33KV INDOOR

GAS INSULATED SWITCHGEAR

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Engineering Department

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Updates for WBSETCL / TECH SPEC / Rev.-0.1

1. The clause 1

This point is added in the clause (General)

"The **LIFE CURVE** (the curve showing number of operations against current level being interrupted during the life span of the VI) of vacuum interrupter must be provided with each VCB

TECHNICAL SPECIFICATION FOR 33 KV METAL ENCLOSED GAS INSULATED SWITCHGEAR

1 GENERAL

The specification covers, the design manufacture, testing and supply of 36KV, 3 phase, 50Hz metal-enclosed gas-insulated switchgear for indoor application having **SCADA/SAS Compatibility.**

All the equipment shall be suitable for satisfactory operation in tropical climate and dry dust laden atmosphere. The equipment shall be able to withstand wide range of temperature variation (-5º to 50ºC). Temperature rise shall be guided by as per IEC 62271-200. The plant / apparatus / equipment supplied shall comply in all respect with the requirement of Indian Electricity Rule 1956 / ISS / IEC with latest amendment.

"The **LIFE CURVE** (the curve showing number of operations against current level being interrupted during the life span of the VI) of vacuum interrupter must be provided with each VCB" [R0.1]

STANDARD TECHNICAL PARAMETERS

SL	DESCRIPTION	VALUES/ INFORMATIONS
1	Type of Insulation	SF6 gas
2	Type of Breaker	VCB
3	Frequency	50 c/s
4	Rated Voltage	33 KV
5	Maximum Design Voltage	36 KV
6	Power Frequency withstand Voltage (1min)	70 KV rms
7	LI withstand Voltage (1.2 / 50 micro-sec)	170 kVp
8	Rated Current (**If not specifically mentioned at Schedule / BOQ**) – i) Busbar ii) Breaker and Disconnector for Bus Coupler iii) Breaker and Disconnector for other bays	i) 2000 A ii) 2000 A iii) 1250A
9	Rated breaking current	25 KA
10	Rated Short Time Withstand Current for 3 sec - Symmetrical	25 KArms
11	Rated Short Time Withstand Current for 3 sec - Asymmetrical	As per relevant IEC / IS & shall be type tested
12	Rated dynamic peak withstand current (KAp)	62.5 KA
13	Cable charging current for C2 duty tested	25 A
14	Capacitor duty (C2 duty tested)	400 A
15	Duty Cycle	O-0.3 sec.-CO-3.0 min.- CO

16	Type of Pressure Relief	Ruptured Diaphragm
17	Degree of Protection for High Voltage Live Parts	IP65
18	Relative Humidity	up to 95%
20	Altitude of installation	Up to 1000m from MSL
21	Separate gas compartments for – i) Busbar-1, ii) Bus bar-2 and iii) Breaker	Yes

2.0 STANDARDS

The Metal Clad Switchgears shall conform to latest revision with amendment available of relevant standards, rules and codes some of which are listed herein for ready reference.

Sl. No.	Standard	Item
1	IEC-62 271-102	Disconnector and Earthing Switch
2	IEC-62271-100,200; IEC-600298 / 600694; IS-3427	Metal enclosed switchgear and control gear.
3	IS-2705 / IEC 60185	Current Transformers
4	IS-3156 / IEC 60186	Voltage Transformer
5	IS-3231 & 3842 / IEC 60255	Protective Relays
6	IS-1248	Ammeter & Voltmeter
7	IEC 60129	Alternating current disconnectors (isolators)
8	IEC 60529	Classification of degrees of protection
9	IS-375	Arrangement of Breakers Bus bars main connection and auxiliary wiring.
10	IEC-687/CBIP Report	Tri Vector Meter

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

3.0 GENERAL CONSTRUCTION

The Switchgear shall be an indoor gas-insulated, factory assembled, totally enclosed, metal clad, dead front, 3-phase cubicle design (segregated SF6 insulated compartments for Circuit breaker and busbar systems). It shall be suitable for local and remote control.

The switchgear shall be designed to ensure optimum continuity and reliability of supply as well as safety for operation.

Each of the gas compartments shall have a separate gas filling non return valve, gas density monitoring by means of a temperature-compensated pressure sensor, and its own pressure relief system.

The power cables shall be fed in from the bottom and rear side of the panel. Provision shall be provided for cable testing and current and voltage injection.

A leakage rate of less than 0.1% per annum is required. The gas tanks should therefore preferably be state of the art manufactured of stainless steel and cut / welded by laser and built as a hermetically sealed pressure system.

The switchgear is to be designed in such a way that all high voltage parts with the exception of cable plugs are located within the SF6 enclosure.

For operator safety the switchgear must have protection system against internal faults in each partitioned compartment. In the event of internal arc the hot gases are to be guided via pressure relief disks from each compartment concerned. The pressure relief duct ends are guided to open air or fitted with absorbers to cool and de-energize the hot gases. Hazards to persons or risk of fire are to be reliably prevented. Evidence is to be provided of type testing to IEC 62271- 200, IAC class AFLR for 33Kv.

The high voltage part of the switchgear does not require maintenance under normal conditions during the lifetime of the switchboard. The circuit breaker drive mechanisms must be accessible for inspection and maintenance without opening the gas system.

Pressure relief has to be provided for each high voltage compartment. Relief into the cable basement or cavity below a false floor is not permitted.

Metering, circuit breaker chamber, cables and cable box chamber should have proper access for maintenance, proper interlocks should be provided. The switchgear shall be complete with all necessary wiring fuses, auxiliary contacts, terminal boards etc.

The design of the panels shall be such that no permanent or harmful distortion occurs either when being lifted by eyebolts or when moved into position by rollers or trans pallets.
SF6 gas tank shall be Aluminium alloy 6mm thickness; remaining enclosure shall be steel minimum 2mm thickness.

The switchgear must be readily extendable in either direction.

The switchboard may be subject to seismic disturbance hence the switchgear supplier shall provide the type test report or documentation to support the same.

Each cubicle shall be equipped with anti-condensation heater controlled by thermostat.

Each gas compartment shall be available with repair openings, so that during any kind of maintenance or repair can be possible at site & no need to bring the panels at factory.

4.0 BUS BARS, GAS MODULES AND AIR COMPARTMENT ARRANGEMENT

The bus bar section shall be of ample capacity to carry the rated current continuously without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full fault MVA. Bus bar shall be of Copper and Cross section of the same shall have to be designed to limit the current density within 1.75A/sq.mm.

Bus bar shall be extensible on either side to make it in switch board configuration of any make.

The CB Tank contains the stationary mounted vacuum circuit breaker inside gas. The instrument current & voltage transformers and the cable bushing shall be installed outside gas tank. The power cables and terminations must be touch-prove.

The gas insulated busbar modules contain the busbars. The disconnector's with earthing arrangement may be placed at same gas chamber with bus bar or breaker. The switchgear panel has to be segregated by a plug-in system / suitable connection for the busbars.

All operating mechanisms have to be motorized. All the basic mechanical operations shall be possible after door opening to avoid the unauthorized access. Manual emergency operation and mechanical position indicators shall also be provided.

5.0 LOW VOLTAGE / SECONDARY SECTION

The incorporated Low Voltage Compartment contains the switch operating mechanisms and all secondary equipment including protection and controls. A separate protection cabinet is not required.

It must be possible to adapt the software for protection and control to the function of the panel by means of a laptop/notebook and corresponding data media. A data interface is to be provided for this purpose. Setting of protection parameters must be possible both by laptop/notebook and manually at the panel. Suitable action is to be taken to ensure that only authorized persons have access to the parameters and programs.

The technology used must permit the connection to a future substation control system by a bus system i.e. communication cards must be provided respectively subsequent extension must be possible without de-energizing the switchboard and recalibration of the protection unit.

The measurement system should be capable of calculating further values such as average/maximum current, active and reactive power, power factor and active and reactive energy consumption from the current and voltage measurements. Both digital and – where appropriate – analogue values should be displayed.

All indications for measurements, switch positions and status or hazard signals are to be presented on a display. Normal operation, i.e. switching, reading of measurements and messages, must be possible without any special instruction or training of the operators. The technology used must be capable of monitoring both itself and the trip circuits.

The low voltage compartment must be a self-contained unit with its own front door incorporated in the switchgear panel.

6.0 CIRCUIT BREAKER

The Circuit Breaker shall be spring operated, Motor charged, manually released spring closing mechanism with three pole simultaneous operation. The indicating device shall show the **OPEN** and **CLOSE** position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 15 sec. The "TRIP" and "CLOSE" coils shall be of reliable

design and low consumption preferably less than 300W. It shall be possible to manually charge the circuit breaker operating spring in case of auxiliary supply failure.

The breakers shall be capable of Making & Breaking the short time current in accordance with the requirement of ISS 13118 / IEC 60056 conform to latest amendment thereof and shall have 3 phase rupturing capacity of 25KA at 33KV.

The circuit breakers shall be vacuum type and comply with IEC Publication 62271-100. The stationary mounted circuit breakers shall be type-tested. Test certificates, as evidence of successful completion of type tests shall be submitted by the successful bidder on request.

The HV part of the circuit breakers must be maintenance-free for life time under normal operating conditions to IEC 60694. The CB drive is accessible for maintenance.
Each circuit breaker shall be provided with following accessories.

i) ON-OFF indicator for indicating circuit breaker position.
ii) Trip push button iii) Shunt trip coil operating between 70% - 110% of rated control voltage. iv) Close coil, operating between 85% - 110% of rated control voltage.
v) Spring charge motor, operating between 90% - 110% of rated control voltage.
vi) Two trip coils and one closing coils shall be provided in all the breakers.
vii) Mechanical indicators for switch position and mechanism position viii) Mechanical Counter

Circuit breakers will be provided with at least one spare normally-open and one spare normally-closed contact, each wired out to terminals for the connection of external wiring. Circuit breakers shall have electrical and mechanical tripping. The operating mechanism shall be trip-free and shall include an anti-pumping device.

7.0 CURRENT TRANSFORMER

The CT shall be mounted in a manner to make it very easy for fitting / replacement at site. It shall be designed with built in adjustable cable holding clamps, makes it very easy for removal/sturdy fitting of power cables and to prevent any swing due to forces encountered during short circuit.
P1 of primary side of the in-built CT shall be at bus side of all the panels. If not specifically mentioned in Schedule / BOQ, the CT particulars shall be as follows -

Description	**Core**	**Application**	**Current Ratio**	**Burden (VA)**	**Max ISF**	**Accuracy class**	**Min Knee point Voltage (V)**	**Max CT Sec. Winding Resist.(W)**	**Max excitation current (mA) at Vk**
Transformer	1	Metering	1600-800/1A	20	5	0.2			
	2	Protection	1600-800/1A			PS Class	400/200	6.4/3.2	37.5
	3	Protection	1600-800/1A			PS Class	1600/800	6.4/3.2	37.5
Feeder /	1	Metering	800-400/1A	20	5	0.2			

Capacitor Bank	2	Protection	800-400/1A			PS Class	200/100	3.2/1.6	37.5/75
	3	Protection	800-400/1A			PS Class	800/400	3.2/1.6	37.5/75
Bus Coupler Bay	1	Protection	1600-800/1A			PS	400/200	6.4/3.2	37.5
	2	Protection	1600-800/1A			PS	400/200	6.4/3.2	37.5

8.0 POTENTIAL TRANSFORMER

Voltage Transformer's should be with a disconnector switch and shall be placed at both the 33KV Main bus. . If not specifically mentioned in Schedule / BOQ, the core details shall be as follows -

Description of Core	No. of Core	Core Details of Core I	Core Details of Core II
33000/□ 3 : 110 /□ 3, 110/□ 3	2	50 VA, 0.2	50 VA, 3P

9.0 ISOLATORS AND EARTHING SWITCHES

Isolators or isolators combined with earthing switches shall be motor operated. In cases of emergency, manual operation must be possible. Arrangement shall be provided for earthing of individual feeders and bus bars without hampering the functionality of the Sub Station.

Detection of the switch positions is to be performed by proper wear and tear free arrangement. The actual position of contacts for all 3 phases must either be visible via a mechanical position indicator directly connected to the drive shaft or directly detectable at the main contacts.

Disconnectors and Earthing Switches will be provided with at least one spare normally-open and one spare normally-closed contact, each wired out to terminals for the connection of external wiring.

10.0 AUXILIARY/CONTROL WIRING

All the secondary wiring in the panel shall have high quality PVC insulation 1100 volts grade and the same shall be of standard Copper Conductor of size not less than 1.5 sq. mm. for control circuit and 2.5 sq. mm. for CT circuits. Colours of the secondary / auxiliary wiring should confirm to IS 375/1963 conform to latest amendments thereof. All wiring shall be neatly run and group of wiring shall be securely fixed with clips so that wiring can be checked without necessity of removing the clamps. Ferrules with number shall be provided on both end of the wiring.

11.0 PROTECTION AND CONTROL SYSTEM

For Protection & Control philosophy and details, the relevant sections of latest WBSETCL specification for Control & Relay Panel to be followed.

12.0 PAINTING

The visible metal sheets of the switchgear panel enclosures should have an external coat of paint, light gray with Paint shade of RAL 7032 / RAL 7035.

13.0 EARTHING

(a) An earth bus of size minimum 40 mm x 6 mm or equivalent copper shall be provided and shall be extended throughout the length of the switch board with a provision to extend further on both sides of the end switchboard for future extension of switchboards.
(b) It shall be possible to connect each bay and bus of the switchgear to earth, through earthing switches suitable for fault make current.
(c) Earthing switch shall be mechanically interlocked with the associated breaker and disconnectors as per interlock requirement.
(d) Earthing circuit shall be suitable for testing at 25KA for 1.0 sec.

14.0 Installation facility

The panels are to be delivered to site as factory assembled and routine tested units. After linking the panels (or panel assemblies) by the plug-in or other suitable busbar connection system and connection of the power and control cables the system should be ready for operation.

15.0 QUALITY OF SF6 GAS

The SF6 gas insulated metal-clad switchgear shall be designed for use with SF6 gas complying with the recommendations of IEC 376,376A & 376B,at the time of the first charging with gas. All SF6 gas supplied as part of the contract shall comply with the requirements of IEC as above as a minimum & should be suitable in all respects for use in the switchgear under all operating conditions.

16.0 TYPE TESTS, ROUTINE TESTS AND ACCEPTANCE TESTS

All tests shall be carried out according to relevant IEC / IS standards. The metal-enclosed switchgear is to be type tested at a recognized and internationally well-reputed test laboratory. Type test certificates shall be available for verification as evidence of successful completion of type tests.

The bidder shall submit following Type test reports to prove the capability and suitability of his offered switchgear.

i) Short Time Current Test for 25KA for 3 second.

ii) Short Circuit Test duties on Circuit Breaker. iii) Impulse withstands Test.

iv) Power Frequency withstands Test. v) Temperature Rise Test.

vi) Internal Arc Test. vii) Mechanical Endurance test on Circuit Breaker. viii) Test to prove Degree of Protection of enclosure

Notification for factory tests along with list of proposed tests shall be submitted as required. The tests shall include the following:

i) Power frequency withstand test

ii) Insulation resistance iii) All the Functional tests of the fully installed and wired equipment.