer in VA	
viii	Accuracy class for core 1	
ix	Accuracy class for core 2	
x	Limitation of exciting current of Current Transformer	
xi	Material use for primary/secondary winding of Current Transformer	
xii	Cross section of primary winding of Current Transformer	
xiii	Size of primary winding of Current Transformer	
xiv	Cross section of secondary winding of Current Transformer	
xv	Size of secondary winding of Current Transformer	
xvi	Short Time Current rating of Current Transformer	
xvii	I. S. F. at lower ratio of Current Transformer	
xviii	Type of Insulation Housing of Current Transformer	

C	**Current Transformer for 11 kv Line Feeder panel:**	
i	Make of Current Transformer	
ii	Type of Current Transformer	
iii	Designation of Current Transformer.	
iv	Rated Insulation level of Current Transformer	
v	Current Transformer Ratio	
vi	VA Burden of core 1 of Current Transformer in VA	
vii	VA Burden of core 2 of Current Transformer in VA	
viii	Accuracy class for core 1	
ix	Accuracy class for core 2	
x	Limitation of exciting current of Current Transformer	
xi	Material use for primary/secondary winding of Current Transformer	
xii	Cross section of primary winding of Current Transformer	
xiii	Size of primary winding of Current Transformer	
xiv	Cross section of secondary winding of Current Transformer	
xv	Size of secondary winding of Current Transformer	
xvi	Short Time Current rating of Current Transformer	
xvii	I. S. F. at lower ratio of Current Transformer	
xviii	Type of Insulation Housing of Current Transformer	
D	Current Transformer for 33KV/22KV Transformer panel:	
i	Make of Current Transformer	
ii	Type of Current Transformer	
iii	Designation of Current Transformer.	
iv	Rated Insulation level of Current Transformer	
v	Current Transformer Ratio	
vi	VA Burden of core 1 of Current Transformer in VA	
vii	VA Burden of core 2 of Current Transformer in VA	
viii	Accuracy class for core 1	
ix	Accuracy class for core 2	
x	Limitation of exciting current of Current Transformer	
xi	Material use for primary/secondary winding of Current Transformer	
xii	Cross section of primary winding of Current Transformer	

xiii	Size of primary winding of Current Transformer	
xiv	Cross section of secondary winding of Current Transformer	
xv	Size of secondary winding of Current Transformer	
xvi	Short Time Current rating of Current Transformer	
xvii	I. S. F. at lower ratio of Current Transformer	
xviii	Type of Insulation Housing of Current Transformer	
10	**Potential Transformer:**	
A	Potential Transformer for 33kv /22k/11KV level :	
i	Make of Potential Transformer	
ii	Type of Potential Transformer	
iii	Designation of Potential Transformer	
iv	Rated insulation level of Potential Transformer	
v	Is offered Potential Transformer single phase units? (Yes/No)	
vi	Voltage Ratio of Potential Transformer	
vii	Nos. of Secondary cores of Potential Transformer	
viii	VA Burden of Core I of Potential Transformer in VA	
ix	VA Burden of Core 2 of Potential Transformer in VA	
x	Accuracy class of Core 1 of Potential Transformer	
xi	Accuracy class of Core 2 of Potential Transformer	
xii	Winding connection of Potential Transformer shall	
xiii	Rated Voltage factor and time of Potential Transformer	
xiv	Type of insulation housing of Potential Transformer	
xv	Whether HT fuses provided for Potential Transformer. (Yes/No)	
xvi	Material used for primary/secondary winding of Potential Transformer	
xvii	Cross section of primary winding of Potential Transformer	
xviii	Size of primary winding of Potential Transformer	

xix	Cross section of secondary winding of Potential Transformer	
xx	Size of secondary winding of Potential Transformer	
11	**DISCONNECTORS**	
i	Applicable standards	
ii	Type	
iii	Rated current in Amp for	
iv	- Bus disconnector	
v	- Line disconnector	
vi	- Transformer disconnector	
vii	- PT disconnector	
viii	Maximum Current that can be safely interrupted by the Isolator (Amp).	
ix	- Inductive	
x	- Capacitive	
xi	Rated Short time withstand Current in kA, for 3 sec	
xii	Rated peak short time Current, kAp	
xiii	Rated bus charging current, in Amp	
xiv	Type of contacts	
xv	Material of contacts	
xvi	Current Density at minimum cross section (A/mm^2)	
xvii	Rated lightning impulse withstand voltage across the open gap, kVp	
xviii	Rated Power Freq withstand voltage across the open gap, kVrms	
xix	Mechanical Endurance class	
xx	Type of Operating Mechanism	
xxi	Operating Motor details	
xxii	- Type	
xxiii	- Rated Voltage	
xxiv	- Rated Current	
xxv	- Rated Watts	

xxvi	Operating Time	
xxvii	- Closing - Opening	
xviii	Mechanical indication on drive shaft	
12	**Maintenance Grounding Switch**	
i	Applicable standards	
ii	Type	
iii	Rate Short time withstand Current in kA, for 3 sec	
iv	Rated peak short time Current, kAp	
v	Rated lightning impulse withstand voltage across the open gap, kVp	
vi	Rated Power Freq withstand voltage across the open gap, kVrms	
vii	Type of Operating Mechanism	
viii	Operating Motor details	
ix	- Type	
x	- Rated Voltage	
xi	- Rated Current	
xii	- Rated Watts	
xiii	Operating Time	
xiv	- Closing - Opening	
xv	Mechanical indication on drive shaft	
13	**Local Control Cubical**	
i	Name of Manufacturer	
ii	Location in GIS	
iii	Material	
iv	Sheet Thickness	
v	Degree of Protection	
vi	Padlocking arrangement	
vii	Major components of LCC	

viii	- Bay control mimic diagram	
ix	- Control Switches	
x	- Indicating lamps	
xi	- Position indicators	
xii	- Annunciation scheme	
xiii	- Auxiliary relays	
xiv	- Annunciation scheme	
xv	- Auxiliary relays	
xvi	- Contact multiplication relays	
xvii	- System parameters display	
xviii	- Heater with thermostat	
xix	- Interface terminal blocks for relaying &protection	
14	**GIS to Line connection**	
i	No's of XLPE cable can be terminated	
ii	Type of cable termination required	
15	**GIS to Transformer connection**	
i	No's of XLPE cable can be terminated	
ii	Type of cable termination required	
16	**Numerical Line Protection Relay:**	
i	Make of non direction 3 O/C + 1 E/F relay.	
ii	Type of non direction 3 O/C + 1 E/F relay.	
iii	Designation of non direction 3 O/C + 1 E/F relay.	
iv	Setting of O/C elements of non direction 3 O/C + 1 E/F relay	
v	Setting of E/F elements of non direction 3 O/C + 1 E/F relay	

vi	Characteristics of non direction 3 O/C + 1 E/F relay	
vii	Number of N/O & N/C contacts provided for non direction 3 O/C + 1 E/F relay.	
viii	DC Auxiliary Voltage of Non direction 3 O/C + 1 E/F relay	
ix	Operational indicator of non direction 3 O/C + 1 E/F relay	
x	Make of High speed Master Trip relay.	
xi	General Design of High speed Master Trip relay.	
xii	Designation of High speed Master Trip relay.	
xiii	Number of poles of High speed Master Trip relay	
xiv	C. T. Secondary current of High speed Master Trip relay	
xv	Time setting of High speed Master Trip relay.	
xvi	Frequency of High speed Master Trip relay	
xvii	Number of N/O & N/C contacts provided for High speed Master Trip relay	
xviii	DC Auxiliary Voltage of High speed Master Trip relay	
xix	Operational indicator of High speed Master Trip relay	
17	**Ammeter :**	
i	Make of Ammeter	
ii	Size of Ammeter	
iii	Response time of Ammeter.	
iv	Ammeter shall be operable up to 55°C	
v	Dielectric strength of Ammeter	
vi	Make of Ammeter selector switch	
vii	Designation of Ammeter selector switch.	
18	**Voltmeter:**	
i	Make of Voltmeter	
ii	Type of Voltmeter.	
iii	Size of Voltmeter.	
iv	Response time of Voltmeter	
v	Voltmeter shall be operable up to 55°C	
vi	Dielectric strength of Voltmeter	
vii	Make of Voltmeter selector switch	

viii	Designation of Voltmeter selector switch.	
19	**Energy meter :**	
i	Make of HT Trivector TOD energy meter.	
ii	Type & Designation of HT Trivector TOD energy meter .	
iii	Class of accuracy of HT Trivector TOD energy meter shall be 0.5	
iv	Measuring parameters of HT Trivector TOD energy meter.	
v	HT Trivector TOD energy meter shall have customized backlit liquid crystal display.	
20	**Digital Frequency Meter :**	
i	Make of Digital Frequency Meter.	
ii	Size of Digital Frequency Meter.	
iii	Range of Digital Frequency Meter in Hz.	
iv	Type of Digital Frequency Meter.	
v	Display of Digital Frequency Meter shall be seven segment red colour LED Display with 0.5" height	
21	**Terminal Connector :**	
i	Material of Terminal Connector shall be Nickel Plated Brass.	
ii	Size of stud of Terminal Connector shall be Minimum 4 mm dia.	
iii	Normal current capacity of terminal connector shall be 10 amps.	
iv	Breaking current capacity of terminal connector shall be 4	
22	**Maintenance :**	
i	Maximum down time for replacement or removal of any part	
ii	Maximum down time for degassing and re-filling the biggest compartment	
iii	Time between two refilling of SF6 gas.	
iv	Recommended period for overhauling	
v	Operation and Maintenance manual attached	
vi	Nearest local service centre	
vii	Minimum time of availability of local service	
viii	Availability of spares at local service centre	
ix	List of recommended spares attached?	
x	List of recommended special tools, etc attached?	
xi	List of commission spares attached?	
xii	List of maintenance spares attached?	

23	**Type Test Reports :**	
i	Is Type Test Reports for Lightning Impulse Voltage Withstand test for switchgear panel (with circuit breaker installed)	
ii	Is Type Test Reports for Dry H.V. 1 min power frequency with stand test for switchgear panel (with circuit breaker installed)	
iii	Is Type Test Reports for Short time and peak withstand current test for switchgear panel (with circuit breaker installed)	
iv	Is Type Test Reports for Short Circuit Test with basic duties for switchgear panel (with circuit breaker installed) submitted?	
v	Is Type Test Reports for Single phase breaking capacity test for switchgear panel (with circuit breaker installed) submitted?	
vi	Is Type Test Reports for Temperature Rise Test for switchgear panel (with circuit breaker installed) submitted?	
vii	Is Type Test Reports for capacitor current switching and cable charging Test for switchgear panel (with circuit breaker installed) submitted?	
vii	Is Type Test Reports for internal arc on busbar , breaker and cable chamber for switchgear panel (with circuit breaker installed) submitted?	
viii	Is Type Test Reports for Mechanical Endurance test for the offer circuit breaker installed) submitted?	
ix	Is Type Test Reports for Short Time Current test for Current Transformer submitted?	
x	Is Type Test Reports for Impulse Voltage Withstand Test for Current Transformer submitted?	
xi	Is Type Test Reports for Temperature Rise Test for Current Transformer submitted?	
xii	Is Type Test Reports for Impulse Voltage Withstand Test for Potential Transformer submitted?	
xiii	Is Type Test Reports for Temperature Rise Test for Potential Transformer submitted?	
xiv	Is test certificate in respect of current transformer submitted?	
xv	Is test certificate in respect of Potential Transformer submitted?	

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