33KV INDOOR SWITCHGEAR

Engineering Department

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WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED
পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
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Update of Revision - 4.1

1. Short Time Current Test for 31.5KA for 3 second. Instead of 25KA for 3 sec in clause no 11.(i)

2. 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.

3. The front portion of each gear including the front doors must be of 3 mm thick sheet.

GENERAL TECHNICAL SPECIFICATION 33 KV INDOOR SWITCHGEAR

1 GENERAL

The specification covers, the design manufacture, testing and supply of 36KV, 3 phase, 50 Hz air insulated Metal clad indoor VCB type switchgear unit having **SCADA/SAS Compatible facilities** with horizontal draw out (trolley system) circuit breaker as per IS 13118 (1991)/IEC-60056 and other standards as specified below.

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 : 600694.

The plant / apparatus / equipment supplied shall comply in all respect with the requirement of Indian Electricity Rule 1956 / ISS / IEC with latest amendment.

STANDARD TECHNICAL PARAMETERS

SL	DESCRIPTION	VALUES/ INFORMATIONS
1	Type of Switch Gear as per Arc Interrupter	VCB
2	Frequency	50 c/s
3	Rated Voltage	33 KV
4	Maximum Design Voltage	36 KV
5	Power Frequency withstand Voltage (1min)	70 KV rms
6	LI withstand Voltage (1.2 / 50 micro-sec)	170 kVp
7	Rated Current – i) Busbar ii) Breaker iii) Disconnector	 2500 A 2000 A 1250 A
8	Rated breaking current	31.5 KA
9	Rated Short Time Withstand Current for 3 sec - Symmetrical	31.5 KArms
10	Rated Short Time Withstand Current for 3 sec - Asymmetrical	As per relevant IEC / IS & shall be type tested
11	Rated dynamic peak withstand current (KAp)	78.5 KA
12	Cable charging current for C2 duty tested	25 A
13	Capacitor duty (C2 duty tested)	400 A
14	Duty Cycle	O-0.3 sec.-CO-3.0 min.- CO, Class C2-M2

2.0 STANDARDS

The circuit breaker and Metal Clad Switchgear Panels 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-60056 / IS 13118 /IEC	Circuit Breaker
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 STRUCTURAL & MECHANICAL CONSTRUCTION

3.1 The Switchgear shall be factory assembled, totally enclosed, metal clad, dead front cubicle. It shall be of sheet Steel (preferably galvanized to avoid rusting) construction and shall be dust, moisture and vermin proof complying with degree of protection of not less than IP-4x as per IS-3427 (1997). The panels shall be of Metal Clad compartmentalized design with all the High Voltage compartments viz. Circuit Breaker, Bus Bar etc. separated by metallic partitions. The switchgear panels shall be rigid without using any external bracing. The switchboard panels should comply with relevant ISS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, 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.

3.2 The panels shall be constructed from prime quality folded steel sheet of 2 mm thick or Al-Zn sheet steel. **The front portion of each gear including the front doors must be of 3 mm thick sheet.** (R-4.1) Only doors and end covers shall be painted with paint shade as specified.

The observation window on the CB compartment door shall be provided. Observation window shall be of same material and construction as the type tested design/construction.

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.

The switchgear and control gear should have the minimum degree of protection (in accordance with IEC 60529)

- IP 4X for the enclosure for rated current up to 3000A
- IP 3X for the enclosure for rated current up to 1600A
- IP 2X for the partition between compartments

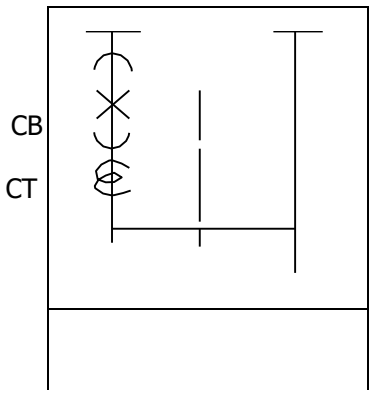
The switchgear must be readily extendable in either direction.

3.3 For Seismic Applications: The switchboard may be subject to seismic disturbance, hence the switchgear supplier shall provide the type test report or documentation to support the same.

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

3.5 **Bus Sectionalize panels**

In bus Sectionalize panel one panel shall be used for truck with the C.B. and second panel for connection of busbar to the top. The bus Sectionalize panel can be combined with a metering panel.



Bus Sectionalize Panels (Typical)

3.6 Assembly of all current carrying parts shall be such that they shall be easily accessible for inspection and maintenance.

3.7 Switchgear cubicles shall be satisfied the requirement of IEC:62271-200, IEC:60298, IEC:60694.

3.8 Each switch gear shall be supplied with basic operating tools like – rack-in rack-out handle etc.

3.9 The switchgear and control gear shall be suitable for continuous operation under the basic service conditions indicated below.

Ambient temperature	- 5°C to + 50°C
Relative humidity	up to 95%
Altitude of installation	up to 1000m, IEC 120

4.0 BUS BARS AND CONNECTORS

Bus bars and all other electrical connections between various components shall be made of Electrolytic copper of adequate cross-section. 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. Cross section of the Bus bars shall have to be designed to limit the current density within 1.75A/sq.mm.

All bus bars shall be rigidly and firmly mounted. Spacious bus bar chamber shall be provided with use of tubular busbar design and free from any high voltage stresses by avoiding all sharp edges and bringing them to uniform potential. Bus bar shall be sleeved for full voltage. Sleeve shall be heat shrinkable BTPM type of Raychem make. **No PVC sleeve in bus bar for 36KV is acceptable**.

Bus bar shall be located in a separate metal clad chamber and shall be air insulated. It shall be adequately supported on insulators or integral epoxy spouts to withstand dynamic stress due to the short circuit current as specified.

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

5.0 CIRCUIT BREAKER

5.1 The Circuit Breaker shall be drawing out type with **ground mounted trolley arrangement** suitable for installation in the switchgear cubicle. The breakers shall comply with IS-13118 / IEC-60056 conforms to latest amendment thereof**. Cassette type design with separate trolley for draw out of the breaker is not acceptable**.

5.2 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.

5.3 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 31.5KA at 33KV.

5.4 The circuit breaker shall be isolated by horizontal racking and positively fixing the unit into any one of the following positions:,

- **Service position;** main and auxiliary circuits connected
- **Test position;** main circuits disconnected auxiliary circuits connected. Circuit breaker in its isolated position shall be completely contained in the apparatus compartment with shutters on main circuit closed and compartment front door closed.
- **Withdrawn position;** main circuits and auxiliary circuits disconnected. Circuit breaker is removed out of the cubicle.

Locking of circuit breaker in the test position shall be possible by means of key lock on the earth switch manoeuvre.

A position indicator switches or viewing window must be provided for visual indication of the circuit breaker position.

Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of circuit breaker from bus bar or insertion into bus bar shall only be possible when the breaker is in the **"OPEN"** position.

5.5 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.

5.6 The switchgear shall be provided with facilities for full operation from a remote point. In case of Local Operation of circuit breakers, Control switch of Circuit Breaker shall be located at such a height so that a man can operate standing on ground/floor. It shall be possible to trip the circuit breaker locally by mechanical means.

5.6 The circuit breaker truck shall ensure earth in both connected and disconnected positions.

5.7 An electro-mechanical device shall be provided to ensure the auxiliary circuits have been securely connected between the fixed and moving portions of the switchgear, before allowing closing operation of the circuit breaker. The voltage rating of the device shall be the same as the voltage used for the closing circuit.

5.8 Tripping and/or release coils shall be continuous rated to ensure longer life but rating should not exceed 300 W each. The electrical tripping device shall be of a type which acts directly on the circuit breaker mechanism and shall give positive operation for a supply voltage of 70% of nominal at dc and 85% of nominal at ac control voltage.

5.9 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.

5.10 Each circuit breaker shall be interlocked to prevent:

- the breaker being inserted into service position unless it is open
- the breaker being withdrawn from the service position unless it is open
- the breaker being closed unless it is fully in the service or test position remote operation whilst in the withdrawn/test position

5.11 Circuit breakers shall be mechanical latching and electrical and mechanical tripping. The operating mechanism shall be trip-free and shall include an anti-pumping device.

5.12 **Shutters:** Circuit breaker compartment should have automatic shutters, which shall be opened and closed by the mechanical drive of the circuit breaker. The bus bar and circuit spout covers shall be operated independently of each other. Padlock facilities can be provided on the metal shutters.

5.13 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. (R- 4.1)

5.14 **INTERLOCKING**

Isolation and connection of the circuit breaker shall be carried out inside the compartment with the door closed. The following mechanical interlocks shall be provided for service safety: - interlocking which prevents racking-in and racking-out of the circuit breaker when closed

- interlocking which prevents manual or electrical closing of the circuit breaker in the intermediate positions between connected or isolated
- interlocking which prevents either the circuit breaker from being racked in when the relative earth switch is closed and the earth switch from being closed with the circuit breaker racked in

6.0 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.

CT core details shall be as per core particulars tabulated in the Specification of Current Transformer / as mentioned in BOQ in line with breaker rating.

7.0 POTENTIAL TRANSFORMER

Three numbers Single phase draw out type PT of ratio 33000/√3; 110/√3 Volts with HT/LT fuses mounted on an independent trolley housed at the same feeder/transformer panel. This Line PT shall not get disconnected along with the Circuit Breaker in case the breaker is drawn out from 'SERVICE' position. Bus potential transformer shall be housed in separate trolley, placed in a separate panel. Arrangement shall be made in such a way so that PT primary fuse can be replaced without switching OFF the breaker.

PT core details shall be as per core particulars tabulated in the Specification of Potential Transformer.

8.0 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 ISS 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.

9.0 PAINTING

The Panels shall be pre-treated using 7-Tank process and then Epoxy Powder Coated with Paint shade of RAL 7032.

10.0 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 of the switchgear to earth, through earthing switches suitable for fault make current. And provision of bus earthing is also required.
(c) Earthing switch shall be mechanically interlocked with the associated breaker as per interlock requirement.
(d) Earthing circuit shall be suitable for testing at 25KA for 1.0 sec.
(e) Breaker compartment shall have scrapping earth bar and spring load finger shall be provided in withdrawal truck.
(f) Provision of Busbar earthing at both side of Bus-Coupler is to be provided.

11.0 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 31.5KA for 3 second.(R-4.1)
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