TECHNICAL SPECIFICATION
COVER SHEET

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TECHNICAL SPECIFICATION

1KV, 33KV (Vacuum) & 66KV (SF_6) Outdoor Circuit Breaker

Central Engineering Services

TPC-M/TPDDL/TPCODL/TPNODL/TPWODL/TPSODL/TPADL

Specification Title: Technical Specification for 11KV, 33KV & 66KV Outdoor Circuit Breaker.

REVISION HISTORY

Rev. #	*Date of revision*	*Purpose of revision*	*Summary of revisions / comments (Attach separate sheet if required)*	*Initiated by*	*Revised /Reviewed by*	*Approved by*
R1	22-01-2026	Revised for TP Odisha Discom only	Annexure -I attached	Nirojanalini Garnaik		
R2						
R3						

Central Engineering Services

TPC-M/TPDDL/TPCODL/TPNODL/TPWODL/TPSODL/TPADL

ANNEXURE- I (For TPCODL/TPNODL/TPWODL/TPSODL)

SL. NO.	Description	Remarks
1.	Panel illumination and space heating	AC MCB rating shall be 16 A
		Space heater capacity shall be at least 80W
		Hygrostat shall be provided
2.	Material of Hardware (Bolts, Nuts, Washers, Spring Washers etc.)	SS for M10 and below, HDG for above sizes
3.	Tripping Circuit and Closing coil circuit	Breaker shall be supplied with Two Tripping Circuit and Closing coil circuit with independent and separate DC MCBs (3 nos)
		Conventional tripping coil needs to be provided instead of an Electronic coil
4.	Terminal Connector	Concern TP Odisha DISCOM to confirm during release of RO (i.e. DOG/COYOTE/Panther/Zebra)
5.	Control Voltage	Concern TP Odisha DISCOM to confirm during release of RO (24VDC/48VDC)
6.	Locking provision	Castle key is required for safe local Maintenance of VCB
7.	Spring charging Motor	Shall be universal type with suitable ratings of MCB
8.	Rating of Trip Coil and Close Coil	Burden and Resistance to be mentioned during GTP /Drawing approval
9.	Door Access	Provision of additional stand at back side for VCB Back Door Access
10	Angle Size	75x75x6 mm for structure and additional support structure to be considered in between CT Mounting Structure and VCB
11	Local remote Selection switch	To be provided by OEM
12	Closing and Opening Time of Breaker	Closing and Opening Time shall not be changed w.r.t Voltage variation within 85% to 110% and 70% to 110% respectively
13	Nut and Bolts	3 Nos of Nuts are required instead of 2 for each Mounting structure

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1. SCOPE:

This specification covers technical requirements of design, manufacture, construction, performance, testing at manufacturer's works, packing, forwarding, supply and unloading at stores/site of 11kV, 33KV & 66kV Outdoor CB of 1250/1600/2000 Amps. Complete with all accessories for trouble free and efficient performance.

2. APPLICABLE STANDARDS:

a) IS 13118: Specification for High Voltage Alternating Current Circuit Breakers
b) IS 12063: Classification of degrees of protection provided by enclosures of electrical equipment.
c) IS 2099: Bushings for alternating voltages above 1000 Volts
d) IS 2629: Recommended Practice for Hot-Dip Galvanizing of Iron and Steel : Methods for testing uniformity of coating of zinc coated articles
e) IS 2633: Hot Dip Zinc coatings on structural steel and other allied products
f) IS 4759: High-voltage switchgear and control gear
g) IEC 62271-100 Alternating current circuit breakers
h) IEC 62271-1-: High-voltage switchgear and control gear - Part 1: Common specifications
i) ISO 1460: Metallic coatings - Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area
j) BS 729 : Specification for Hot dip galvanized coatings on iron and steel articles

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	40 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	100%
5	Average Annual Rainfall	150cm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPC-M/TPDDL/TPCODL/TPNODL/TPWODL/TPSODL/TPADL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed up to 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

4. GENERAL TECHNICAL REQUIREMENTS

S. No.	Particulars		Requirements	
		11kV	**33 kV**	**66Kv**
4.1	Application	Outdoor	Outdoor	Outdoor
4.2	Type	VCB	VCB	SF06
4.3	Rated voltage	12KV	36 kV	72.5kV
4.4	Service voltage	11KV	33 kV	66kV
4.5	Rated Frequency	50 Hz	50 Hz	50 Hz
4.6	Number of phases	3	3	3
4.7	Rated insulation level			
4.7.1	Rated Lightning impulse withstand voltage			
a	To earth and b/w Poles	75 kVp	170 kVp	325kVp
b	Across the isolating distance	75 kVp	195 kVp	325kVp
4.7.2	Rated short duration power frequency withstand voltage			
a	To Earth and between Poles (Dry test for 1 Min)	28 kV	70 kV	140kV
b	To Earth and between Poles and across the isolating distance (Wet test for 10 Sec)	28 kV	75 kV	140kV
c	Across Open Switching Device	28 kv	75 kV	140kV
4.8	Rated normal current	1250 A	1250 A / 2000 A	1600 A
4.9	Rated load breaking current (sym)	25 kA	25 kA (rms)	31.5 kA (rms)
4.1	Percentage DC component	<40 %	<50 %	<50 %
4.11	Rated short circuit withstand current for 3 seconds	25 kA	25 kA (rms)	31.5 kA (rms)
4.12	Rated short circuit making current	62.5 kA	62.5kA	78.75 kA
4.13	First Pole to Clear factor	1.5 for Terminal fault		
		1 for Short line fault		
		2.5 for Out of phase fault		
4.14	Rated capacitive switching currents			
4.14.1	Rated line charging breaking current	As per IEC 62271-100	10 A (rms)	10 A (rms)
4.14.2	Rated cable charging breaking current	25 A (rms)	50 A (rms)	125 A (rms)

4.14.3	Rated single capacitor bank breaking current	400 A (rms)	400 A (rms)	400 A(rms)
4.14.4	Capacitor Banks with series reactors switching capacity	Suitable for 7.62MVAr capacitor banks with Series Reactors	Suitable for 14.4MVAR Capacitor Banks with series reactors	Suitable for 28.8 MVAR Capacitor Banks with series reactors
4.15	Maximum switching over voltages for cable charging & capacitor bank breaking current	2.5 p.u		
4.16	Rated operating sequence	0-0.3sec-CO-3min-CO		
4.17	Total Break time(max)	45 ms (Shall not change during operating life)	45 ms(Shall not change during operating life)	45 ms(Shall not change during operating life)
4.18	Closing time (max)	60 ms (Shall not change during operating life)	60 ms(Shall not change during operating life)	60 ms(Shall not change during operating life)
	CO Time (max)	100ms		
	Spring charging time	<15 s		
4.19	Rated supply voltage of control circuits	220/110/48/24V DC *Control Voltage will be shared by concern TP DISCOM at the time of release of RO/PO		
4.19.1	Range for satisfactory operation of Trip circuit	70% to 110%		
4.19.2	Range for satisfactory operation of closing & other circuits	85% to 110%		
4.2	Transient recovery voltages	As per IEC 62271-100		
4.21	No. of auxiliary contacts	10 NO & 10 NC		
4.22	**Clearance in air (**As per IEC 62271-100**)**			
4.22.1	Between phases	300 mm	320 mm	630 mm
4.22.2	phase to earth	370 mm	320 mm	630 mm
4.23	Min. creepage distance of insulator	31mm per kV		
4.24	Degree of Protection	IP 55		
4.25	Operating mechanism	Spring charged by universal motor.		
4.26	Operation	Gang operated		
4.27	Temp. rise at rated normal current	As per IEC 62271-100		

4.28	Minimum Vertical clearance of live conductor from ground level	As per CEA guidelines		
4.29	Mechanical Endurance	M2		
4.3	Electrical Endurance	E2 with Auto-reclosing	E2 with Auto-reclosing	E1 / E2
4.31	Restriking Class	C2		
4.32	Class	S2		
4.33	Material of main contact	Should be as that in Clause 5.6.1		
4.34	Interrupter	Vacuum Interrupter should be of same make as that of Breaker manufacturer. Representative shall visit Interrupter manufacturing Facility during Factory Inspection.		
4.36	Contact Resistance	<30 μΩ (shall not change by ±10% during operating life)		
4.37	Panel illumination and space heating	Shall be suitable for 240V AC±10% Space Heater – min. 80 W Thermostat – 300C to 1100C LED Lamp with holder – 5 W Door Limit Switch – 6A 3Pin Switch & Socket – 15 A Control Fuse with Base – 6A DP AC MCB – 6A, 10kA I/C AC & DC MCB rating should be 16 A		
4.38	Anti-pumping features	Yes (Anti pumping ckt should be connected with 52a & its own contact in parallel.)		
4.39	Total Weight	Bidder to provide		
4.40	Dimensions	Bidder to provide		
4.42	No. of operations			
4.42.1	At rated normal current	Bidder to provide		
4.42.2	At rated capacitor bank breaking current	Bidder to provide		
4.42.3	At SC breaking current	Bidder to provide		
4.43	No. of Breaks per phase	1	1	1
4.44	SF6 Low & Lockout Alarm	-	-	To be provided
4.45	Min. Operating Pressure @200C	NA	NA	Bidder to provide

4.46	Low SF6 Gas Pressure @200C	NA	NA	Bidder to provide
4.47	Nominal Operating Pressure @200C	NA	NA	Bidder to provide
4.48	Permissible Gas leakage	NA	NA	Max. 1% per year
4.49	Qty. of Gas	Bidder to provide		

Circuit Breaker shall be suitable for switching capacitor bank of rating 7.62 MVAr for 11KV , 14.4 MVAR for 33 kV & 28.8 MVR for 66 kV with capacitor bank star point undergrounded and series reactors (rating 6% of capacitor bank rating if connected on line side & 0.2 % if connected on neutral side of the capacitor bank rating). The circuit breakers should withstand capacitor bank inrush currents.

5. GENERAL CONSTRUCTIONS

5.1 GENERAL:

5.1.1 The Circuit Breakers shall be outdoor type, comprising three identical single pole units, moisture proof, complete in all respects with all fittings and wiring, majorly as follows:

- Breaker assemblies with bases
- Support structure
- Control cabinet
- Foundation bolts
- Terminals and operating mechanisms
- All required accessories for efficient and trouble-free operation
- Provided with two independent trip coils and one closing coil for better reliability.
- Breaker shall be supplied with Two Tripping Circuit. Pre & Post Trip Circuit supervision relay should also be provided and is required in both circuits.
- There shall be separate contactor for each coil.

5.1.2 The removable parts of the breaker shall be freely interchangeable without the necessity of any modification at site. Checking and removal of components shall be possible without disturbing adjacent equipment. All equipment shall be easily accessible for routine inspection and repairs.

5.1.3 The terminal pads shall be made up of electrolytic copper and shall be silver plated. The current density of the terminal pads shall not exceed 1.6A/sq.mm. The terminal pad shall have protective covers which shall be removed before interconnections.

5.1.4 The height of manual operating handle shall not be more than 1500mm from ground level. The control cabinet shall be provided with "Pistol Grip" type T-N-C Switch for local operation and a Local/Remote Switch.

5.1.5 No external damping circuit shall be acceptable with the circuit breaker. Breaker tripping curve to be provided by the bidder.

5.1.6 Provisions shall be made for attaching an operational analyzer after installation of circuit breakers at site to record contact travel, speed and making measurement of operating timings, synchronization of contacts in one pole. Bidder shall have to supply a suitable adopter/transducer as per TPCODL/TPNODL/TPWODL/TPSODL/TPAL/TPC-M/TPDDL. Operational analyzer, so that the offered circuit breaker can be used with the operational analyzer.

5.1.7 The circuit breaker shall be designed to withstand the rated terminal loads, wind load/ earthquake load, short circuit forces. Supportive design calculation for the same shall be submitted along with bid documents. Floor clamps, Foundation bolts, Lifting hooks and one manually operated tank lifting & lowering device for frame-mounted tanks shall be provided. Exposed live parts shall be placed high enough above ground to meet the statutory requirements and safety codes. All Terminal blocks shall be stud type and ring type lugs. Bidder shall give suitable provision in CB such as space, auxiliary contact with wiring etc. for providing castle lock by TPCODL/TPNODL/TPWODL/TPSODL/TPAL/TPC-M/TPDDL. CB mechanism internals shall be easily accessible during maintenance troubleshooting.

5.1.8 Floor clamps, Foundation bolts, Lifting hooks and one manually operated tank lifting & lowering device for frame-mounted tanks shall be provided. All similar parts, particularly removable ones shall be interchangeable with one another. Exposed live parts shall be placed high enough above ground to meet the statutory requirements and local safety codes. All Terminal blocks shall be stud type. Bidder shall give suitable Provision in CB such as space, auxiliary contact with wiring etc. for providing castle lock by purchaser.

5.1.9 **For SF6 Circuit Breaker:**

a. Vent outlets of the circuit breaker shall be so situated that a discharge of gas shall not cause electrical breakdown and is directed away from any location where persons may be present. The necessary safety distance shall be stated by the bidder. The construction shall be such that gas cannot collect at any point where ignition can be caused, during or after operation, by sparks arising from normal operation of the circuit breaker or its auxiliary equipment.

b. Suitable pressure gauge to be provided to monitor the SF6 pressure. Cable connecting pressure gauge with circuit breaker shall be laid with GI flexible pipe. A small canopy for SF6 gas pressure gauge shall be provided to protect the gauge from rain. The Copper Tubes to be used shall be silver plated.

5.2 VCB CIRCUIT BREAKER FOR 11 kV & 33kV:

5.2.1 An indicator/means to indicate status of contact erosion should be provided, to know the residual life of vacuum interrupter.

5.2.2 The insulating ceramic body of the interrupter should have high mechanical strength and it should be capable of withstanding high temperature without any significant deterioration in its mechanical and electrical properties.

5.2.3 The metal/alloy used for the fixed and moving contacts shall have very low resistivity and low gas content. They should be resistant to arc erosion and the contact should have no tendency to get Cold Welded under the high vacuum in the interrupter. The interrupter

design should ensure rapid de-ionization of the gap so that normal electrical strength of the gap is restored instantaneously.

5.2.4 The metallic bellow or any other similar vacuum sealing arrangement should be provided at the moving contact and should have a long fatigue life. A pressure gauge to monitor positive pressure lower part of the pole is to be provided to protect ingress of moisture.

5.3 SF6 CIRCUIT BREAKER FOR 66kV:

5.3.1 The circuit breakers shall be single pressure type Circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breaker. SF6 gas filling point shall be of hot dip galvanized. SF6 Pipe should come with anti-corrosion treatment.

5.3.2 All gasketted surfaces shall be smooth, straight and reinforced, if necessary, to minimize distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 1% per year. In case the leakage under the specified condition is found to be greater than 1% after one year of commissioning of circuit breaker, the manufacturer will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during first year of operation after commissioning.

5.3.3 In the interrupter assembly there shall be an absorbing product box to minimize the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products. Each pole shall form an enclosure filled with SF6 gas independent of two other poles, the SF6 density of each pole shall be monitored.

5.3.4 The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale.

5.3.5 It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by providing suitable interlocked non return valve coupling. SF6 Gas Filling Point/Test Point shall be accessible easily. Each circuit breaker shall be capable of withstanding a vacuum of minimum 8 millibars without distortion or failure of any part. Sufficient SF6 gas including that will be required for gas analysis during filling shall be provided to fill all the circuit breakers installed.

5.3.6 The SF6 gas shall be suitable in all respects for use in the switchgear under the worst operating conditions. The high pressure cylinders in which the SF6 gas is shipped and stored at site/store.

5.4 OPERATING MECHANISM:

5.4.1 Circuit breaker shall be power operated through a motor compressed spring charging mechanism. The mechanism shall be housed in a weather proof and dust proof control cabinet. The operating mechanism shall be strong, rigid, not subject to rebound and shall be readily accessible for maintenance for a man standing on ground or a Platform which to be provided by Bidder. Spring operated mechanism shall be complete with motor, opening spring, closing spring and all necessary accessories to make the mechanism a complete operating unit.

5.4.2 Spring charging motor shall be universal type with overload protection and overload

relay with contacts for annunciation. Each mechanism shall be so designed as to enable a continuous sequence of circuit breaker opening and closing operations to be obtained by the control switch as long as power is available to the motor, and at least one circuit breaker opening and closing after failure of power supply to the motor. Also, the Circuit breaker shall have suitable provision for manual spring charging. Anti-pumping feature shall be provided.

5.4.3 The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices. Operating mechanism shall normally be operated by remote electrical control. Provision shall be made for local electrical control and a "local/remote" selector switch shall be provided in the operating mechanism cubicle. A conveniently located manual tripping lever or button shall also be provided for tripping the breaker and simultaneously opening the reclosing circuit. A manual closing device that can easily be operated by one person standing on the ground shall also be provided for maintenance purposes. Each circuit breaker unit shall be provided with operation counter.

5.4.4 A mechanical indicator shall be provided to show open and close position of the breaker. It shall be located in a position where it will be easily visible from the ground level with the mechanism housing closed. An operation counter shall also be provided in the central control cabinet.

5.4.5 A closing release shall operate correctly at all values of voltage between 70% and 110% of the rated voltage. A shunt trip shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage.

5.4.6 Working parts of the mechanism shall be of corrosion resisting material. Bearing which require greasing shall be equipped with pressure type grease fittings. Bearing pins, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.

5.4.7 Main poles of each breaker shall be connected together and operated by a common mechanism and shall be so adjusted and arranged that interrupting contacts of all phases can be readily adjusted to touch and part simultaneously.

5.4.8 Provision shall be made to enable electrical & Castel Key interlocking with the opening or closing of the isolator when breaker is closed. All electrical and mechanical interlocks, which are necessary for safe and satisfactory operation, shall be furnished.

5.4.9 **For SF6 Circuit Breaker:** The mechanism shall be anti-pumping and trip free under every method of closing. The mechanism of the breaker shall be such that the position of the breaker is maintained even after the leakage of SF6 gas.

5.5 CONTROL CABINET:

5.5.1 Control cabinets shall be of the dust, moisture, vermin proof and free standing floor mounting out door type. Control Cabinets shall be CRCA, surface treated for anti-oxidation/corrosion and power coated with epoxy highly suitable for outdoor installations (test reports shall be submitted). Door stopper provision to be provided in the control cabinet.

5.5.2 Control cabinets shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel shall be at least 3mm thick. 15mm thick neoprene gaskets shall be provided to ensure degree of protection of IP 55. Control cabinets shall be provided with hinged door and padlocking arrangement. The door hinges shall be of union joint type to

facilitate easy removal. Door shall be properly braced to prevent wobbling. Cable entry from bottom.

5.5.3 All wiring in the control cabinet shall be carried out with 1100V grade single core multi strand flexible copper conductor wires of size not less than 2.5sq.mm with HRPVC insulation and shall be flame retardant, vermin and rodent proof.

5.5.4 All necessary cable terminating accessories such as glands, crimp type tinned copper lugs etc., for control cables shall be included in Bidder's scope of supply. Suitable double compressed brass cable glands shall be provided for cable entry.

5.5.5 Push button shall be rated for not less than 6 Amps. 240 V ±10% AC or 2 Amps, 24/48/110/220 V DC and shall be flush mounted on the cabinet door and provided with appropriate name plates. Electrical and Mechanical indications for ON, OFF & spring charged to be provided which is visible from the front. Red, Green and Amber / Blue indicating lamps shall be flush mounted and provided with series resistors to eliminate the possibility of short circuiting of control supply in the event of fusing of lamps.

5.5.6 24/48/110/220 V DC LED Type Indicating Lamps shall be mounted inside control cubicle which shall be visible from outside through glass of cubicle door. Control Voltage will be shared by concern TP DISCOM at the time of release of PO/RO.

5.5.7 Breaker ON - Red
5.5.8 Breaker OFF – Green
5.5.9 Spring Charged – Blue

5.5.10 Terminal boards shall be furnished in the mechanism housing. All the terminal blocks shall be of disconnecting type links. Terminals for DC and AC shall be isolated from each other. A minimum of 20% spare terminals for control wiring shall be provided. All wiring in the housing shall be stranded and the insulation shall be vermin proof. All terminals shall be provided with ferrules indelibly marked or numbered and these identifications shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity which shall not be less than 10 Amps. Insulation shall be such that it shall not support combustion. Suitably rated switches shall be provided to enable the control supply to the breaker to be cut off from the mechanism housing. Requisite number of cable entries shall be provided at the bottom of the operating cabinet to receive purchaser's control cables. Number and size of cable glands will be intimated to the bidder. A light point with a control switch shall be provided inside the housing of the breaker.

5.5.11 Strip type space heaters of suitable /min. 80W capacity shall be provided inside the control cabinet to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240 V ±10%, 1 phase, 50 Hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. Heaters shall be complete with double pole MCB for phase and neutral of the heater supply. An adjustable type thermostat shall be provided in the heater control circuit with temperature range of 30-110º C.

5.5.12 Height of operating box of the CB shall be specified. The height of manual operating handle shall not be more than 1500mm from ground level. The operating box shall be provided with T-N-C switch "Pistol Grip" type for local operation. Separate terminal box below the main operating box to accommodate the terminal blocks shall be provided.

5.5.13 Control Cabinet shall be provided with a 5W, 240V AC±10%, 1-Ph, 50Hz LED for the interior illumination of the panel during maintenance. The fitting shall be complete with switch-fuse unit and the switching of the fitting shall be controlled by the respective

panel door switch.

5.5.14 No external damping circuit shall be acceptable with the CB. Breaker tripping curve to be provided by the bidder.

5.6 CONTACTS:

5.6.1 Main contacts shall have sufficient area and contact pressure for carrying the rated current and the short time rated current of the breaker without excessive temperature rise that may cause pitting or welding. Contacts shall be adjustable to allow for wear, easily replaceable and shall have a minimum of movable parts and adjustments to accomplish these results. Main contacts shall be the first to open and the last to close. All contacts shall be silver coated (with thickness of 15 micron) and Contact materials should be as per Type tested design.

5.6.2 All making and breaking contacts shall be sealed free from atmospheric effects. Contacts shall be designed to have adequate thermal and current carrying capacity for the duty specified and to have a life expectancy so that frequent replacements due to excessive burning will not be necessary. Provision shall be made for rapid dissipation of heat generated by the arc on opening.

5.7 BUSHINGS:

Porcelain used in bushing manufacture shall be a single piece and homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Glazing of the porcelain shall be of uniform brown color free from blisters, burns and similar other defects. Bushings shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable. Insulation of bushings shall be coordinated with breaker insulation so that impulse flashovers will occur outside the tank. Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulation or supports by the formation of substances produced by chemical action. No radio disturbance shall be caused by the bushings when operating at the normal rated voltage. Iron parts shall be preferably hot-dip galvanized, all joints shall be airtight. Surfaces of the joints shall be trued up; porcelain parts by grinding and metal parts by machining. Bushing design shall be such as to ensure a uniform compressive pressure on the joints. All current carrying contact surfaces shall be silver-plated. Silver plating shall not be less than 15 Micron. Thickness. Bushings shall satisfactorily withstand the insulation level specified in the relevant IS.

5.8 PRIMARY TERMINALS:

Primary terminals shall be Silver plated copper suitable for wedge type connectors with (PANTHER for 11kv, ZEBRA for 33kV & 66kV) conductors. Connectors is in scope of the bidders. It should have Primary terminals (connected at fixed contact) on either side at top in case of bypassing CB.

5.9 SUPPORT STRUCTURES:

5.9.1 Support structures including foundation bolts shall be hot dip galvanized. The support structure shall meet the following requirements.

5.9.2 The minimum vertical distance from the bottom of the lowest porcelain part of the enclosures to the circuit breaker base, where it rests on the foundation pad shall be 2.55

meters. The structure design shall be such that during operation of circuit breaker vibration are reduced to minimum.

Structure Material details

Mass of Zinc Coating	Min 705 gm/m_2
Zinc Coating Thickness & No of Dips	Min. 100 Micron at every point with 6 Dips
Chemical composition	Grade: E 250 A (As per IS: 2062)

5.10 CT Mounting Arrangement: (To be finalized during Detailed Engineering)

CT Mounting Arrangement shall be in scope of supplier. Supplier has to provide the detailed calculation for selection of all Load Bearing Components. Components shall be GI.

For 33 kV:

CT Base shall be 450 X 450 mm (Hole Centre to Centre)
Minimum weight to be considered: 150kg per CT.

For 11 kV:

CT Base shall be 310 X 310 mm (Hole Centre to Centre)
Minimum weight to be considered: 80kg per CT.

Requirement of CT mounting arrangement on structure along with Circuit Breaker shall be specified at the time of tender.

5.11 GALVANIZING:

I. All galvanizing shall be carried out by the hot dip process, in accordance with IS 2629/ ISO 1460 amended to date. However, high tensile steel nuts, bolts and spring washers shall be electro -galvanized to service condition four. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath, which could have a detrimental effect on the durability of the zinc coating.

II. The minimum mass of Zinc coatings shall be as per IS 4759. After galvanizing no drilling or welding shall be performed_ on the galvanized parts of the equipment except that nuts may be threaded after galvanizing. All hardware, nuts, bolts, washers & spring washers shall be of Hot Dip Galvanized with minimum 86 micron thickness.

III. To avoid the formation of white rust, galvanized material shall be stacked during transport and stored in such a manner as to permit adequate ventilation. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization. The galvanized steel shall be subjected to tests as per IS-2633/ BS 729 amended to date.

5.12 EARTHING:

a) Suitable grounding terminals shall be provided on the circuit breaker on opposite sides, for connecting to earth pit. The earthing terminals shall be readily accessible and so placed that the earth connection of the circuit breaker is maintained even when the cover or any other movable part is removed.

b) GI strip for earthing shall be of size 50 mm X 6mm, approx. The earthing terminals shall be of adequate size, be protected against corrosion and shall be metallically clean. The earthing terminal shall be identified by means standard symbol marked in a legible and indelible manner on case or frame to be earthed adjacent to the terminals. Bolts & Nuts of Size M12 shall be provided at both ends of earth bus to

facilitate connection with TPCODL/TPNODL/TPWODL/TPSODL/TPAL/TPC-M/TPDDL existing earth connection.

c) The earth bus shall be located at sufficient height from the gland plate and shall not be removable from the outside of the cubicle. Each door earthing (2.5 sqmm flexible stranded copper conductor of green color) shall also be provided with bolted lugs. Earth pads with provision of 03 nos M12 bolts should be provided at both ends.

5.13 PAINT & FINISH:

All sheet steel work shall be phosphate in accordance with the IS: 6005 "Code of practice for phosphating iron and steel". It should follow the 9/10 tank process. Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water rinsing with a slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoved type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved. Thereafter an established painting procedure like electrostatic painting shall be followed for powder coating the panel. The color shade shall be Siemens grey RAL 7032/ Shade 631 as per IS 5 with thickness not less than 80 microns. All Hardwires (Bolts, Nuts, Washers, Spring Washers etc.) shall be Hot Dip galvanized or Stainless Steel. In case of connection of two different metals, bimetallic nuts & bolts shall be used with washer arrangement. Paint shall be complied minimum C4 atmospheric corrosively category as per EN ISO 12944-5.

5.14 ACCESSORIES:

The circuit breakers shall be provided with the following accessories, in addition to those needed for normal operation and control:-

a. Breaker position indicator (ON/OFF status)

b. Breaker Operation counter

c. T-N-C switch

d. A local mechanical emergency trip device with necessary shrouds

e. Common pressure gauge with alarm and trip contacts (for low SF6 pressure) for SF6 breakers

f. Castle key & lock (Series will be finalized during detail engineering)

g. Electrical & mechanical interlocks with isolators

h. A heater rated 240V±10% AC, 50 Hz for the operating mechanism housing heater current monitor

6. NAME PLATE & MARKING:

Circuit breaker and its operating devices shall be provided with durable and legible nameplates containing all technical parameters. Name plate for Circuit breaker shall be embossed with "PO No. with date", "PROPERTY OF Concern TP DISCOM", along with the following information: Manufacture's name, Type designation and serial number

1. Year of manufacture
2. Relevant standard
3. Rated voltage
4. Rated lightning impulse withstand voltage
5. Rated switching impulse withstand voltage
6. Rated normal current
7. Rated duration of short circuit
8. Rated short circuit breaking current
9. DC time constant of the rated short circuit breaking current if different from 45 ms
10. DC component of the rated short circuit breaking current at contact separation corresponding to the dc time constant of the rated short circuit breaking current
11. Rated operating sequence
12. Classification
13. Rated Insulation Level
14. Weight
15. Guarantee Period (60/66 Months)
16. Control Voltage

Name plate for the operating device shall be provided with following information:

1. Manufacturer's name
2. Type designation and serial number
3. Relevant standard

7. TESTS

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine/acceptance tests shall be witnessed by the Purchaser/his authorized representative. Following tests shall be necessarily conducted in addition to others specified in relevant standards.

7.1 Routine tests:

1. Dielectric tests on the main circuit
2. Tests on auxiliary and control circuits
3. Measurement of the resistance of the main circuit
4. Tightness tests
5. Design and Visual checks
6. Mechanical operating tests
7. Dynamic contact resistant measurement (Signature test)
8. High Voltage test at VI. IR test should be carried out Before & after HV test
9. Trip coil resistance check
10. Close coil resistance check.
11. SP charging motor resistance check.

7.2 Type tests:

1. Dielectric Tests
2. Measurement of the resistance of the main circuits
3. Temperature rise tests
4. Short time withstand current and peak withstand current tests
5. Mechanical operation test at ambient temperature
6. Short circuit making and breaking tests
7. Verification of the degree of protection
8. Tightness tests
9. Mechanical tests
10. Out of phase making and breaking tests

11. Electrical endurance tests
12. Double earth fault tests
13. Capacitive Current switching tests
14. Static Terminal Load (Calculation to be submitted)
15. Short line fault tests (for 66kV only)

The above type test certificates must accompany drawing of type tested equipment, duly signed by type testing authority.
The above tests must not have been conducted on the equipment within time frame as per latest CEA Guidelines.

In case of any change in design/type of Breaker already type tested and the one offered against this specification, the owner reserves the right to demand repetition of type tests, without any extra cost.

8. TYPE TEST CERTIFICATES

The Bidder shall furnish the type test certificates of the Item for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA/CESI/KEMA/KERI/PEHLA as per the relevant standards. Type tests should have been conducted in certified Test laboratories during the period not exceeding years as per CEA Guidelines from the date of opening the bid. In the event of any discrepancy in the test reports, I.e. any test report not acceptable, same shall be carried out without any cost implication to TPCODL/TPNODL/TPWODL/TPSODL/TPAL/TPC-M/TPDDL.

9. PRE DISPATCH INSPECTION

The Material shall be subject to inspection by a duly authorized representative of the TP DISCOM. Inspection may be made at any stage of manufacture at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to RESPECTIVE TP DISCOM representatives at all times when the work is in progress. Inspection by the RESPECTIVE TP DISCOM or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL/TPNODL/TPWODL/TPSODL.

Following documents shall be sent along with material
a) Test reports
b) MDCC issued by TPCODL/TPNODL/TPWODL/TPSODL
c) Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORES

The material received at Respective TP DISCOM store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.

11. GUARANTEE

Bidder shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Company up to a period of 60 months from the date of commissioning or 66 months from the

date of last supplies made under the contract, whichever is earlier, bidder shall be liable to undertake to replace/rectify such defects at his own costs. within mutually agreed timeframe, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at bidder's risks and costs and recover all such expenses plus the Company's own charges(@ 20% of expenses incurred), from the bidder or from the " Security cum Performance Deposit" as the case may be.
The bidder shall further be responsible for “Free Replacement” for another period of THREE years from the end of the guarantee period for any “Latent Defects” if noticed and reported by the company.

12. PACKING:

1. Bidder shall ensure that all equipment covered by this specification shall be prepared for air/rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit.
2. The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
3. The packing shall be suitable for outdoor storage under wet climatic conditions during rainy season.
4. Suitable cushioning, protective padding or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
5. The bidder shall provide instructions regarding handling and storage precautions to be taken at site.
6. All packing cases shall be marked legibly and correctly with indelible ink.
7. Note: Single use plastic not to be used for packing of the material.

13. TENDER SAMPLE : Not required

14. QUALITY CONTROL:

The bidder shall submit with the offer, assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, Components during manufacture and after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's/ Consultant's engineer shall have free access to the manufacturer/sub bidder's works to carry out inspections.

15. MINIMUM TESTING FACILITIES:

Bidder shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16. MANUFACTURING ACTIVITIES:

CAT-B/CAT-A approval is mandatory to start manufacturing works.

17. SPARES, ACCESSORIES & TOOLS SPARES

Following spares along with product catalogue, part no. shall be supplied along with Circuit Breaker. The quantity of spare shall be as per below mentioned list,

Vacuum Circuit Breaker (11 / 33kV) – 1 Set	**SF6 Circuit Breaker (66kV) – 1 Set**
Trip Coil – 01 with each CB	Trip Coil – 01 with each CB
Closing coil – 01 with each CB	Closing coil – 01 with each CB
Local / Remote selector switch – 01 with each CB	Local / Remote selector switch - 01 with each CB

T-N-C Switch – 01 with each CB	T-N-C Switch - 01 with each CB
Limit Switch – 01 with each CB	Pressure Switch – 01 with each CB
Spring Charging Motor – 01 upto 5 nos. CB	Limit Switch – 01 with each CB
Pole Assembly – 01 upto 5 nos. CB	Spring Charging Motor – 01 upto 5 nos. CB
Vacuum interrupter – 01 upto 5 nos. CB	Pole Assembly – 01 upto 5 nos. CB
Driving Mechanism Box – 01 upto 5 nos. CB	SF6 Gas Leak detector – 01 upto 5 nos. CB
	Overhauling Kit – 01 upto 5 nos. CB
	Driving Mechanism Box – 01 upto 5 nos. CB
	Set of Pole Gasket & Seals – 01 upto 5 nos. CB

In addition to above bidder shall submit recommended list of spares for 3 years, if any with unit prices and recommended quantity. All spare parts shall be interchangeable in similar make, model of the Circuit Breaker. SERVICE LIFE: Bidder need to provide life cycle support and supplies to ensure necessary support in terms of services and spares for next 25 years from date of supply.

ACCESSORIES: The circuit breakers shall be provided with the following accessories, in addition to those needed for normal operation and control

1. Breaker position indicator
2. Breaker Operation counter (with provision of integration with SCADA)
3. T-N-C switch & L-R Switch
4. A local mechanical emergency trip device with necessary shrouds
5. Castle key & Lock (Series will be finalized during detail engineering)
6. Electrical & Mechanical interlocks with isolators
7. A heater rated 230 volts AC, 50 Hz for the operating mechanism housing heater current monitors.
8. Insulated spring charging handle along with additional sleeve (for holding the handle).
9. Trip coil & close coil should be conventional type. Electronic close & tripping coil not required.

SPECIAL TOOLS & GAUGES: A list of complete set of special tools and gauges required for erection & maintenance and installation procedure shall be submitted.

17. DRAWINGS AND DOCUMENTS

Following documents shall be prepared based on RESPECTIVE TP DISCOM specifications and statutory requirements with complete BOM and shall be submitted with the bid:

a) Completely filled in Technical Particulars.
b) General description of the equipment and all components including brochures.
c) Type test Certificates
d) Experience List/Performance Certificates from end users.
e) Foundation Plan
f) Operation & Maintenance Manual

After the approval of the contract, four (4) copies of the drawings, drawn to scale, describing the equipment in detail shall be forwarded for approval and shall subsequently provide four (4) complete sets of final drawings, one of which shall be auto positive suitable for reproduction, before the dispatch of the equipment. Soft copy of all the drawing, GTP, test certificates shall be submitted after the final approval of the same to the purchaser

Following Drawings/Documents shall be submitted after the award of the contract

S. No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√		√
2	GA Drawings	√		√
3	Internal Wiring Diagram		√	√
4	Foundation Plan		√	√
5	Installation Instruction		√	√
6	Transport/Shipping dimension Drawing		√	√
7	QA & QC Plan	√	√	√
8	Test Certificate	√	√	√

All the Documents and Drawings shall be in English Language.

Instruction Manuals: Bidder shall furnish two (2) soft copies (CD) and four (4) hard copies of nicely bound manual (in English Language) covering erection and maintenance instructions and all relevant information pertaining to the main equipment as well as auxiliary devices.

18. GUARANTEED TECHNICAL PARTICULARS

S. No.	Description	Units	To Be Furnished by Bidder
			Circuit Breaker_ Outdoor Type
1	Application		
2	Type		
3	Rated voltage	kV	
4	Service voltage	kV	
5	Rated Frequency		
6	Number of phases		
7	Rated insulation level		
7.1	Rated Lightning impulse withstand voltage		
a	To earth and b/w Poles	kVp	
b	Across the isolating distance	kVp	
7.2	Rated short duration power frequency withstand voltage		
a	To earth and b/w Poles (dry test for 1 min)	kV	
b	Across the isolating distance(dry test for 1 min)	kV	
c	To earth and b/w Poles and across the isolating distance(wet test for 10 sec)	kV	

8	Rated normal current	A	
9	Rated load breaking current (sym)	kA (rms)	
10	Percentage DC component		
11	Rated short circuit withstand current for 3 seconds	kA	
12	Rated short circuit making current	kA	
13	First Pole to Clear factor		
14	Rated capacitive switching currents		
14.1	Rated line charging breaking current		
14.2	Rated cable charging breaking current	A	
14.3	Rated single capacitor bank breaking current	A	
14.4	Capacitor Banks with series reactors switching capacity	MVAR	
15	Maximum switching over voltages for cable charging & capacitor bank breaking current	p.u.	
16	Rated operating sequence		
17	Total Break time(max)	ms	
18	Total closing time	ms	
19	CO time	ms	
20	Pole discrepancy	ms	
21	Rated supply voltage of control circuits	V	
21.1	Range for satisfactory operation of Trip circuit		
21 2	Range for satisfactory operation of closing & other circuits		
20	Transient recovery voltages		
21	No. of auxiliary contacts		
22	Clearance in air		
22.1	Between phases	mm	
22.2	phase to earth	mm	
23	Min. Creepage distance of insulator	mm	
24	Degree of Protection		
25	Operating mechanism		

26	Anti-pumping feature		
27	Spring charging time		
28	Temp. rise at rated normal current	Deg C	
29	Vertical clearance of live conductor	mm	
30	Mechanical Endurance		
31	Electrical Endurance		
32	Restriking Class		
33	Class		
34	Main Contacts		
34.1	Type		
34.2	Material		
35	Arcing Contacts		
35.1	Type		
35.2	Material		
36	No. of operations		
36.1	At rated normal current		
36.2	At rated capacitor bank breaking current		
36.3	At rated short circuit breaking current		
37	No. of breaks per phase		
38	Minimum contact resistance		
39	**FOR VCB Type**		
39.1	Type of indication for contact erosion		
39.2	Rating of interrupter		
39.3	Make of interrupter		
40	Connectors		
41	Type test certificates		
42	Test for Re-strike free for VCB		
43	Total weight of breaker (Kg)		
44	Dimensions (mm)		

19. SCHEDULE OF DEVIATIONS

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

S. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above

Seal of the Company:

Signature

Designation

20. SAMPLE DRAWING (For Tender purpose only)