

**TECHNICAL SPECIFICATION
OF
36 KV GAS INSULATED METAL CLAD INDOOR SWITCHGEAR**

1.0 SCOPE:

1.1 SUPPLY OF EQUIPMENT: This specification covers the design, manufacture, assembly, testing at manufacturer's works before dispatch and delivery of the metal clad partitioned, SF-6 gas insulated, 36 kV double busbar switchboard panel conforming to IEC- 62271-200. The switch board panels for line bays, transformer bays, bus coupler bay etc as per single line diagram given elsewhere in the specification shall be fitted with 36 kV vacuum circuit breakers, three position disconnecting and earthing switches, voltage transformers, current transformers, metering instruments, protection relays, terminal ends for 36 kV incoming & outgoing cable feeders etc as per foregoing specification & schedule of requirement.

1.2 ERECTION AND COMMISSIONING: The scope also include the installation & commissioning of SF-6 gas insulated switchboards Panels at 33 kV GIS substation, proposed in JCC circle & Alwar circle of Jaipur Discom along with inter connection/ inter-panel wiring from 36 kV panels as well as 36 kV terminal ends jointing / connection with 36kV cables in incoming (transformer) and outgoing feeders panels.

1.3 36 kV Gas 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 of high order. The circuit breakers, switches and protective devices etc shall be of latest design so as to ensure rapid and efficient interruption of fault current low arc energy, small arcing time, complete phase segregation and freedom from fire hazards.

1.4 The specification shall be read and constructed with all drawings, schedules and annexures appended to the specification which shall form part of this specification.

1.5 CLAMATIC CONDITIONS: Refer clause 33.0 of GTC (Part-II, Volume II)

1.6 Auxiliary Power Supply: Refer clause 24.0 of GTC (Part-II, Volume-II) 110V DC

2.0 STANDARDS:

2.1 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 following International Electro-technical Commission (IEC) Publications including their parts and supplements as amended or revised to date:

IEC 62271-200 Gas Insulated metal-enclosed switchgear for rated voltages above 1 kV and upto and including 52 kV
IEC 60376 New sulphur hexafluoride

IEC 62271- 100 High voltage alternating current Circuit breakers
IEC 60694 Common clauses for high voltage Switchgear and control-gear standards
IEC 62271-102 Alternating current disconnectors (isolators) and earthing switches.
IEC 60128 Alternating current disconnectors. Bus-transfer current switching by disconnectors.
IEC 66044-1 Current transformers
IEC 66044-2 Voltage transformers
IEC 60137 Bushings for alternating voltages above 1000 V
IEC 60859 Cable connections for gas-insulated switchgear
IEC 60480 Guide to checking of sulphur hexafluoride taken from electrical equipment
IEC 60099-1/4 Non-linear resistor type arresters for AC systems
IEC 60439 Factory-built assemblies of low-voltage switchgear and control gear.
IEC 60427 Report on synthetic testing of high-voltage alternating current circuit breaker.
IEEE 80 (2000) IEEE Guide for Safety in AC Substation grounding.
CIGRE-44 Earthing of GIS- an application guide. (Electra no.151,Dec'93)

- 2.2 The components and devices which are not covered by the above standards shall conform to, and comply with, the latest applicable standards, rules, codes and regulations of the internationally recognized standardizing bodies and professional societies as may be approved by the Employer. The manufacturer shall list all applicable standards, codes etc. and provide copies thereof for necessary approval.
In case the requirements laid down herein differ from those given in above standard in any aspect the switchgear shall comply with the requirements indicated herein in regard thereto.

3.0 GENERAL DETAILS

- 3.1 The equipment should operate satisfactorily under the climatic conditions specified in this specification. **The reference maximum ambient air temperature may be taken as 50 Deg. C as against 40 Deg. C. The permissible temperature rise for various equipments offered should therefore be de-rated accordingly to meet the specification requirement.**
- 3.2 The equipment will be used for controlling supply to power transformers, overhead / underground feeders & combination of overhead & underground feeders. The incoming and outgoing terminals of the equipment shall be connected by XLPE Aluminium/copper Power Cables.

4.0 General Design & Constructional Features:

4.1 - GENERAL

1. The switchboard must be metal clad, indoor execution, SF6 isolated. The switchboard structure must be made up of standardized cubicles placed side by side, each consisting of modular built-up and standardized elements.
2. Cubicles must be made up of stainless steel/CRCA (as per type tested design) boxes, completely segregated one from the other, containing the power parts of the cubicle. These stainless steel /CRCA (as per type tested design) boxes will be molecular sealed; the degree of protection on the external part of the cubicle will be IP4X.
3. Power parts boxes must be made up of stainless steel /CRCA (as per type tested design) metal sheets, with a minimum thickness of 2.5 mm, pressed bent and welded, filled up with SF6.
4. The low voltage compartment, the panels and doors must be made up of pressed bent metal sheet with a minimum thickness of 2 mm.
5. Degree of protection of Gas Insulated Enclosure shall be IP65.
6. Within the various cubicles, the following typical compartments must be identified:
 - i. Busbar compartment, containing the busbars and the busbar side isolator (In SF6 gas enclosure)
 - ii. Circuit breaker compartment (In SF6 gas enclosure)
 - iii. CT compartment (In SF6 gas enclosure/External)
 - iv. Cable VT's compartment
 - v. Operating mechanism compartment, containing the circuit breaker operating mechanism
 - vi. Low voltage compartment, containing instruments, protection relays and auxiliary devices
7. All SF6 stainless steel tank enclosures shall have independent temperature compensated pressure switch for Alarm purpose.
8. The pressure of SF6 gas inside shall not be more than 1.3 Bar / type tested design . The switchgear design shall be such that even at 1 Bar (Atmospheric Pressure) the basic insulation levels as specified can be maintained. The current rating of the feeders shall be maintained at this pressure so as no gas refilling is required at site.
9. All the other supporting structures, cable compartment and Low Voltage compartment made of absolutely non corrosive material (Al Zn /CRCA (as per type tested design) is preferred)[Supporting write up to be enclosed if any other material is used].
10. The circuit-breakers must be a vacuum circuit breaker with horizontal or vertical pole arrangement as per manufacturer's standard type tested design; they must be placed in the central front part of the cubicle. Rating of the Vacuum circuit Breaker shall be as per single line diagram of the proposed substation elsewhere in the specification.

11. The power parts contained in the different stainless steel boxes must be electrically connected through bushing type insulators, in order to perform the sealing and segregation.
12. Internal parts of circuit breakers must be accessible for maintenance. The latter must be removable keeping busbars and cables energized, once opened busbar and cable side isolators.
13. The circuit breaker operating mechanism must be accessible for maintenance with no operations on SF6 compartments.
14. Low voltage compartments must be accessible from the front part of the switchboard, once opened the relevant hinged door.
15. The basic insulation levels as specified

4.2 – DOUBLE BUSBARS

1. Busbars must be made up of electrolytic copper. Busbar system must be three-phase, sized to support short-circuit currents of 25 kA for 3 sec. Busbars shall be tubular type in construction and shall be bare and insulated with SF6 gas only.
2. Rating of Busbars shall be 1600A.
3. 36kV GIS shall be able to withstand rated voltage even if SF6 gas in any of gas insulated compartments leaks to atmospheric pressure.
4. Busbar fixing arrangement shall be of plug in type/as per manufacturer type test design and shall not require any gas work at site during erection, Testing and commissioning.

4.3 - SWITCHBOARD EARTHING SYSTEM

1. An earthing conductor extending the whole length of the switchboard must be provided. The current density in the earthing conductor, if made of copper, must not exceed 200 A/mm^2 under the specified earth fault conditions. In any case, the cross-section must not be less than 30 mm^2 .
2. There must be suitable drilling at each end of the earthing busbar for connection by cable to the earthing system of the substation.
3. The whole structure and the metalwork elements must be openly connected to each other by means of special screws to ensure good electrical contact between the parts.
4. All the main components (such as CTs, VTs, relays, instruments ...) must be connected to earth.

4.4 - INTERLOCKS

1. The switchboard must be fitted with all the interlocks needed to prevent incorrect operations which may jeopardise safety of personnel in charge of operating the installation, as well as the efficiency and reliability of the apparatus.

2. In particular, the following mechanical interlocks at least must be provided to prevent:

- i. operation of busbar and cable side isolators if the circuit breaker is closed
- ii. operation of circuit-breaker during busbar and cable side isolators operation
- iii. closing of the earthing switch when busbar and cable side isolators are closed and, in incoming unit, without consent from the upstream switchboard.

Switchgear provided as per SLD

4.5 - SURFACE TREATMENTS

PAINTING: The metal structure of the cubicles must be suitably treated and painted according to the following cycle:

- i. hot (60 / 70 °C) surface-active alkaline pre-degreasing and degreasing
- ii. double washing
- iii. activation
- iv. phosphating
- v. washing
- vi. passivation
- vii. drying
- viii. electro-static painting with 180 °C epoxy polyester powder 60 µ thickness (-0+20) dry film, with embossed finishing coat.

The minimum finishing thickness must be 50 µ.

The colour of the painted surfaces will be RAL 7035 / Light Smoke Gray (inside and outside) as per approval of purchaser.

The degree of protection shall be as per relevant standards.

The painted surfaces must pass the adherence test in compliance with DIN 53151 standards.

The manufacturer shall provide the complete painting procedure and its adherence/ conformity to various standards and quality checks for the approval of owner.

4.6 - POWER CABLES CONNECTIONS:

Connections for power cables must be plug in type, according to DIN 47637 or relevant IEC. Testing of cable shall be possible without disconnection of Power cables.

Manufacturers specific design may be acceptable but the termination arrangement should meet the requirement of multiple (min 2 Nos.) ckt. from panel.

4.7- INTERNAL ARC

- i. Every switchboard shall be constructed in order to support the mechanical stress due to the maximum pressure value of the gases produced by the arc.
- ii. The switchboard shall be designed to withstand the maximum short circuit current up to 1 s to meet the protection coordination needs. Under fault conditions there must be no emissions of gas and/or materials hazardous for service personnel.
- iii. The IEC 298 Standards, app. AA, test criteria from 1 to 6, class A accessibility, must be complied with. An "active" protection system shall also be provided, which shall be able to discriminate the faults inside the switchboard from those outside and therefore to activate a protection in case of an internal fault, to contain the damage caused to the switchboard and to remove voltage only from the part of the switchboard directly affected by the fault.
- iv. There shall be some pressure sensors which are unaffected by electromagnetic interferences and which must reduce the duration of the arc in the switchboard, directly controlling opening of the circuit-breakers which supply the fault.

5.0 **ELEMENTS/APPARATUS OF SWITCHGEAR:**

The main elements/ apparatus mounted in the switchboard must be suited to the design characteristics further on indicated, and must comply with the following provisions in particular. Circuit breakers and switches must be constructed by the same manufacturer so that parts can match and relevant mechanical interlocks can work properly.

5.1 - CIRCUIT-BREAKERS

- i. The circuit-breakers shall be of Vacuum Type. The operating mechanism of the circuit-breaker shall be stored energy, free release, with pre-charged closing springs, motor/manual operated type. The closing and opening operations must be independent of the operator action. Re-closing locking device must be provided.
- ii. The circuit-breakers shall be free release type with re-closing locking device.
- iii. Internal parts (main and arcing contacts) of circuit breaker must be accessible for maintenance simply removing front cover, with no operations on SF6 compartments. **For easy maintainability of switchgear. However specific design already type tested**

shall be accepted. This maintenance operation shall be carried out by skilled personnel only, both on energized or out of service switchboards.

- iv. The circuit-breakers shall be preset to mount the locks foreseen under point 4.4 and must also be fitted with accessories hereunder indicated:
 - manual opening/closing mechanism
 - electrical opening/closing mechanism with spring-loading gear motor
 - auxiliary contacts
 - key lock
 - operation counter
- v. The following components are to be provided with each Circuit Breaker:
 - i) Manual emergency tripping in the event of the control voltage being failed.
 - ii) Requisite tripping and closing coils, including security interlocks.
- vi. Control voltage for tripping, closing, relays and motor shall be 220V DC measured at the device terminals suitable for operation between 110% to 85%.
- vii. The minimum number of normally open and normally closed auxiliary contacts on each circuit breaker. Auxiliary switch, additional to those required for control and interlocking, shall be as specified. The fitting of additional auxiliary relays to achieve the number of auxiliary contacts required will not be acceptable.
- viii. Indicating devices shall be provided to clearly indicate whether a circuit-breaker is open or closed.
- ix. Each circuit-breaker shall be provided with an operation counter per mechanism to record the number of tripping operations performed.
- x. Testing certificates shall be provided with the switchgear to enable ascertaining of timing of the circuit breakers operations. All details of the test facilities/ setup available to this respect shall be submitted with the tender.
- xi. The vacuum circuit-breaker has to have at least 10,000 breaking operations at rated current or 50 breaking operations at rated short-circuit breaking current control maintenance free. The mechanical life of the vacuum interrupter has to comprise at least 10,000 operating cycles.
- xii. As per IEC 60694 and VDE 0670 part 1000, vacuum circuit breaker shall be maintenance free:
 1. No re-lubrication or adjustment.
 2. The operating mechanism must be maintenance-free without time limit up to 10,000 operating cycles.
 3. Its service life has to comprise at least upto 10,000 operating

cycles.

4. Vacuum tight for life.

- xiii. The vacuum circuit breaker shall form a completely independent & interchangeable module so that in case of failure, the VCB can be replaced, in least time. **The manufacturer specific changes in design may be accepted however it shall be type tested .**

5.2 – ISOLATORS/ EARTHING SWITCH

- i. Isolators shall be three-pole, two positions type: OPEN - CLOSED.
- ii. Isolators with earthing switch shall have 3 position Closed – Open – Earthed.
- iii. Isolators shall connect busbars/circuit breakers/ LINE, if closed.
- iv. In the circuit breaker cubicles the operation of both busbar and cable side isolators must be simultaneous, operated from the front part of the cubicle. This operation must be interlocked with the relevant circuit breaker and earthing switch.
- v. Isolators shall also be fitted with accessories hereunder indicated:
 - manual operating mechanism on the front part of cubicle
 - auxiliary contacts
 - electromechanical lock
 - mechanical indication of position for earthed position

5.4 - CURRENT AND VOLTAGE TRANSFORMERS

5.4.1 Current Transformer:

- i. The current transformers, Inductive type, shall be in accordance to IEC 60185, IEC 60044-3 read with latest revisions and the general requirements as detailed in foregoing paras of specification The current transformers shall be conventional type and shall comply with the ratings indicated in the single line diagram. They shall be **wound core type/ ring type CT (as per type tested design)** and shall be located inside/outside the gas compartment. The secondary wiring of 2.5 sqmm shall be taken out to the LV compartment via bushings.

- ii. CT Details

Transformer Incomer Feeder & Bus-Coupler

1000-500/5/5/5A

Core 1: 5VA, Class 0.5s

Core 2: 10VA, 5P15

Core 3: Class X, V_{kp} ≥150V, R_{ct} ≤ 4 Ohms

Outgoing/ Transformer Feeders/ Bays

600-300/5/5A

Core 1: 5VA, Class 0.5s

Core 2: 10VA, 5P15

NOTE: The above CT parameters are indicative and to be approved by owner as per protection co-ordination requirement during detailed engineering based on details/ calculations to be submitted by successful bidder.

- iii. All terminals shall be stamped or otherwise marked to correspond with the marking on the diagram plate.
- iv. Provision shall be made for earthing of the secondary windings inside the terminal box.

5.4.2 EPOXY ENCAPSULATED VOLTAGE TRANSFORMERS (POTENTIAL TRANSFORMERS)

- i. The voltage 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.
- ii. Epoxy Encapsulated Voltage Transformers Single Pole insulated VTs which can be simply and safely changed shall be used exclusively. They shall be Plug in type / withdraw-able type and mounted outside the gas compartment for better accessibility and maintenance.
- iii. To allow this switchboard with the primary directly plugged to the line. A manually operated isolator has to be installed to enable disconnecting of the voltage transformer from line from line for partial discharge and cable testing.
- iv. P.T. PARTICULARS
 - a. Ratio $33000/\sqrt{3} / 110/\sqrt{3} / 110/\sqrt{3}$
 - b. Burden: 40VA
 - c. Class of Accuracy: 0.2/3 P
 - d. Voltage Factor: 1.2 continuous & 1.9 for 30 seconds.
 - e. 3 Nos. Single Phase P.T. shall be connected in Star formation

5.4.3 The CTs, in particular, shall be sized to support a fault current of 25kA for 1 s.

5.4.4 The current and voltage transformers shall have cast resin insulation, and be suitable for installation inside the cubicles and be free of partial discharges.

5.5 - AUXILIARY APPARATUS

- i. The switchboard shall be completed with all the protection, measuring, control and signaling apparatus indicated and required to make it ready for operation.
- ii. The protection relays and the measuring instruments shall be suitable for embedded assembly.

- iii. The suitable cut-out with appropriate wiring terminals shall be provided in the outgoing feeder panels for installing the revenue class meters (to be provided by the purchaser). The dimensions for cut-outs shall be approved at the time of detailed drawing approval of the panels.

5.6 - WIRING AND AUXILIARY CIRCUITS

- i. All the auxiliary control and signaling circuits must be made using flexible copper conductors insulated in non fire-propagating PVC, with minimum degree of insulation 2 kV, minimum cross-section of 1.5 mm² (excluding the circuit-breaker for which a cross-section of 1 mm² is permitted for its own auxiliary circuits).
- ii. The current circuits must be made with conductors with characteristics as above, but must have a minimum cross-section of 2.5 mm².
- iii. Each terminal part of the conductors must be provided with suitable terminals appropriately insulated.
- iv. All the conductors of the circuits regarding apparatus contained in the switchboard must be terminated at numbered modular terminal boxes.
- v. The insulating support of the terminals must be made of incombustible and non-hygroscopic material.
- vi. The tightening of the terminals in the clamp must be of the anti vibrating type for connection on the customer side.
- vii. The delivery terminals of the current circuits must be of the type which can be short-circuited, fitted with connections for temporary connection of instruments.
- viii. The delivery terminals of the volt circuits must be fitted with connections for temporary branches of instruments.
- ix. The terminal boxes for connections with cables outside the switchboard must be sized to allow fixing of a single conductor to each terminal. There must also be a number of additional terminals equal to 5% of the number of terminals used.
- x. All the apparatus which is normally live with degree of protection < IP 20, mounted in the instrument compartment, must be fitted with an easily removable insulating screen which prevents accidental contact with live parts by personnel in charge of maintenance and inspection.

5.7 - PROTECTION AND SUPERVISION SYSTEM

- i. A multi-function microprocessor-based device i.e bay control & protection units for switchboards shall be used, manufactured by the same company as the switchboard and circuit-breaker. It shall

be of a single hardware type regardless of the applications and shall be used for Protection, Control & Measurements.

- ii. Bay Unit: The bay control unit combines the following functions in a single unit:
- Exclusive local or remote control, to be switched via password protected electronic lock switch
 - Double-pole control of up to 2 Circuit Breakers & 5 Disconnectors (depending on the version and equipment fitted)
 - Separate display of the switching status of up to 8 switching devices on the front display.
 - Graphical display on the front shall be an integral part of the unit. It shall display dynamic statuses of CB, Disconnectors etc on a programmable single line diagram.
 - Software interlocks
 - Cancellation of panel interlocks for test purposes
 - Measured value acquisition for current and voltage, where instrument transformers are fitted
 - Internal calculation of variables derived from measurements.
 - Display of the measured values as absolutes (numerical).
 - Performance of configured protection functions
 - Incorporation of signals wired in from external protection devices for triggering purpose.
 - Separate display of individual and group alarms by means of LEDs, plus display of individual alarm messages in clear text
 - Parameterization of the protection and control functions via an optical interface on the front panel
 - As an option, it can be connected to a higher-level automation system.
 - Internal self-monitoring routines make it an active partner to the operators, signaling malfunctions as soon as they occur.
 - It shall be possible to integrate these units to MMI on IEC 61850 protocol on fibre optic cable for better speed and reliability.
 - It shall be possible to achieve redundant communication, hence preferably two serial communication ports shall be provided.
 - The unit shall also have communication port in the front for local communication through PC without opening the metering door on the switchgear.
 - The logic scheme provided in the Bay Control Unit shall be freely programmable.
 - It shall be possible to set the protection functions from the front of the instrument without the aid of external instruments.

- iii. The minimum functions required of the instrument shall be as follows: protection, measurement, motor operated circuit-breaker and operation actuator control, signaling of statuses and alarms, mimic diagram of the monitored panel, locking relay, supervision of the opening coil, local-remote switching, acquirement and diagnosis of all the panel parameters (gas pressure in the circuit-breaker, state of the operating mechanism springs, and state of the thermo-magnetic protection circuit-breakers of the auxiliary circuits).
- iv. The protection unit shall be able to manage interlocks between the various operating parts and display the main values and diagnostic information on an LED display. It must also be possible to memorize the last 30 events/data in a non-volatile memory.
- v. The unit shall have disturbance recorder to record at least **8** current or voltage waveforms and 16 logic digital signals.
- vi. The sampling frequency for the analog input to disturbance recorder shall be **1** kHz at rated 50Hz frequency.
- vii. The bay control unit shall have following protection feature:
 - 1. Over current Instantaneous protection (ANSI 50)
 - 2. Over Current definite time & IDMT (51 high, 51 low & 51 IDMT)
 - 3. Earth Fault Definite time & IDMT (51N High, 51N Low, 51N IDMT)
 - 4. Under-voltage instantaneous, definite time (27, 27 High, 27 Low)
 - 5. Over-voltage Instantaneous, Definite time (59, 59 High, 59 low)
 - 6. Differential (87, 87N) for 33/11 kV Transformers
- viii. Apart from protection & control function as above the bay control unit shall also have following metering function:
 - 1. Line & phase currents.
 - 2. Earth Fault Current
 - 3. Line & Phase Voltages
 - 4. Residual Voltage
 - 5. Frequency
 - 6. Power Factor
 - 7. Active / Reactive power
 - 8. Active / Reactive Energy
- ix. The BCU shall have minimum 14 binary inputs, 5 Power Outputs & 5 Signal output for control of various equipments.
- x. For tariff metering a provision i.e. cutout of approx dimensions 303 mm (H) X171mm (W) X102 mm (D) shall be left in the GIS panel. This meter shall be in the scope of the purchaser. A separate core of accuracy class 0.2 as desired in the CT data is to be connected to this meter at site. The secondary wires from this core shall be

terminated on the Terminal Blocks in the LV compartment. The details of the meter shall be provided and fixed during detailed engineering.

5.8 MIMIC DIAGRAM & MECHANICAL OPERATING AND INDICATING ELEMENTS

- i. For indoor panels painted colour bands shall be used for the mimic bus. The mimic diagram shall be on eye level. Equipments such as circuit breakers, isolators, current transformers, voltage transformers etc. shall be represented by suitable symbols. The colour shall be Red Shade 537 **or as per manufacturer practice** of IS-5.
- ii. Each cubicle shall have a mimic diagram integrating the following mechanical operating and indicating elements which shall be operable and visible from the front.
 - a) Circuit breaker
 - Mechanical ON
 - Mechanical OFF
 - Mechanical indicator Spring charged/discharged
 - Mechanical switch position indicator
 - Mechanical operations counter
 - b) Three position switch, disconnecting function
 - 1 Opening for inserting lever for manual ON/OFF operation
 - 1 mechanical switch position indicator
 - c) Three position switch, cable earthing function
 - 1 Opening for inserting lever for manual ON/OFF operation
- iii. The wiring for transformer circuit must be flexible and of cross section of 2.5 mm². The signaling and control leads must be led to a terminal block via plug connectors in which they are grouped together according to function.

5.9 INDICATING LEDS/LAMPS:

- i. Indicating LEDs / Lamps shall be provided on the control board to indicate the following:
 - a) Visual indication of ON and OFF position of each circuit breaker.
 - b) Trip circuit healthy indication.
 - c) Auto trip indication for each circuit breaker panel.
 - d) VT supply indication.
- ii. Each lamp body shall be of molded insulation and shall be able to withstand a high voltage test of appropriate value. All lamps shall be suitable for 240 V AC supply and shall have low power consumption and shall provide a wide angle of illumination of sufficient intensity for comfortable viewing. A glass of appropriate colour shall be screwed into the front of the lamp body. The design

of the indication lamps shall be such as to facilitate replacement of burnt lamps. An engraved label indicating the purpose of the lamp shall be provided with each lamp.

- iii. The automatic trip of the Circuit Breaker due to operation of protection relays shall be indicated by sounding of a hooter. All non-trip alarms shall be indicated by an alarm bell.

5.10 CAPACITIVE VOLTAGE INDICATORS

- i. Capacitive dividers in the bushing leading to the cable termination should allow for safe testing of partial discharge & the cable for dead state. These dividers must be a fixed integral part of the system. Capacitive layers on the plug connector may be used only for additional testing.
- ii. Capacitive voltage dividers shall be incorporated in the power cable sockets. The indication system shall comply with the requirements of IEC 1243-5, IEC TC 8/183/CDV
- iii. The connections from the capacitive dividers to the voltage indicator shall be made with shielded wires.

6.0 SWITCHGAR RATINGS:

6.01 GENERAL CHARACTERISTICS:

- i. Rated voltage : 36 kV
 - ii. Operating voltage : 33 kV
 - iii. Rated lightning impulse withstand voltage : 170 kV
 - iv. Rated power frequency withstand voltage : 70 kV
 - v. Insulating gas : SF₆
 - vi. Rated filling level for insulation : 130 kPa
 - vii. Alarm level for insulation : 120 kPa
 - viii. Minimum functional level for insulation : 80 kPa
- [All pressures stated are absolute pressures at 20°C Max. permissible site altitude at he above gas pressures: ≤ 1,000 m
- ix. Rated short time current : 25 kA
 - x. Rated short time : 3 s
 - xi. Rated peak withstand current : 62.5 kA
 - xii. Rated busbar current : 1600 A
 - xiii. Degree of protection of the high voltage compartments : IP65
 - xiv. Degree of protection of the low voltage bay : IP4X
 - xv. Rated supply voltage of the auxiliary circuits : 220 V
DC

6.02 3 position switch and switch-disconnector:

Rated current:

Feeder/ Transformer Bay	1250 A
Bus-Coupler	1600 A

Transformer I/C (132 kV Tr.) 1600 A

Supply Voltage for motorized Mechanism: 220 VDC

6.03 Technical data of the circuit-breaker

Circuit breaker type:	Vacuum
Rated voltage:	36 kV
Rated current:	1250 A
Feeder/ Transformer Bay	800A
Bus-coupler	1600 A
Transformer I/C	800 A
Rated short circuit breaking current, symmetrical :	25 kA
Rated short circuit making current (peak) :	62.5 kA
Rated voltage of the motorized mechanism :	220 V DC
Rated frequency :	50 Hz
Rated operating sequence :	O-0.3s-CO-3min-CO
Total opening time :	approx. 60 ms
Closing time :	approx. 60 ms
Rated powers :	
Charging motor :	230W
Closing coil :	250 W
Opening coil :	250 W

Current Ratio A/A

- i) 132kV side T/F Incomer & B/C: 1000-500/1A 3Cores
- ii) Feeder/ Transformer Bay side: 600-300/1A 2Cores

6.04 Panel dimensions :

- i. The standard switchgear shall have approximately following overall dimensions:

Height: 2,300 mm
Depth: 1,760 / 1,860 mm
Width: 800 mm

Or

As per standard type test design of the manufacturer

- ii. Clearances: The following clearance distances shall be taken into account:

At the front- 1200mm, At the Rear- 600 mm, On the left: 1000 mm, On the right: 1000 mm

iii. Panel weight : Approx. 1,700 kg

The Panel dimension and weight are indicative in nature, it may vary as per manufacturers design. The minor variations if any shall be acceptable subject to meeting of specification and standards as applicable.

7.0 33 KV CONFIGURATION:

The single line diagram of proposed substation is enclosed for bidder's reference elsewhere in the specification to understand the panel requirement/ design of 36 kV Metal Clad Switchgear. The configuration is Double Busbar arrangement with 2 Nos. Incomer Transformer Feeders, 2 Nos. Outgoing Feeders, and 1 No. bus-Coupler (as per SLD).

8.0 SWITCHBOARD COMPLETION ACCESSORIES:

The following standard accessories shall be also included for completion of the switchboard configuration for this project:

- i.end panels
- ii.lifting eyebolts
- iii.series of levers and special tools
- iv.paint for touching up (1 kg tin)
- v.test certificates
- vi.catalogues and drawings
- vii.instruction booklets

The bidder must add any other standard accessory as required to complete the configuration and satisfactory operation of the switchboards.

9.0 TESTS AND CERTIFICATES

The switchboard must undergo the acceptance and commissioning tests foreseen by the relative IEC standards in the manufacturer factory and in the presence of the customer or one of his representatives. The panel builder must show ISO 9001 certificates.

The following routine tests may be carried out in the factory for the purpose. Necessary Certificates pertaining to this shall be submitted before dispatch of the material

- power frequency withstand voltage
- auxiliary and control circuits voltage test
- principal circuit ohm-metric test
- mechanical operation test

- electrical auxiliary devices test
- wiring check
- sealing test

TYPE TEST CERTIFICATES

The bidder shall submit a list of valid Type Tests conducted on the Switchgear panels along with bid. The Type Test must have been conducted in a 3rd party Lab of Internationally reputation. If required the bidders may be asked to submit the complete Type Test Reports if so desired by the purchaser.

Following Type Test as per IEC 62271-200 & IEC 62271-100 & IEC 62271-102 shall be applicable:

- Dielectric Test for the Insulation levels as specified in the Tender.
- Temperature Rise Test including measurement of resistance.
- Short time & peak withstand current tests
- Mechanical Operation tests
- Verification of making & breaking current tests
- Internal arc test for each gas compartment.

10.0 MISCELLANEOUS

10.1 - DATA AND DOCUMENTATION TO BE PROVIDED WITH THE OFFER

- Information about the type of switchboard and apparatus
- Single-line diagram showing the front of the switchboard and indicating the overall dimensions (preliminary)
- Foundation diagram for fixing to the floor (preliminary)
- List of sub-suppliers

10.2 - DATA AND DOCUMENTATION TO BE PROVIDED IN CASE OF AN ORDER

- Functional electrical wiring diagrams
- Switchboard foundation drawing with system for fixing to the floor and slab drillings (final)
- Single-line diagram (final)
- General drawing with overall dimensions (final)
- Switchboard installation and maintenance manual
- Circuit-breaker installation and maintenance manual
- Switchboard test certificates