TECHNICAL SPECIFICATION FOR 33 KV GIS

1. 33 KV GIS Switchgear Panel

GIS Switchgear shall be an indoor gas insulated and metal-clad cubicle design with single busbar system in accordance with single line diagram and data sheet. Each panel shall be metal enclosed, free standing, fully arc proof, floor mounting, flush fronted and arranged to single structure with a common busbar assembly. Each compartment shall be protected by a metal enclosure with IP65 minimum for gas compartments and IP4X for the supporting frames, low voltage and other compartments. Construction, including cable entry, shall be vermin proof.

Adequate safety margin with respect to thermal, mechanical, dielectric stress, dynamic short circuit fault and insulation coordination 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. 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).

The manufacturer shall give guarantee for maximum leakage rate of SF6 gas will be lower than 0.1 % per year. SF_6 gas leakage rate should not exceed 0.1% per annum after guarantee period. In case of Gas Leak the GIS should have the capability to withstand di-electric strength at minimum 1.3 bar pressure. Separate gas monitoring sensors should be available for all the gas filled chambers.

The panel complying ingress protection IP 65 for HV live part and IP 4X for LV compartment shall be constructed from corrosion-resistant stainless steel sheet of min 3 mm thickness, filled with SF_6 accommodating the primary switching devices (VCB and Three position disconnector cum earthing switch) and all live parts.

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 for not less than 500 hrs.

2. SERVICE CONDITIONS:

All materials supplied and installed shall be capable of operating without fault in a tropical climate, which exhibits a high level of ultra-violet radiation and severe thunderstorms. Relevant environmental conditions are listed as follows:

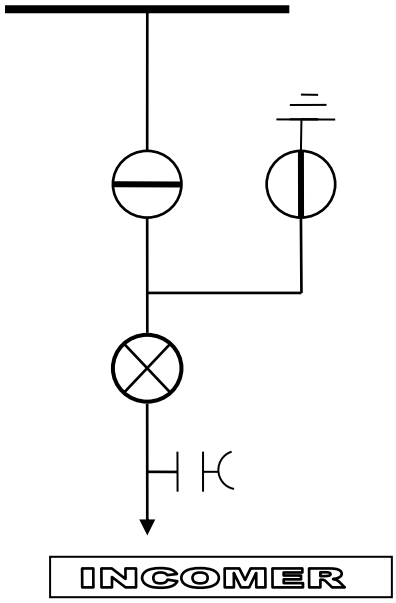
1	Max. ambient air temperature	50°C
2	Min. ambient air temperature	(-) 5°C
3	Average Daily Max. ambient temperature (Design Ambient)	40°C
4	Max. yearly weighted average ambient temperature	32°C
5	Max. altitude above mean sea level	1000m
6	Relative Humidity(%)	10 - 100
7	Avg. No. of Thunder storm Days / Year	100
8	Avg. annual rainfall	3000 mm
9.	Maximum wind pressure	250 kg / sq. mtr.
10	Pollution Level	Heavily polluted area
11	Seismic Level	Zone level III & IV

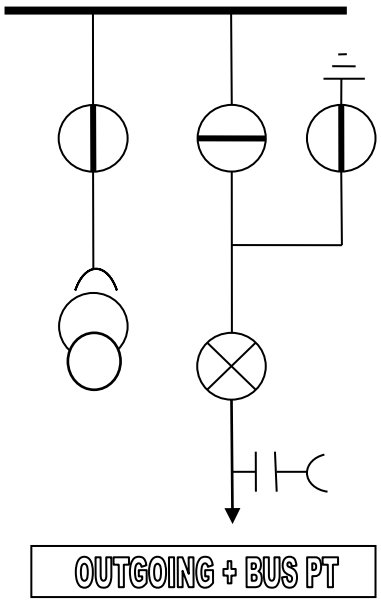
3. REFERENCE STANDARDS:

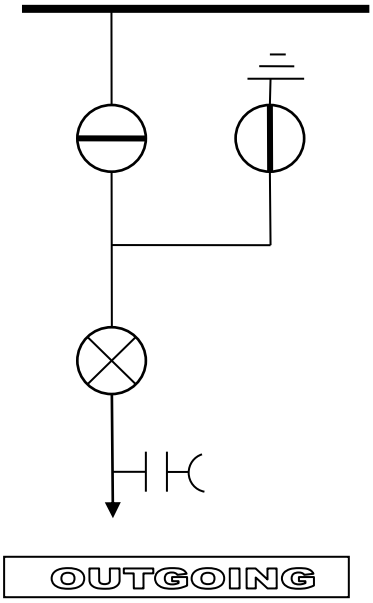
IEC 62271-200	AC metal-enclosed switchgear & control gear for rated voltage above 1 KV and up to and including 52 KV
IEC 622271-1	High Voltage switchgear and controlgear-Part-1: Common specification
IEC 622271-100	High voltage Alternating current circuit breakers.
IEC 60694	Common clauses for high voltage switchgear and control gear standards
IEC 62271-103	High voltage switches for rated voltages above 1 KV and less than 52 KV.
IEC 60071	Insulation coordination
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 above 1000 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 earthing 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 Sulphar Hexafluoride (SF_6)
IEC 60480	Guidelines for checking and treatment of Sulphar Hexafluoride (SF_6)
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 SF_6 in High voltage Switchgear and Control gear
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
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.
IS 55781984	Marking of insulated conductor.
IS 1248/2003	Indicating instruments.

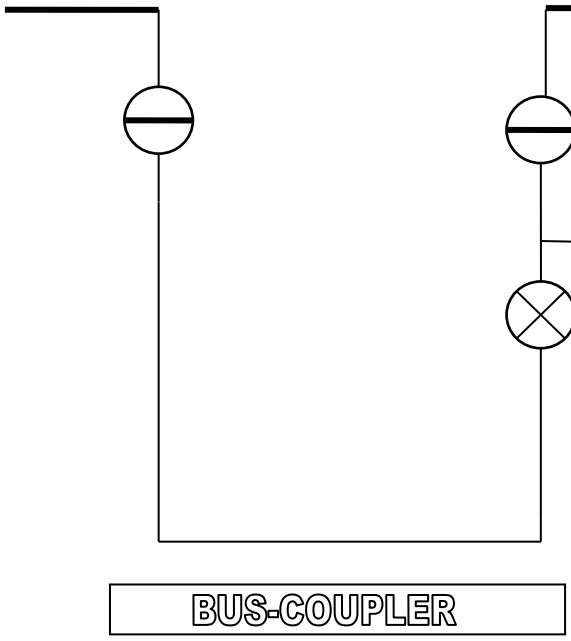
IS 6875 amended up to date	Control switches.
IS 3231/1986 & 87 amended up to date	Electrical Relays for Power System Protection.
IEC 60255 amended up to date	Numerical protection relays.
IS 8686/1977	Static protective relays.
IS 4794/68 & 86	Push button.
IS:9385/1979	High Voltage Fuses
IS 9431/1979	Indoor post insulator of organic material
IEC 60529 / EN 60529	Protection against accidental contact, foreign Objects and water

4. SLD for different combination of 33 KV GIS panel









4.01. Busbar and Insulators

33 kV busbar shall be housed in SF_6 gas chamber.

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.

Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators.

Bus bar cross-section shall be uniform throughout the length of switchgear board. Bus bars shall be in SF_6 gas insulated compartment.
All piping for SF_6 gas including their fittings shall be made of non- magnetic stainless steel housings.

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 $1.1/\sqrt{3}$.The temperature of the busbars and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Standards, duly considering the specified ambient temperature (50°C). Clearances between phases and between phase and earth shall be kept liberally so as to obtain high reliability.

Bus bar System	SINGLE BUS BAR
Rated Voltage	36 kV
No of phases	3
Rated Power Frequency Withstand Voltage	70 kV
Rated Lightning impulse withstand Voltage	170 kV
Rated current for bus bar system	1250 A
Current density	1.6
Rated Short time withstand current (3 Ph)	25kA/3 Sec
Rated Frequency	50 Hz

4.02 Circuit Breaker

Circuit breakers should be Vacuum type for 33KV. They should be according to IEC 62271-100 standard. Rated operating sequence must be 0-0.3sec-CO-3min-CO. Operating time for opening, breaking and closing, less than 100ms. Circuit breaker must be E1/M1/C1 type (electrical, mechanical endurance and capacitor breaking/making ability) according to relevant standard. Circuit breaker operating mechanism will be outside the SF_6 tank, and electrically operated. The operating mechanism should consist in the following items. Spring system that stores the necessary energy for opening and closing operation. Spring charging system (motor operated) that automatically recharges the springs after the main contacts of the CB have closed. Mechanical “charged-discharged” position indicator for CB opening and closing springs. Manually operated spring charging system (in case of lack of auxiliary power supply).

Electrical system including:

- Closing coil
- Tripping coil
- Anti pumping relay
- Mechanical emergency trip pushbutton.

Circuit breaker shall be provided with two trip coils. 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, SF_6 gas density monitor for all gas compartments and trip Coil / Circuit supervisions indicating lamp.

The closing coil shall operate satisfactorily at all values of control supply voltage between 85-110% 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.

Electrical parameters of the breakers:

	Nominal System Voltage	33 KV
1	Highest System Voltage	36 kV(rms)
2	No. of Poles	3
3	No. of Trip Coil	2
4	Frequency	50Hz
5	Basic Insulation Level	170 kV(p), 70KV (rms)
6	Operating Duty	0-0.3sec-CO-3min-CO
7	Total Break time for any current upto	3 cycles max (60ms)
8	Control Circuit Voltage	110 V DC +10% to-15%
9	Continuous Current rating at Ambient temperature (50°C) of Incomer and Outgoing	1250 Amp
10	Continuous Current rating at Ambient temperature (50° C) of Bus coupler	1250 Amp
11	Short Circuit Breaking Current	25 A for 3 Sec

4.03 Disconnector and Earthing switch

The Earthing Disconnector will operate always de-energized and the making capacity is provided by the circuit-breaker, which is designed for these purposes. The Disconnector must be according to the latest edition of the IEC 62271-102 and shall meet requirements as specified in paragraph ratings. The indication of the position of the Disconnector must be mechanical. The Operating mechanism must be outside the SF_6 atmosphere and accessible from the front. The Disconnector must be of single rotation-driving axis both for the Disconnector and the Earthing switch. It is mandatory that the operation from "closed to busbar" to "ready to earth" is made in two separate operations, closed - open and open - ready to earth. These are completely independent operations, with two separated operating access.

Isolators or isolators combined with earthing switches(switches-Open, Close Earthed) shall be motor operated. Incase of emergency, Manual operation must be possible. The earthing position of 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/disconnector switch must be possible with door closed for operator safety.

The interlocks shall be provided as per standards. It shall be possible to control these switches from front of the panel & remotely from SCADA through IED. Key interlocks shall also be provided for local manual operations.

4.04 Mechanical Safety and Interlocks:

i) The switchboard must be fitted with all the interlocks needed to prevent incorrect operations which may jeopardize safety of personnel in charge of operating the installation, as well as the efficiency and reliability of the apparatus. Internal mechanical interlocks of the panel with the circuit breaker closed, the interrogation slide is locked for the disconnector and the

earthing switch. (Restriction to the insertion of HandCrank for Disconnector-Earth Switch when CB is ON).

ii) The interrogation slide always release some insertion opening only (disconnector or earthing switch), or both of them are locked.(To ensure that either Disconnector-or Earth Switch operating at a time)
The crank for the disconnector and earthing switches can only be removed in its appropriate end position.

iii) When the crank on the disconnector or earthing switch is still in place, or when the interrogation slide is open, the following components are locked:

- ON push button of circuit breaker
- ON pulse is interrupted

iv) In particular, the following mechanical interlocks at least must be provided to prevent;
i. Operation in busbar if the circuit breaker is closed.
ii. Closing of the earthing switch when busbar isolator are closed.

v) The following interlocking dependencies must be provided-
- Interdependence of disconnector with earthing switch in the same panel.
- Interdependence of the circuit breaker and the earthing switch in the same panel.
- Dependence of the disconnector / Circuit breaker on the bus coupler circuit breaker and vice versa.

vi) The basic interlocking between disconnector switch and circuit breaker may be achieved by aux relays/other mechanical control equipments. The interlocking logic shall be operational and shall be fool proof and independent in the event of relay/BCU failure for operator's safety.

vii) Gas Pressure Interlock with alarm (Not Tripping) must be there.

4.05 Earthing and Earthing Devices

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

b. The earth busbar made of electrolytic high grade copper with cross sectional area of minimum 300sq 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 300sq mm) to carry the momentary short-circuit and short time fault currents to earth without exceeding the allowable temperature rise.

c. 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.

d. 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.

e. 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.

f. 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.

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

h. All hinged doors shall be earthed through flexible earthing braid.
i. Separate earthing for switchgear and composite VCB panel shall be provided.

4.06 Instrument Transformers

a. All current transformers shall be ring type (epoxy/cast resin) where as voltage transformers (PT) shall be cast resin insulated type. Must provide details of ratio, output, class and accuracy for all CTs & PTs in its supply on the panel itself

b. 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 50° C. The class of insulation shall be E or better.

c. The secondary windings of CTs & PTs shall be earthed at one point through a removable link, with provision for attaching test links.

d. The current transformers, Inductive type, shall be inaccordance to IEC60185, IEC60044-1 read with latest revisions and the general requirements. As detailed in foregoing paras of specification. The current transformers shall be core cast resin type and shall comply with the ratings indicated in the single line diagram. They shall be outside gas compartment. The secondary wiring of 2.5 sq.mm. shall be taken out to the LV compartment via bushings.

e. The Potential transformers shall be in accordance to IEC 60185, IEC 60196. IEC 60044-3 read with the latest revisions and general requirements as detailed in foregoing paras of specification. Easy access to Potential Transformers should be possible from front side of GIS.

f. Epoxy encapsulated / Metal enclosed Potential Transformers Single Pole insulated PTs which can be simply and safely changed shall be used exclusively. They shall be Plug in type and mounted outside the gas compartment for better accessibility and maintenance.

g. Currant transformers shall be rated to withstand the thermal and magnetic stresses resulting from the maximum available through fault current, the momentary and time rating requirements same as that of the switchgear.

h. Must provide calculations together with current transformer magnetizationcurvestoprovethethroughfaultstabilityoftheprotectionup to the switchgear fault rating.

i. Secondary terminals of current transformers and potential transformers shall be wired to disconnecting type terminal blocks, located at an accessible place in air filled low voltage compartment. The CT TBs shall be provided with short- circuiting links for each CT shorting and connection to earth. Alternatively, facilities for testing the CTs shall be provided by means of separate test blocks associated with each set of CTs. Each CT connection to the TBs shall be provided with ring type lugs. All wiring shall be colour coded.

j. Use of current and voltage sensors each high linearity over the entire working range and incorporating potential / capacitive divider circuit for connection to voltage indicator lamps.

k. Nameplates shall be fixed in a position so that details can easily be read when fitted in the cubicle.

l. Bus bar voltage transformers shall have provisions for safely disconnecting the fuses and transformers from energized bus.

m. Primary Injection Terminal of CT should be open for testing.

n. PT Selection scheme must be there

o. Accessible test links and terminals, with the following facilities, shall be provided for each CT and PT

- Source side short circuit of CT secondary.
- Burden side short circuit of CT secondary.
- Insertion of external device (including injection test set) in secondary lead of each CT or star point lead.
- Each phase and neutral of VT secondary for test equipment takeoff.
- Connection of any source side transformer's differential protection relays

p. **CT Technical Parameters**

i. 33 kV Incomer panel

Sl. No.	ITEM	Core-I	Core-II
i.	Purpose	metering	protection
ii.	Primary Current rating	400-200 A	400-200A
iii.	Secondary Current rating	1Amps	1Amps
iv.	Rated Burden	5 VA	5 VA
v	Accuracy Class	0.5 S	5P10
vi	Accuracy Limit Factor / Instrument Security factor	10	10

ii. 33kV outgoing panel

Sl. No.	ITEM	Core-I	Core-II	Core-III
i.	Purpose	Metering	protection	Special
ii.	Primary Current rating	400-200 Amps	400-200 Amps	400-200 Amps
iii.	Secondary Current rating	1Amps	1Amps	1Amps
iv.	Rated Burden	5 VA	5 VA	5 VA
v	Accuracy Class	0.5 S	5P10	PS Vk 300V, Ie Max 30ma at Vk
vi	Accuracy Limit Factor / Instrument Security factor	10	10	

p) PT Technical parameters

The voltage transformers shall be inductive metal-enclosed transformers.

Sl. No.	ITEM	33 KV
i.	Voltage class	36 KV
ii.	Rated primary voltage (kV rms)	33000/√3
iii.	Secondary voltage (volts)	110/√3
iv.	Rated Burden	Core I : 20 VA (metering) Core II : 20 VA (protection)
v	Accuracy Class	Core I : 0.5 Core II : 3P
vi	Class of Insulation	E or better
vii	One minute power frequency withstand voltage for Secondary wiring (kV rms)	1.2 continuous and 1.9 for 30seconds
viii	Method for earthing the system	Impedence earthed

PT's for Busbar Voltage metering

Location	Mounting
In Busbar Compartment	Plug in type, Top mounted over the Busbar & directly connected to the Busbar system. No Isolator needed. No separate compartment is required.

5. . CABLE TERMINATIONS:

5.1 Power cables shall be bottom entry, unless specified otherwise. Facilities shall be provided for cable testing and current and voltage injection. A socket/bushing and plug assembly shall be provided for the power cables.

5.2 Connections for power cables shall be plug in type/push on, according to DIN 47637outer cone type as per relevant IEC.

5.3 Cable terminating facilities and terminals shall be for the specified cable type, gland and conductor size.

5.4 Terminal blocks shall be arranged and positioned to afford easy access for carrying out external cable termination, testing, inspection and maintenance. There shall be clear space allowed between the terminals and the gland-plate for the spreading land termination of external conductors.

5.5 The panel wiring shall be on one Side of the terminal block only. No more than two wires shall be connected to a terminal.

5.6 Terminal blocks shall be shrouded or provided with transparent covers. Pinch screw type terminals are not acceptable.

5.7 Terminals for different voltages shall be separated by partitions. CT wiring and control wiring shall not be on the same terminal stripe.

5.8 A terminal box or chamber with un-drilled gland plate or entry panel of sufficient dimensions to terminate the specified cables shall be provided.

5.9 Positioning of cable terminations shall avoid obstruction of other cable terminations; removable cover set and provide for easy access for terminating cables.

5.10 Cable supports shall be provided (where practicable) to avoid undue strain on the cable termination.

5.11 Separate terminal arrangements shall be provided for each panel and for power and control cables.

5.12 SCADA terminal should be terminated in separate SCADA Panel for both 11 KV & 33 KV separately

6. Low voltage Compartment (Instrument Chamber)

6.1 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.

6.2 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 switches

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

6.4 The Communication device shall have USB/RJ 45 communication port in the front for the setting software use and at the back there has to be of this communication port: 2xRJ-45 Ethernet port.

6.5 The Communication device shall support following communication protocols: Modbus TCP, Modbus RTU, Human-Machine communication, display and Human-machine communication, PC.

6.6 The IEC 61850 communication has to support peer to peer communication (GOOSE). The IEC 61850 interface has to able configure through setting software. Also the same setting software has to be able to generate ICD files.

6.7 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.

6.8 Panel interlocking wiring cables shall be supplied with panels.

6.9 End termination required for cables should be touch proof type, EURO mould.

7.0. METERING PROTECTION, CONTROL AND INDICATION :

7.1 Meters and relays shall be capable of withstanding, without damage the secondary currents associated with the maximum available through fault current same as switchgear rated fault current. External zero adjustment shall be possible to facilitate adjustment without dismantling the instrument.

7.2 Protection and metering devices shall be flush mounted, where possible shall be withdrawable.

7.3 Protective relays shall be of the solid state, microprocessor-based programmable type with serial communication facilities.

7.4 Protective relays shall have electrical-reset facilities and clear operation indication, e.g. light emanating diodes. Non-tripping relays may be self-resetting if an indication of operation remains until hand reset.

7.5 Relay shall have front RJ 45/USB port for communication to a local PC with rear RJ45 port for connection to remote operation on IEC61850 protocol without any external convertor.

7.6 Relay shall have circuit breaker failure protection built-in.

7.7 Trip Relay should have electrical reset facility.

7.8 Relay shall have under and over voltage protection for Incomer Panels.

7.9 Indication lamps (green-open, red-closed, amber-tripped, white-trip circuit healthy plus Service Position, and Circuit Earthed) shall be provided for each circuit breaker. Status of spring charging mechanism (Charged or Discharged) and positive drive mechanical position indicators, visible without opening the cubicle door, shall be provided for each circuit breaker. Volt-free contacts for remote indication shall be provided. Indications may be incorporated in the multifunction relay via relay LEDs.

7.10 Control of circuit breakers shall be carried out from a control switch at the low voltage compartment door. Provisions shall be implemented at the switchgear for breaker control from a remote control panel. Where a multifunction relay is specified the control feature available

in the relay may also be used. Switchgear mounted and remote manual tripping facilities shall act direction the trip coil. Manual trips via relays are not acceptable.

7.11 As minimum, the following signal/indication shall be provided locally andremotely:

Conditions	Locally	Remote
Circuit Breaker status : ON / OFF	Open/Closed Status	
Earthing switch status	Earthed/Open Status	
Control Status	Manual (test)/Auto/Off	Alarm-Non auto
Circuit Breaker tripped	Alarm	
Loss of control power	Alarm	
All metering	Display Values	
Trip Circuit : Healthy / Auto Trip / Test / Service	Display status	

7.12 Alarm Scheme – Alarm & Annunciation and scheme must be at Feeder & Bus coupler.

a) Alarm scheme for trip alarm due to electrical faults-

Trip commands due to operation of protective relays will actuate bell and will be cancelled by the circuit breaker control handle. Auto trip lamp will glow on the panel and there will be flag indication on the concerned protective relay/auxiliary relay of the panel.

b) Alarm scheme for non trip alarm:

This scheme will conform to the following:

i. The closing of an initiating contact snail actuate a buzzer and will be accompanied by a flag indication on the concerned auxiliary relay.

ii. The closing of an initiating contact shall glow a lamp, which will not reset until the fault has cleared.

iii. It shall be possible to silence tree buzzer by pressing ‘accept' pushbutton. If after canceling the alarm but before resetting the visual signal, the same fault persists the buzzer shall be suppressed.

iv. If after canceling the alarm but before resetting the visual signal some other fault takes place then the alarm accompanied by the flag indication on the concerned auxiliary relay shall take place.

v. If after canceling the alarm and after resetting the visual signal, the same fault appears or some other fault takes place, he alarm flag indication and non-trip lamp indication shall reappear as usual.

vi. The non-trip alarm acceptance shall be by means of a pushbutton and resetting of visual signal may also be done through a pushbutton.

vii. Non-trip Alarm and buzzer shall be actuated in case of low SF_6 pressure in any of the compartments in the GIS as well as for AC fail, DC fail, Transformer non trip supervision.

viii. Means shall be provided for test checking the alarm and lamp circuits.

ix. The equipment shall be suitable for 110V DC operations.

7.13 Metering Scheme

a) Voltmeter shall be accompanied by a suitable selector switch facilitating the measurement of voltage between phase to phase and between phase to neutral. The voltmeter coil shall be rated for 110 Volts between phase to phase obtainable from the secondary of potential transformers. The instrument shall be of moving iron spring controlled type grade 'A' classification with an accuracy class of 1 and shall conform to IS: 1248- 1983. IS:2419-1963 (latest version thereof) or relevant BIS, IEC or ASA standard.

b) Suitably sealed ammeter to cover CTs ratio be accompanied by a selector switch facilitating the measurement of phase currents as well as the unbalanced current in the neutral. The ammeter coil shall be rated for 1 Amp. The instrument shall be of moving iron spring controlled type of industrial grade'A' classification with an accuracy class 1

and shall conform to IS:1248-1983,IS:2419-1963 (latest version thereof) or relevant BIS/I.E.C standard.

7.14 Protection Scheme

a) Transformers panels

Triple pole over current relay IDMTL type with high set elements for Over Current Protection, at ripple pole inverse definite minimum time lag over Current relay with a setting range of 50%-200% (of 1 Amp Rating) and also fitted with high setelements of 500%-2000% of 1A for instantaneous clearance of faults within the transformer(s) shall be provided one each of the transformer panel. For restricted earth fault protection to 11KV winding of the power transformer, an instantaneous balanced earth fault relay shall be provided on each of the transformer panel. The relay shall have a setting range of 10%-40% of 1Amp. & shall be complete with 50Hz circuit & stabilizing resistance. 33 kv REF to be provided. Both sides RE/F relay to be provided.

b) Line Panel

Triple pole combined over current and earth fault relay:-

Tripple pole combined over current and earth fault relay consisting of outer two over current elements having setting range 50%to200% of 1Amp having IDMTL characteristics and inner earth fault element having setting range of 10-40% of 1Amp having IDMTL characteristics shall be provided on each of the 33KV line panel.

c) Potential free contacts required from relay for SCADA purpose. The analog signals shall be RS485 port

i) DC supply fail
ii) Inter trip to breaker from Relay
iii) Breaker failure protection

8. FEEDER PROTECTION (33KV) :

8.1 The device shall contain all the necessary protection functions/ completed protection scheme for feeder and motor applications. The functions are as follows (including separate Relay for differential & REF Protection):

- DI in each relay – 12 nos.
- DO in each relay - 16 nos.

One no. Numerical Relay to be encompasses following protection.

*O/C & E/F
* Over load
* Under Frequency
* Over Frequency
* Under Volt.
* Over Volt.
* Directional O/C, E/F
* Trip Ckt. Supervision

8.2 Overcurrent protection shall have a wide range of time overcurrent protection curve settings, providing a choice of curve types:

- Standard delay characteristics curve family: IEC, IEEE, IEEE2 and RI Standard delay formulae with free parameters selecting a curve family (IEC, IEEE, IEEE2) and defining one's own parameters for the selected formula
- Fully programmable inverse delay characteristics

8.3 Pick-up setting of three over current stages have to be able to control remotely.

8.4 Changing setting groups has to able to do via: manually, digital inputs, virtual inputs, virtual outputs or LED indicator signals.

8.5 The device shall have force start and trip condition for testing.

8.6 Any protection function has to be able to block by internal and external signals using block matrix.

9.0 TRANSFORMER PROTECTION :

- DI in each relay – 12 nos.
- DO in each relay - 16 nos.

Two nos. Numerical Relays are required as mentioned below :

No. 1 Numerical Relay –

- Normal OC
- HV REF
- Trip Ckt. Supervision coil 1
- Transf. internal trouble supervision.

No. 2 Numerical Relay

- Differential
- LV REF
- Trip Ckt. Supervision coil 2

10. SCADA Compatibility

The panels shall be fully SCADA compatible.

11. Type Test

Manufacturers of HV switchgear shall be able to manage a first party conformity assessment procedure, as defined by ISO 17000, and to provide the associated deliverables "Declaration of Conformity" for the performances stated in this specification. The supplier shall ensure the validity of the declarations over the time. The switchgear must be type tested according to latest relevant IEC standards. The next type tests might be required during tendering process according to the IEC 62271-200 standards.

- Tests to verify the insulation level of the equipment
- Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of circuits
- Test to prove the capability of the main and Earthing circuits to be subjected to the rated peak and the rated short time withstand currents
- Test to prove the making and breaking capacity of the included switching devices.
- Test to prove the satisfactory operation of the included switching devices (operation and mechanical endurance test)
- Test to verify the protection of persons against access to hazardous parts and the protection of the equipment against solid foreign objects (IP protection degree)
- Test to verify the strength of gas filled compartments
- Tightness test of gas filled compartments

12. Routine Tests.

The switchgear shall be subjected to routine tests as per the latest relevant IEC standards. The following tests shall be performed at the supplier's factory:

- Visual inspection of: dimensions (according to drawings), painting thickness and adherence, appearance, protection degree, electric devices and polarity of connections.
- Electrical tests for low voltage compartment: dielectric test and voltage drop.
- Dielectric withstand at power frequency for the entire switchgear.
- Voltages drop of main circuit.
- Voltages Gas leakage test with helium in every switchgear.
- Mechanical/electrical operation and cabling of main circuit and auxiliary circuits.

13. Site Tests.

The complete GIS assembly shall be tested at site after installation, under the manufacturer's supervision. The following site tests shall be carried out:

- Visual inspection
- Dielectric withstand test at power frequency for the busbar.
- Voltage drop test for busbar.
- Complete functional tests.

14. GUARANTEED TECHNICAL PARTICULARS FOR SWITCHGEAR (33 KV GIS)

Sl.No.	Particulars	33kVGIS (Cubicle type)
1.a	Type (Model No.)	To be specified by the bidder.
1.b	Standard Applicable	IEC-62271-100/ IEC-62271-200
2.	Service	Indoor
3.a	Enclosure-Tank	Stainless steel
3.b	Enclosure- Panel	CRCA
4.	Nominal System Voltage	33kV
5.	Highest System Voltage	36kV
6.	No. of phases and frequency	3ph.50Hz
7.	Busbar material	Copper
8.	Bus Color code	RYB
9.	System Earthing	Impedence earthed
10.	Circuit Breaker Rating	1250 A (IC,OG & BC)
10.1	Continuous Current Rating at 50°C	630A for Feeder & 1250 A for BusBar
10.2	Short Circuit Rating	25 kA
10.3	Short Circuit duration	3 sec
10.4	Internal Arc Rating	25kA
10.5	Internal Arc Duration	1 sec
11.	Rated making Current	As per IEC-62271
12	Operating duty	O-0.3sec-CO-3minutes-CO
13	Leakage rate per year ingas compartment	Less than0.2%
14.	Busbar rating	1250 A
15.	Outgoing feeder rating	1250A
16.	Power Frequency Withstand voltage	70kV for 1 minute
17.	Impulse withstand voltage (1.2/50 microsec)	170kV
18.	Control Voltage	110 V DC
19	Spring charge motor voltage	110 V DC
20.	CT Ratio	400-200 / 1-1 (during detail engineering)
21.	PT ratio-STAR/ STAR	(33/√3)/ (.11/√3)/ (.11/√3)
22.	Aux. Contacts	6 NO + 6NC
23.	Termination	
23.1	Incomers	XLPE Cables as specified
23.2	Outgoings	XLPE Cables as specified
24.	Degree of protection (HV equipment)	IP–65forGasCompartment
25	Dimensions	1785 (D) X 800 (W) X 2600 (H)
26	Aux. PT	For open Δconnection

15. SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS OF33KV GIS FOR BREAKERS/ PANELS

01.	Manufacturer's Name and Country of origin	
01.1	Manufacturing Facilities for GIS in INDIA	
01.2	Manufacturing Location	
02.	Manufacturer's Design/type Ref	
03.	Frequency	
04.	Rated Voltage	
05.	Highest system voltage	
06.	Rated current	
07.	Short Circuit current rating with duration	
08.	Certificate or report of short circuit type test	
09.	Rated operating duty cycle	
10.	Short Circuit Breaking Current: (a)Symmetrical (b)Symmetrical at rated voltage (c) Asymmetrical at rated voltage (i) Per Phase (ii)Average (iii)D.C.Component	
11	Arcing time (at rated breaking current) in ms.	
12	Opening time	
13	Total break time in millisec.	
	(a)At 10% rated interrupting capacity (b)At rated interrupting capacity	
14.	Make time in ms.	
15.	Dry 1 minute power frequency withstand test voltage (a)Between line terminal and Earth KV rms (b)Between terminals with breaker contacts open	
16.	1.2/50 full wave impulse withstand test voltage (a) Between line terminal and Earth KV rms (b)Between terminals with breaker contacts open KVp	
17	Control Circuit Voltage DC	
18	Power required for Closing Coil at 110 V	
19	Power required forTripping Coil at 110 V	
20	WhetherTrip free or not	
21	Whether all the interlocks provided	
22	Overall dimensions	
23	Total weight of one complete Breaker	

16. SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 33KV CURRENT TRANSFORMERS

01.	Manufacturer's Name and country of origin	
02.	Manufacturer's design Ref/ Model	
03.	Applicable Standards	
04.	Type	
05.	Rated Primary current	
06.	Rated secondary current	
07.	Rated frequency	
08.	Transformation ratios	
09	Number of cores	
10	Rated output (Core wise)	
11	Class of insulation	
12	Class of accuracy (a)For metering (b)For Protection (c) PS Class	
13	Short circuit current rating and its duration	
14	One minute power frequency dry withstand voltage	
15	1.2/50 microsec. Impulse withstand test voltage	
16	One minute power frequency withstand test voltage on secondary	
17	Instrument safety factor	
18	Type of primary winding	

17. SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 33KV POTENTIAL TRANSFORMERS

01.	Manufacturer's Name and country of origin	
02.	Manufacturer's design reference	
03.	Applicable Standards	
04.	Type	
05.	Ratio	
06.	Rated Primary voltage	
07.	Rated secondary voltage	
08.	Rated frequency	
09.	Class of accuracy	
10.	No. of phase and method of connection	
11.	Burden	
12.	One min. power frequency dry flash over voltage	
13.	1.2/50 microsec.impulsewithstandtestvoltage	
14.	Class of insulation	

18. SCHEDULE OF GUARANTEEDTECHNICAL PARTICULARS FOR NUMERICAL RELAYS

01.	Manufacturer's Name and country of origin		
02.	Manufacturer's design Ref/Type		
03.	Applicable Standards		
04	Current setting range for		
	(a)Over current relay	IDMTL Instantaneous	
	(b)Earth-fault relay	IDMTL Instantaneous	
	(c)Contact Rating		
05.	Details on IDMTL characteristics		
06	Whether High Set is Transient free		
07	Whether separateTime setting for IDMTL/ Instantaneous Elements available		
08	Whether Relay sensesTrue RMS Current		
09.	Accuracy for different settings and limits of errors		
10	Whether settings site selectable and HMI provided		
11	Whether AlphaNumeric LED display		
12.	Whether Compatible for 110 VDC		
13	Whether Compatible for 1A CT Secondary		
14	Whether Self diagnostic features available		
15	Whether Communication Port RS485 Compatible for IEC61850		
16	Whether Blocking characteristics available for blocking the unscrupulous tripping of Upstream Breakers		
17.	a)Whether relay test block is provided b)Type of test block with literature		
18.	Whether draw out type unit or not		
19.	Types of case		
20.	Reset time		
21.	Burden of relay		
22.	Maximum and Minimum operating ambient air temperature		