



Maharashtra State Electricity Distribution Company Limited

SPECIFICATION NO. T&QC: MSC-I/ 33 kV, 400 Amps /800 Amps /1600 Amps Outdoor
Vacuum Circuit Breaker with Breaker Cabinet/2019/06

Technical Specification

Of

33 kV, 400 Amps /800 Amps /1600 Amps Outdoor Vacuum Circuit Breaker
with Breaker Cabinet

For

Distribution System

In

MSEDCL

I N D E X

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MSEDCL

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

Technical Specification for 33 kV, 400 Amps /800 Amps /1600 Amps Outdoor Vacuum Circuit Breaker with Breaker Cabinet

1.0 Scope :-

- i) This specification covers design, manufacture, assembly, testing before supply, inspection, packing and delivery of outdoor type Vacuum circuit breakers of rated insulation class of 33 kV. The Vacuum Circuit Breakers shall be complete with all the accessories and auxiliary equipments required for their satisfactory operation in various sub-stations of MSEDCL in Maharashtra State, India.
- ii) It is not the intent to specify, completely here in all the details of design and construction of the circuit breaker. However, the breaker shall conform, in all respects to high standards of engineering, design and workmanship as per recent Indian standards or International standards. It shall be capable of performing in continuous commercial operation up to the supplier's guaranteed life of equipment in a manner acceptable to the purchaser who will interpret the meanings of drawings and specifications and shall have power to reject any work or material which, in his judgment, is not in accordance therewith. The Vacuum circuit breaker offered shall be complete with all components necessary for its effective and trouble free operation. Such components shall be deemed to be within the scope of supplier's supply, irrespective of whether those are specifically brought out in this specification and/or in the commercial order or not.
- iii) The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.
- iv) The Bidder/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.
- v) Only Vacuum circuit breaker manufacturer can quote against this specification.
- vi) The Vacuum circuit breaker offered shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements.
- vii) Tolerances:
Tolerances on all the dimensions shall be in accordance with provisions made in the relevant Indian /IEC standards and in these specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality of the product.

2.0 System Particulars:-

- | | | |
|---|---|---|
| 2.1 Nominal System Voltage | : | 33 kV |
| 2.2 Voltage variation on supply side | : | ±10 % |
| 2.3 Corresponding Highest System Voltage: | | 36 kV |
| 2.4 Frequency | : | 50 Hz with ± 3 % tolerance |
| 2.5 Transient condition | : | -20 % or + 10 % combined variation of
voltage and frequency. |

- 2.6 Number of Phase : 3 Phases
- 2.7 Neutral earthing : Solidly earthed.
- 2.8 Fault level (minimum) : 25 kA for 3 sec.

3.0 Service Conditions :-

A) The Vacuum circuit breaker to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

- 3.1 Maximum ambient temperature (Degree C) 50
- 3.2 Maximum temperature in shade (Degree C) 45
- 3.3 Minimum Temperature (Degree C) 3.5
- 3.4 Relative Humidity (percent) 10 to 95
- 3.5 Maximum Annual rain fall (mm) 1450
- 3.6 Maximum wind pressure (kg/sq.m) 150
- 3.7 Maximum altitude above mean sea level (Meter) 1000
- 3.8 Isoceramic level (days per year) 50
- 3.9 Seismic level (Horizontal Acceleration) 0.3 g

Moderately hot and humid tropical climate conducive to rust and fungus growth

B) The climatic conditions are prone to wide variations in ambient conditions and hence the Vacuum circuit breaker shall be of suitable design to work satisfactorily under these conditions.

4.0 Auxiliary Power Supply:

The rating, quality and location of electrical supply system that will be made available by the purchaser for operation of the circuit breaker are described below. The auxiliary electrical equipments provided by the bidder for specified operation of the circuit breaker, shall be suitable for operation on the Ratings as below:

a) For A. C. Control & Protective devices, lighting fixtures, space heaters and motors:

A.C. supply 1 phase 2 wire, AC supply with one point grounded.

Voltage : 250 V±10%

Frequency : 50 Hz ±3%

b) For D.C. alarm, control and protective device:

D.C. supply 2 wire, DC source from batteries with midpoint grounded. The available DC supply voltage is 30 V DC.

Voltage : 30 V, -15% to +10%.

5.0 Applicable Standards :-

- i) The design, manufacture and performance of the Vacuum circuit breaker shall comply with all currently applicable statutes, regulations and safety codes.

Nothing in this specification shall be construed to relieve the bidder off his responsibilities.

- ii) The Vacuum circuit breaker meeting with the stipulations of equivalent IEC, ANCI, CSA, DIN standards, which ensure equal or better quality than the standards listed below, shall also be acceptable. In such case the Bidder should submit along with his offer, two copies of such standards in authentic English translation, if the language of the standard is other than English. In case of dispute, the stipulations in the English translation, submitted by the Bidder, shall prevail. Further, in the event of conflict between the stipulations of standard adopted by the Bidder and the corresponding Indian Standard Specification, the stipulation of Indian Standard Specification shall prevail.

- iii) Unless otherwise specified, the Vacuum circuit breaker offered shall conform to the latest applicable Indian, IEC, British, U.S.A. or International Standards and in particular, to the following:-

Sr. No.	Standards	Particulars
1.	IS 13118/ IEC 62271 -100 amended upto date	High-voltage alternating-current circuit-breakers.
2.	IEC 694	Common clauses for switchgear
3.	IS 2099/IEC:815 IS 5621:1980	Porcelain Bushings.
4.	IS 2544	Porcelain Post Insulators
5.	IE C-2331	High Voltage porcelain bushings.
6.	IS 325 -	Specification for 1phase induction motor
7.	IS 12063/ 1987 IEC: 529	Degree of protection provided by enclosures of electrical equipment.
8.	IS 5	Colour for ready mixed paints and enamels.
9.	IEC - 60 -	High voltage test techniques
10.	IS 5578 & IS:11353	Marking and arrangements for switchgears, busbars, main connections and auxiliary wiring.
11.	IS 4794	Push button switches.
12.	IEC - 71 Part-I & II -	Insulation co-ordination, Terms, definitions, principles and rules
13.	IEC 270-	Partial discharge measurements.
14.	IS 2629 -	Recommended practice for hot dip galvanizing of iron and steel.
15.	Indian Electricity Rules.	2005

6.0 Principal Technical Parameters :-

The Vacuum circuit breaker covered under this specification shall conform to specific parameters given below:

Sr. No.	Property	Requirement
1.	Rated voltage of the breaker (KV rms.) Rated System Voltage Highest System voltage	33 kV 36 kV
2.	System frequency	50 HZ
3.	System Neutral grounding	Effectively earthed
4.	Continuous current rating (Amps)	For Incomer : 1600 Amps For Bus Coupler: 800 Amps For Feeder : 400 Amps
5.	Installation	Outdoor
6.	Rated voltage of the breaker (KV rms.) Rated System Voltage Highest System voltage	33kV 36kV
7.	Type of breaker	Vacuum
8.	Mounting	On hot dip galvanized steel support structure or on the operating mechanism box, as the case may be, to be supplied by the bidder.
9.	Number of Poles	3
10.	Type of operation Individual-	Mechanically coupled Three poles gang operated
11.	a) Minimum Clearance between adjacent pole b) Minimum clearance between lowest live part to earth in mm c) Minimum clearance between upper live part (terminal) to lower live part in mm	430 mm (minimum) 450 430
12.	Required clearance from the lowest live part of breaker to ground level	3700 mm
13.	Height of concrete plinth above ground level (mm) (To be provided by the Purchaser).	300
14.	Minimum height of the lowest part of the support insulator from ground level (mm).	3250
15.	Operating mechanism	spring operated
16.	Auto reclosing duty	Three phase

17.	Rated operating duty cycle.	0-0.3 seconds-CO-3-minutes-CO
18.	"First pole to clear" factor	1.5
19.	Max. closing time (ms)	<80 ms
20.	Max. total break(Tripping) time at rated breaking capacity excluding relay time	45-50 ms
21.	1.2/50 micro second impulse withstand voltage:	
	i) to earth (KVP)	170
	ii) Across open contacts: Impulse on one terminal, power frequency voltage on opposite terminal (kvp)	170
22.	One minute power frequency with-stand voltage (KV rms.)	70
23.	Rated symmetrical short circuit breaking current (for 3 seconds) of outdoor circuit breaker in kA (rms)	25 kA
	a) AC component (kA (rms)	25kA
	b) percentage of DC component	Corresponding to minimum opening time as per standard IEC -62271-100
24.	Permissible limit of temperature rise.	As per given below.
25.	Minimum creepage distance of insulator (mm)	900
26	Out of phase breaking capacity	100 % of rated breaking capacity

7.0 General Technical Requirements of Vacuum circuit breaker:-

- i) Vacuum Circuit breakers shall be Porcelain clad Vacuum type. Vacuum circuit breaker shall be M2 class.
- ii) The Vacuum Circuit breakers offered shall be 3-pole mechanically coupled gang operated having rating 25 kA for 3 seconds. Incomer Vacuum Circuit Breaker shall have 1600 Amps continuous current rating; Bus coupler Vacuum Circuit Breaker shall have 800 Amps continuous current rating whereas the feeder (outgoing circuit) Vacuum Circuit breaker shall be of 400Amps. For similar rated Vacuum Circuit breakers, it shall be possible to interchange the CBs if required in future.
- iii) C.B. shall be suitable for rapid reclosing cycle 0-0.3 sec - CO - 3 min-CO. clear factor shall be 1.5
- iv) Similar parts of the breaker, especially the removable ones, shall be freely interchangeable without the necessity of any modification at site.

8.0 Breaker Contacts:

- i) Main contacts shall have ample area and contact pressure for carrying the rated continuous and short time currents of the breaker without excessive temperature

rise which may cause pitting or welding. Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear.

- ii) The inside operating rod or insulated fiber glass connecting rods wherever used, shall be sturdy and shall not break during the entire life period of the breaker. The insulated rods shall have anti tracking quality towards electrical stresses.

9.0 Specification for Operating Mechanism Housing and Control Cabinets:

- i) The specification covers the requirements of control cabinets and associated control and equipment. Cabinets shall preferably be of the free standing floor mounting type for HV CBs.
- ii) Control cabinets shall be sheet steel enclosed and shall be dust, water and vermin proof. Sheet steel shall be at least 3.0 mm thick when control cabinets are intended for outdoor operation. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Control cabinets shall be provided with double hinged door and padlocking arrangement. The door hinges shall be of union joint type to facilitate easy removal and the distance between hinges shall not exceed 350 mm. Door shall be properly braced to prevent wobbling. It shall be painted white on the interior and Dark Admiralty Grey to shade no 632 of IS-5 on exterior surface. The enclosures shall be dust, moisture and vermin proof, to provide a Degree of protection to IP 55 in accordance with IS 12063/1987. 15mm thick neoprene or better type of gaskets shall be provided to ensure degree of protection of at least IP55 as per IEC: 529. It shall have backwards slanting rain hood of 2 mm thick (14 SWG) sheet for protection against rain water. It shall be accommodate following items:

Sr. No.	Item	Quantity
1.	Mechanical ON & OFF knobs (TNC).	1 No.
2.	Electrical ON/OFF push buttons	1 No. each
3.	CB Mechanical ON/OFF indicator	1 No. each
4.	CB Electrical ON/OFF indicator	1 No. each
5.	Mechanical spring charged indicator.	1 No.
6.	Electrical spring charge indicator	1 No.
7.	Auxiliary A.C./D.C. supply indication	1 No. each
8.	Conveniently located manual emergency trip	1 No.
9.	Auxiliary switches as specified elsewhere in this Specification	1 Set.
10.	Control cable termination connector blocks with stud type brass terminals of min 4 mm dia	1 Set.
11.	One power plug along with control switch (240V,10A).	1 Set.
12.	Space heater along with ON/OFF switch and Thermostat.	1 Set.
13.	Cubical illumination lamp with switch.	1 Set.
14.	Mechanical Operation counter to register the	1 No.

	number of breaker operations.	
15.	Local/Remote(For future requirement) switch	1 No.
16.	Trip circuit Healthy-1 indication	1 No.
17.	Trip circuit Helthy-2 indication	1 No.

iii) **Auxiliary Switches:**

- a) Operating mechanism of the circuit breaker shall be provided with adequate number of Cam/Snap type auxiliary switches of normally open and normally closed contacts for the control and operation of the equipment with continuous current rating of 10 Amp. The Breaking capacity of the contacts shall be minimum 2 A with circuit time constant less than 20 milli seconds at the rated D.C. voltage. Normal position of auxiliary switches refers to contact position when circuit breaker is open.
- b) All spare auxiliary contacts of the circuit breakers shall be wired up and brought to the terminal block. Minimum 4 N/O + 4 N/C contacts shall be available on each breaker for this purpose. Auxiliary contact multiplier, if any used, shall be connected to the DC supply only.
- c) Insulation level of auxiliary contacts shall be 1100 volts, 2.5 kV for 1 min.
- d) All the electrical control equipments/switches, the operating point for manual spring charging handle etc. shall not be more than at a height of 1200 mm from ground level OR from a suitable platform which shall be provided by bidder on the structure at a height not more than 985 mm from ground level. It will be possible to reach the control cubicle/operating mechanism box conveniently. Further, electrical ON/OFF push buttons/switch shall be accessible from the ground.
- e) The two steps platform structure with M S angle of size 40mm x 40mm x 6mm shall be provided to breaker structure. The platform shall be such that the working space on the top platform shall not be less than 500 mm x 1000mm for second step top and 300mm X1000 for first step. The total height of the plat form shall be 985mm (485 mm height for first step and 500 mm for second step).The bidder shall specifically confirm that the offered breaker meets this requirement and furnish the G. A. Drawing showing the arrangement.
- f) The circuit breaker shall be provided with motor operated spring charged closing. Spring charging motor shall be suitable for 250V, 50 Hz, single phase AC. Suitable rating starter shall be provided for Motor protection. Spring release coil for closing shall be suitable for 30V DC. Provision shall be available for charging the springs manually as well, and to close CB mechanically.
- g) Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC operation. It shall be possible to trip the breaker manually in case of necessity.
- h) In each circuit breaker, one potential free contact of the limit switch of spring charging motor shall be provided for remote indication of spring charged. This contact shall be wired up and brought to the terminal block.
- i) Electrical anti-pumping device shall be provided for breaker.

iv) **Circuit Breakers control switch:**

- a) Switches should have finger touch proof terminals. For the convenience of maintenance, screw driver guide should be from top/bottom of the switch and not from the side. Terminal wire should be inserted from the side of the switch terminal.
 - b) Terminal screws must be captive to avoid misplace during maintenance.
 - c) Switch shall be with 48 mm x 48 mm escutcheon plate marked with Trip & Close.
 - d) Circuit Breakers control switch shall be Non- discrepancy type
 - e) Trip-neutral-close, with pistol grip handle must be pushed in to spring return to either trip or close position from Neutral position for safety and not just turn to trip.
 - f) One contact to close in each position of Trip and Close. Contact not required in Neutral position. Contact rating shall be 12 A at 30 V DC.
- v) Equipments and devices shall be suitable for operation on specified auxiliary A.C. supply system.
- vi) Push button shall be rated for not less than 10 Amps, 250 Volts A.C. or 10 Amp, 30 V D.C. and shall be flush mounted on the cabinet door and provided with appropriate name plates. Red, green and amber 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.
- vii) Breaker cabinet shall be provided with 250 V, 1-phase 50 Hz, 20 W Fluorescent lighting fixture with on /off switch and a suitably rated 250 V, 1 phase, 5 amp, 3 pin socket for hand lamp.
- viii) All AC control equipment shall be suitable for operation on 250V, 1 Phase two wire 50 Hz system, with one pole grounded.
- ix) Items inside the cabinet made of organic material shall be coated with a fungus resistant varnish.
- x) For protection of AC/DC aux. circuits, MCBs of suitable capacity & reputed make to be provided.

10.0 Operating Mechanism & Associated Equipments:

- i) The circuit breaker shall be designed for electrical local as well as remote control. In addition there shall be provision for local mechanical control.
- ii) The operating mechanism shall be of spring charging type by electrical control under normal operation. The mechanism shall be adequately designed for the specified tripping and reclosing duty. The entire operating mechanism control circuitry, spring charging motor etc., as required, shall be housed in an outdoor type, steel enclosure processed as per cl.no.9.0 (ii).
- iii) All metal parts in the mechanism shall be of corrosion resistant material. All bearings which require greasing shall be equipped with pressure grease fittings.
- iv) The design of the operating mechanism shall be such that it shall be practically maintenance free. The guaranteed number of years in maintenance free operation, the number of possible full load and full rated short circuit current breaking operations without requiring any maintenance or overhauling shall be clearly stated in the tender bid. As far as possible, the need for lubricating the operating mechanism shall be kept to the minimum and eliminated altogether, if possible.

- v) The operating mechanism shall be anti-pumping and trip free There shall be no rebounds in the mechanism and it shall not require any critical adjustments at site. Operation of the power operated closing device, when the circuit breaker is already closed, shall not cause damage to the circuit breaker or endanger the operator. Provision shall be made for attaching an operation analyzer to facilitate testing of breaker at site.
- vi) The technical requirement of spring type operating mechanism shall be as below.
- vii) Spring Operating Mechanism:
 - a) The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism. The mechanism shall be capable of performing the rated operating duty cycle of O-0.3 Sec - CO - 3 min - CO. The spring charging motor shall not take more than 30 sec for fully charge the closing springs and provision shall be made for automatic charging of the closing springs as soon as they are discharged in a closing operation. For this, mechanism shall be such that charging of springs by motor does not interfere with the operation of the breaker.
 - b) The motor shall be adequately rated to carry out a minimum of 10 close and open operations continuously. Also provision shall be made to protect the motor against overloads.
 - c) In case of failure of power supply of spring charging motor, the mechanism shall be capable of performing one sequence of 0 - 0.3 Sec - CO.
 - d) Mechanical interlocks shall be provided in operating mechanism to prevent discharging of closing springs when breaker is already in closed position. Provision shall also be made to prevent a closing operation to be carried out with the spring partially charged.
 - e) Facility shall be provided for manual charging of closing springs. The actuating force required for manually spring charging shall be less than 250N. In support of this requirement the bidder shall furnish test report for actual requirement of force based on actual measurement.

11.0 Limits of Temperature and Temperature Rise for various parts of Material and Dielectrics:

Sr. No.	Nature of the part of the material and dielectric	Maximum Permissible Values of temperature (°C)	Temperature rise at a max. air temperature not exceeding 50°C
1.	Contacts (see note 4) Bare copper and bare copper alloy in air	75	25
	Silver coated or nickel coated (see note 5) -in air	105	55
	Tin coated (see note 5 & 6) in air	90	40
2.	Connections, bolted or the equivalent (see		

	note 7) Bare copper, bare copper alloy or aluminum alloy. -in air	90	40
	Silver coated or nickel coated-in air	115	65
	- Tin coated in air	105	55
3.	All other contacts or connections made of bare metals or coated with other materials	See Note 8	See Note 8
4.	Terminals for the connection to external conductors by screws or bolts(see note 9)		
	-bare	90	40
	-silver, nickel or tin coated	105	55
	-other coatings	See Note 8	See Note 8
5.	Metal parts acting as springs	See Note 12	See Note 12
6.	Material used as insulation and metal parts in contact with insulation of the following classes	See Note 13	
	-Y (for non-impregnated materials)	90	40
	-A (for materials immersed in oil or impregnated)	100	50
	-E	120	70
	-B	130	80
	-F	155	105
	-Enamel: oil base	100	50
	Synthetic	120	70
	-H	180	130
	-C	See Note 14	See Note 14

NOTES :

- 1.1. According to its function, the same part may belong to several categories as listed in table. In this case the permissible maximum value of temperature and temperature rise to be considered are the lowest among the relevant categories.
- 1.2. For vacuum switching devices the values of temperature and temperature rise limits are not applicable for parts in vacuum. The remaining parts shall not exceed the values of temperature and temperature rise given in table.

- 1.3. Care shall be taken to ensure that no damage is caused to the surrounding insulating material.
- 1.4. When contact parts have different coating, the permissible temperature & temperature rises shall be those of the part having the lower value permitted in table.
- 1.5. The quality of the coated contacts shall be such that a layer of coating material remains at the contact area:
 - i). After making and breaking tests (if any):
 - ii). After short time withstand current test:
 - iii). After the mechanical endurance test:

According to the relevant specification for each equipment. Otherwise, the contacts shall be regarded as "bare".
- 1.6. For fuse contacts, the temperature rise shall be in accordance with IEC publications on High Voltage Fuses.
- 1.7. When connection parts have different coatings, the permissible temperature rises shall be those of the parts having the higher value permitted in table.
- 1.8. When materials other than those given in table are used, their properties shall be considered, notably in order to determine the maximum permissible temperature rises.
- 1.9. The values of temperature and temperature rise are valid even if the conductor connected to the terminals is bare.
- 1.10. At the upper of the oil.
- 1.11. Special consideration should be given when low flash point oil is used in regard to vaporization and oxidation.
- 1.12. The temperature shall not reach a value where the elasticity of the material is impaired.
- 1.13. The following classification of insulating materials is in accordance with IEC-85.

Class Y: Insulation consists of materials or combinations of materials such as cotton, silk and paper when suitably impregnated. Other materials may be included in this classes if by experience or accepted tests they can be shown to be capable of operation at Class Y temperatures.

Class A: Insulation consists of materials or combinations of materials such as cotton, silk and paper when suitably impregnated or coated or when immersed a dielectric liquid such as oil. Other materials or combination of materials may be included in this class if by experience or accepted tests they can shown to be capable of operation at Class A temperatures.

Class E: Insulation consists of materials which by experience or accepted tests can be shown to be capable of operation at Class E temperatures.

Class B: Insulation consisting of materials or combinations of materials such as mica, glass fiber, asbestos, etc. with suitable bonding substances. Other materials or combinations of materials, not necessarily inorganic, may be included in this class if by experience or accepted tests they can be shown to be capable of operation at Class B temperatures.

Class F: Insulation consists of materials or combination of materials such as mica, glass fiber, and asbestos with suitable bonding substances. Other materials or combinations of materials not necessarily inorganic may be included in this class if by experience or by accepted tests they can be shown to be capable of operation at class F temperatures.

Class H: Insulation consists of materials such as silicone elastomeric and combination of materials such mica, glass fiber, asbestos etc. with suitable bonding substances such as appropriate silicone resin. Other materials or combination of materials may be included in this class if by

experience or by accepted tests they can be shown to be capable of operation at Class H temperatures.

Class C: Insulation consists of materials or combination of materials such as mica, porcelain, glass and quartz with or without an inorganic binder. Other materials or combinations of materials may be included in this class if by experience or accepted tests they can be shown to be capable of operation at temperatures above the Class H limit. Specific materials or combinations of materials in this class will have a temperature limit which is dependent upon their physical, chemical and electrical properties.

1.14. Limited only by requirement to any damage to surrounding parts.

12.0 Take Off Terminal Pads:

- i) Terminal pads shall be provided with silver plating of at least 25 microns thickness if these are made of metal other than aluminum. No such plating shall be required if the terminal pad is made out of Aluminum. The pads shall be suitably designed to take the appropriate terminal loads. The terminal connectors required for connecting the Circuit Breaker to purchaser's Bus Bars shall be provided by the purchaser for mounting on aforesaid terminal pad.
- ii) The breaker shall be designed to withstand the rated terminal load, wind load/Earth quake load and short circuit forces. The short circuit forces to be considered for the design shall be based on length of bus bars consisting of conductors and phase to phase spacing as per IS Standard
- iii) The current density adopted for the design of the terminal pad shall in no case exceed 1.6A/sq.mm for copper pad and 1.0 A/ sq. mm for pad made of other material.
- iv) The vertical clearance of lowest live part from ground level (including concrete foundation plinth) shall be as given below:

33 kV Breaker - 3700 mm (min)

In no case the height less than that indicated as above will be accepted.

13.0 Porcelain Housing:

a) Porcelain Housing for the Interrupter:

The porcelain housing for the interrupter shall be of a single piece construction without any joint. It shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown colour with a smooth surface arranged to shed away rain water or condensed water particles (fog).

b) Support insulator:

Breaking units shall be mounted on insulator column of not more than two insulators in each column. For 33 kV class circuit breaker, to take care of bird fault, the clearance in the air from the lowest live part to earth shall be minimum 450 mm and between live parts of poles shall be minimum 430 mm. However if insulating barrier is provided around the live portion of middle pole to take care of bird fault, the spacing between live parts of poles less than 430 mm shall be acceptable subject to withstanding the lightning impulse voltage test in absence of barrier on any pole.

14.0 Surface Finish:

All metal sheet surfaces exposed to atmosphere shall be given two primer coats of zinc phosphate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected.

All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limits specified. The paints shall be battleship gray shade No.632 of IS 5. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

15.0 Galvanizing:

All ferrous parts including nuts, bolts, plain and spring washers of size M 10 and above, support channels, structures, etc. shall be hot dip-galvanized to conform to latest version of IS 2629 or any other equivalent authoritative standard. All other fixing nuts, bolts, washers of size below M 10 shall be made out of stainless steel.

16.0 Earthing:

The operating mechanism housing, support structures etc. shall be provided with two separate earthing terminals for bolted connection to 50 x 8 mm MS flat to be provided by the purchaser for connection to station earth mat. The connecting point shall be marked with "earth" symbol No.86 of IEC publication 117-1 part 1.

17.0 Name and Rating Plate:

- a) Circuit Breaker and its operating device shall be provided with rating plate/s made out of corrosion proof metal, marked with the following data. The data shall be either punched or engraved on the plate/s.
- b) Manufacturer's name or trade mark by which he may be readily identified.
- c) Serial number and type designation of CB & Operating mechanism
- d) Year of manufacture
- e) Voltage
- f) Lightning impulse withstand voltage
- g) Normal current
- h) Short circuit breaking current
- i) Duration of short circuit
- j) Mass of circuit breaker with support structure.
- k) Auxiliary D.C. supply voltage of closing and opening devices
- l) Out of phase making & breaking current
- m) A.C. supply voltage of auxiliary circuits.
- n) Insulation level
- o) Frequency
- p) Purchase order reference
- q) Operating sequence.

The rating plates shall be installed in such positions that the same shall be clearly visible to a man standing on ground. i.e. at the level of eye site.

18.0 Control Cabinet:

The control circuit shall include the following features:

- a) Two electrically independent trip circuits including two trip coils (one for local & one for remote) per CB as the case may be along with 2 bus arrangement for DC system protected with two separate MCBs.
- b) One local/remote selector switch.
- c) Conveniently located manual emergency trip
- d) Anti-pumping feature
- e) Auxiliary switches as specified elsewhere.
- f) The closing coil shall operate satisfactorily at all values of control supply voltage between 80-110% of the rated voltage. The trip coil shall operate satisfactorily under all operating conditions of the circuit breaker up to its rated short circuit breaking current at all values of control supply voltage between 70-110% of the rated voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by indicating lamps and trip coil supervision relay.
- g) The time taken for charging of closing spring shall not exceed 30 seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation. As long as power supply is available to the charging motor, a continuous sequence of closing and opening operations (CO) shall be possible. Spring charging motors shall be capable of starting and charging the closing spring twice in quick succession without exceeding acceptable winding temperature when the supply voltage is anywhere between 80-110% of rated voltage. The initial temperature shall be as prevalent in the switchgear panel during full load operation with 55 deg. C ambient air temperature. The motor shall be provided with over load protection.
- h) Motor windings shall be provided with class E insulation or better. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in a hot, humid and tropical climate.
- i) Independence of trip circuit from local/remote selection with one spare trip coil.
- j) Trip circuit supervision for pre trip as well as post trip. Trip circuit supervision scheme shall be such that testing of trip circuit healthiness is possible irrespective of whether the C.B. is in the closed or open position. The trip circuit Healthy lamp should glow continuously in C.B. 'ON' position and on demand in C.B. "OFF" position. The rating of dropping resistance in series with Trip Circuit Healthy lamp shall be such that the Trip coil should not get damaged because of continuous current flowing through it.
- k) The coils of operating devices shall be marked clearly with the catalogue number/reference number as indicated in control wiring diagram.
- l) One spare trip coil shall be supplied with one breaker.

19.0 Interlocks:

It is proposed to electrically interlock the circuit breaker with Purchaser's air break isolating switches in the switch yard in accordance with switchyard safety interlocking scheme.

The details of the scheme shall be furnished to the successful bidder. The requirement of auxiliary contacts to be provided in breaker operating mechanism by the bidder for successful operation of the scheme has been specified in clause 9.3.

20.0 Mounting:

- a) The design and supply of support structure, required for mounting the Circuit Breaker in Purchaser's switch yard, shall be in the bidder's scope. The bidder's scope shall also include foundation bolts, nuts, plain washers, spring washers etc necessary for the support structure. The support structure can be lattice type or tubular type and shall be made out of hot dip galvanized steel. Wheel mounted type support shall not be accepted. The support structure shall be installed on a concrete plinth of 300 mm height to be arranged by the Purchaser. The height of the support structure shall meet the following requirements.
 - i) Vertical clearance of lowest live part as specified in clause 6.
 - ii) Minimum height of 2950 mm above the top of concrete plinth (This is a Statutory Regulation).
- b) The Circuit Breaker shall be connected to adjacent equipment in the switch yard through ACSR conductor.
- c) The loading data to be considered by the bidder for design of support structure shall include the following.
 - 1 Dead weight of the Circuit Breaker, Structure, Bus Bars
 - 2 Operational steady state and impact loading
 - 3 Wind load on a Circuit Breaker, Structure, Bus Bars
 - 4 Short circuit forces

The support structure shall be designed on the basis of applicable Indian/International Standards and codes of practice.

21.0 Spares:

a) **Optional Spares:**

The list of optional spares required are indicated below. The tenderer shall quote separate rates for these spares which should be valid for two years from the date of issue of detail A/T. However the quantity of these spares shall be ordered separately, if required, on the basis of prices accepted by the Company. These prices shall not be considered for tender evaluation.

List of Optional Spares 33 kV Vacuum Circuit Breaker

Sr.No.	Particulars	Unit	Make & Type design.	Unit Price
1.	Breaking Chamber interrupter with insulator	No.		
2.	Vacuum Interrupter	No.		
3.	Trip coils	No.		
4.	Closing coils	No.		
5.	Set of gasket	Set		
6.	Support insulator	No.		

7.	Rectifier	No.		
8	Support Structure along with foundation bolts for 3 phases of C.B.			

b) Recommended spares:

The bidder shall furnish in his offer, a list of recommended spares with unit rates for each circuit breaker that may be necessary for satisfactory operation and maintenance of the circuit breaker for a period of 5 years. The purchaser reserves the right of selection of items and quantities of these spares to be ordered. The cost of such spares shall not be considered for tender evaluation. The unit prices should be valid for two years from the date of issue of detail A/T.

c) Erection and maintenance tools:

The bidder shall submit a list and unit rates of all the special tools, equipments and instruments required for erection, testing, commissioning and maintenance of the breaker. The purchaser shall decide the quantity of tools to be ordered. Prices of these tools shall not be considered for tender evaluation. However the list of necessary tools/equipments which will be supplied free of cost with each CB may be furnished separately.

22.0 Tests and Type Tests:

A) Tests:

The Breaker offered should have been type tested for the following tests:

Sr. Nos.	Type test
1	Basic short circuit duties tests.
2	Out of phase making and breaking tests.
3	Short time and peak current withstand tests.
4	Lightening impulse voltage withstand test.
5	Power Frequency Voltage withstand test (dry & wet).
6	Temperature rise test.
7	Mechanical operation test.
8	Degree of protection (IP55) for all cabinets.
9	Single phase short circuit test (for 3 phase mechanically gang operated breaker).

NOTE:

All above type tests as per relevant IEC/IS standards shall be carried out on offered 33 kV VCB at any 3rd party National/International Laboratories accredited by National/International Accreditation Board for Testing & Calibration Laboratories (NABL).

B) Type Tests:

- a) All the equipments offered shall be fully type tested as per the relevant standards, amended up-to-date. The supplier shall furnish the type test reports and certificate of accreditation issued by the testing authority along with the offer. These tests must not have been conducted earlier than five years from the date of opening of bids.
- b) In case these type tests are conducted earlier than five years, all the type tests as per the relevant standards shall be carried out by the successful bidder in the presence of purchaser's representative at free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection.
- c) The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of his representative. For this purpose the supplier may quote unit rates for carrying out each type test.
- d) For any change in the design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of tests without any extra cost before commencement of supply. In this case the bidder shall bring out in his offer all such changes made in components, materials, design etc. as the case may be.
- e) The company shall have the option to carry out various tests including type tests as per specification on the samples selected at random from the supplies effected, to ensure that the supplies conform in quality and workmanship to the relevant specification. The testing shall be done at an independent laboratory at company's cost. Due notice shall be given to supplier for such sample selection and such testing thereof to enable him to be present for the same if so desired by him. If the supplier or his authorized representative fails to attend the sample selection and testing, the same shall be carried out unilaterally by the company and the result thereof shall be binding upon the supplier. In case the sample selected from the supplies fails to withstand the required tests, then :-
 - i) For first time failure of sample, supplier shall have to replace the full quantity of the respective inspected lot supplied to various Stores and lying unused at Stores.
 - ii) For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.
 - iii) In respect of further supplies made against the order, if failure of samples is noticed (i.e., second time failure against the order) then the quantity lying unused at various Stores shall be rejected.
 - iv) For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.
 - v) Balance quantity against the order including the rejected qty. shall be cancelled without any liability on either side.
 - vi) The firm will be debarred from dealing with the company upto a period of three years from the date of rejection.

23.0 Acceptance & Routine Tests:

- a) All acceptance and routine tests as stipulated in relevant standards, amended up to date, shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser

(Note:- All measuring/testing equipments shall be of appropriate class of accuracy and shall have valid calibration certificates which shall be produced to the Inspecting Officer for verification.)

- b) After finalization of the program of type/acceptance/routine testing, the supplier shall give three weeks advance intimation to the purchaser, to enable him to depute his representatives for witnessing the tests.

24.0 Inspection:

- i) The inspection may be carried out by the purchaser or his representative at any stage of manufacture. The successful Bidder shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.
- ii) The supplier shall keep the purchaser informed in advance, about the manufacturing program so that arrangement can be made for stage inspection.
- iii) The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall keep the purchaser informed, in advance, about such testing program.
- iv) Chief Engineer (MM Cell) shall depute his representatives i.e. Executive Engineers from Testing Division and Inspection Wing for final inspection of Circuit Breaker Assembly at manufacturers works.

25.0 Quality Assurance Plan:

- 1) The bidder shall invariably furnish following information along with his offer, failing which his offer shall be liable for rejection.
- i) Statement giving information about names of sub-suppliers, list of testing standards, list of tests normally carried out in presence of bidder's representative and copies of test certificates in respect of following items of raw-materials.
- a) Contact material
- b) Porcelain
- ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.
- iii) List of areas in manufacturing process, where joint stage inspections are normally carried out by the bidder/purchaser for quality control and details of such tests and inspections.
- iv) Special features provided in the equipment to make it maintenance free.
- v) List of testing equipments available with the bidder for final testing of breakers vis-à-vis. the type, special, acceptance and routine tests specified herein. The limitations in testing facilities shall be very clearly brought out in schedule-E i.e. schedule of deviation from specified test requirement.
- 2) The successful bidder shall, within 30 days of placement of order, submit following information to the purchaser.
- a) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with the offer.

- b) Type test certificates of the raw material and bought out accessories.
 - c) Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plan and purchaser's hold points shall be discussed between the purchaser and supplier, before it is finalized.
- 3) The successful bidder shall submit the routine test certificates of bought out accessories at the time of routine testing of the fully assembled breaker for the goods manufactured within purchaser's country. The supplier shall also submit the central excise passes for the raw material at the time of routine testing of the fully assembled breaker.

26.0 Performance Guarantee:

The Vacuum Circuit Breakers offered shall be guaranteed for satisfactory performance for a period of 66 months from the date of receipt of complete Vacuum Circuit Breakers at destination store/site in good condition or 60 months from the date of satisfactory commissioning of Vacuum Circuit Breakers whichever is earlier. The equipments found defective/failed within the above guarantee period shall be replaced /repaired by the supplier free of cost within one month of receipt of intimation. If the defective/failed Vacuum Circuit Breakers are not replaced /repaired as per the above guarantee clause, the company shall recover an equivalent amount plus 15 % supervision charges from any of the supplier's bills.

27.0 Documentation:

- i) All drawings shall conform to international standards organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in System International Units.
- ii) Drawings:

The bidder shall furnish four sets of relevant descriptive and illustrative published literature/pamphlets and the following drawings for preliminary study:

 - a. General outline drawings showing outside dimensions, shipping dimensions, weights, quantity of insulating media air receiver capacity and such other prominent details.
 - b. Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance.
 - c. Schematic diagrams of the scheme for control, supervision and reclosing.
 - d. Structural drawing, design calculations and loading data for support structures.
 - e. Foundation drilling plan and loading data for foundation design.
 - f. Bill of Materials.
 - g. Type test reports of circuit breakers along with a separate list showing all the tests carried out with date & place of test.
 - h. Test reports, literatures and pamphlets of bought out items and raw materials.
- iii) The successful bidder shall, within 6 weeks of placement of order, submit THREE sets of final versions of all the above said drawings in A-3 size, bill of material, packing list & all type test reports for purchaser's approval to the office of Chief Engineer (Testing and Quality Control). The purchaser shall communicate his comments/approval on the drawings to the supplier within reasonable period. The supplier shall, if necessary, modify

the drawings and resubmit four copies of the modified drawings for purchaser's approval within two weeks from the date of purchaser's comments. After receipt of purchaser's approval, the supplier shall, within three weeks, submit 10 prints & two good quality reproducible of the approved drawings and 10 sets of instructions manuals in respect of Circuit breaker to the office of Chief Engineer (MM Cell).

- iv) The successful bidder shall furnish in the form of nicely bound volumes, the manuals covering erection, commissioning, operation and maintenance instructions and all relevant information and drawings pertaining to the Vacuum Circuit Breakers as well as auxiliary devices. Marked erection drawings shall identify the component parts of the equipment as shipped to enable Engineer/Purchaser to carry out erection with his own personnel. Each manual shall also contain one set of all the approved drawings type test reports as well as acceptance test reports to corresponding consignment dispatched. The total quantity of the operating manuals/approved drawings sets to be supplied by the supplier shall be equal to the number of three phase breakers of rating, ordered.
- v) The manufacturing of the Vacuum Circuit Breakers shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the Vacuum Circuit Breakers prior to the approval of the drawings shall be at the supplier's risk.
- vi) Approval of drawings/work by the purchaser shall not relieve the supplier of any of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revisions of applicable standards, rules and codes of practices.

28.0 Packing and Forwarding:

- i) The Vacuum Circuit Breakers shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper lifting arrangement such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.
- ii) Each consignment shall be accompanied by a detailed packing list containing the following information:
 - a) Name of the consignee.
 - b) Details of consignment.
 - c) Destination.
 - d) Total weight of consignment.
 - e) Sign showing upper/lower side of the crate.
 - f) Handling and unpacking instructions.
 - g) Bill of materials indicating contents of each package and spare materials

The supplier shall ensure that the packing list and bill of materials are approved by the purchaser before dispatch.

29.0 Training of Engineers:

- i) The successful bidder shall be required to provide facilities for in-plant training at no extra cost to the purchaser to at least four engineers to be nominated by the purchaser for a period of three weeks(i.e. 12 man weeks) at his works, where the Vacuum Circuit Breakers offered shall be manufactured. The scope of the training shall cover assembly, factory testing, site Testing, periodical maintenance, operation and trouble shooting of the breakers.
- ii) If the Vacuum Circuit Breakers offered, is being designed and manufactured in collaboration with any other manufacturer, the supplier shall provide facilities for additional two engineers to be nominated by the purchaser, for in-plant training in the collaborator's work, for a period of 3 weeks(i.e.6 man weeks).
- iii) In case of training within India, the to and fro travel expenses, lodging and boarding charges as well as allowances for out of pocket expenses in respect of the trainees, shall be borne by the purchaser. However, the supplier shall provide for suitable facilities for lodging and boarding as well as to and fro transport to place of training.
- iv) In case of training outside India, the to and fro journey expenses from India to the place of training shall be borne by the purchaser. However the cost of deferment of the expenses of the trainees for lodging and boarding, out of pocket allowance, local transport as per the rates prevailing at the time of training shall be initially borne by the supplier for which he shall quote rates while submitting his offer. Separate set of rates may preferably be quoted for providing facilities to Senior Managers and Intermediate Grade Managers commensurate with their status. The acceptance of the rates shall be decided while finalizing tender. The expenditure incurred by the successful bidder in this regard shall be paid to him by the purchaser. This amount, however, will not be considered for loading his offer.
- v) The period and the program of the training (generally for three weeks) shall be mutually discussed and finalized by the purchaser with the supplier/s.

30.0 Supervisory Erection and Commissioning:

- i) The erection and commissioning of the breakers shall be supervised, if required by the Purchaser, through one work-trained Engineer/foreman who shall direct the sequence of erection and make necessary adjustments to the apparatus and correct in the field any errors or omissions on the part of the bidder in order to make the equipment and material properly perform in accordance with the intent of this specification. The representative shall also instruct the plant operators in the operation and maintenance of breakers furnished. Skilled workers, all the ordinary tools, equipment and cranes required for breaker erection, shall be provided by the purchaser. Apart from the above, the purchaser shall not be responsible for any other expenses incurred by the bidder and expenses such as Erector's salary, insurance against personal injuries to the Erector etc., shall be to bidder's account. Special tools, if required for erection and commissioning shall be arranged by the supplier at his cost. The supplier shall be responsible for any damage to the breaker on commissioning, if it results from faulty or improper assembly unless the erector can conclusively prove that the damage has occurred on account of intentional mistake on the part of the skilled workers provided by the purchaser.
- ii) The bidder shall quote the lump-sum rate per breaker for the service of the erector, which should be valid for 3 years from the date of issue of detailed A/T. The bidder shall also

indicate estimated time period for erection, testing and commissioning of each type of breaker. The separate rates shall be quoted for following works at purchaser's premises.

- a) Supervision of only erection work of the Circuit Breakers.
- b) Inspection of the erected breaker, testing and commissioning of the same.

31.0 Qualifying Requirements: As per tender

32.0 Requirement of Documents:

Following documents should be furnished electronically:

- i) Following information shall be furnished along with the offer in Electronic Form:
 - a) List of type test reports for the offered equipment shall invariably be furnished in the Annexure-III enclosed herewith. (in electronic form)
 - b) Calculations of loading data for mechanical design of support structure for foundation and design of breaker terminal pads (in electronic form).
 - c) Certificate of accreditation of the testing laboratory where the type tests are conducted (in electronic form).
 - d) List of Past Experience of supplies for each type of Breaker offered for evaluation of Qualifying requirements (in electronic form).
 - e) Test report of actual measurement of actuating force required for charging manually (N).
 - f) Performance certificate for the Breakers offered for evaluation of Qualifying requirements (in electronic form).
- ii) Following information/documents (in duplicate) duly sealed and signed on each page shall be submitted in physical form on or before the scheduled date of submission of the tender.
 - a) Details of precautions to be taken in the use of breaker.
 - b) Details of Quality Assurance plan
 - c) Type test reports as per Cl. 22.0 duly sealed and signed on each.
 - d) General arrangement drawing for C.Bs.

All documents in physical form shall be submitted.

ANNEXURE - I

PRICE AND DELIVERY SCHEDULE

ITEM NO.	DESCRIPTION	QUAN-TITY	UNIT PRICE		TOTAL PRICE		GUARANTEED DELIVERY IN MONTHS EX-WORKS FROM DATE OF ORDER
			EX-WORKS	FOR DESTI-NATION	EX-WORKS	FOR DESTI-NATION	
1.	<p>For Bus Coupler 33kV, 25kA, 800A, 3 Phase Reclosing type Mechanically gang operated Circuit Breakers.</p>						
2.	<p>For Incomer 33kV, 25kA, 1600A, 3 Phase Reclosing type Mechanically gang operated Circuit Breakers.</p>						

MSEDCL

ANNEXURE - II

Specific Technical Requirement for 33 KV 400A, 800A and 1600 A Outdoor Vacuum Circuit Breaker with Breaker Cabinet

Sr. No	Description	33 KV
1	Name of Manufacturer	Mfg to give details
2	Type	Porcelain clad type Outdoor Circuit breaker
3	Reference Standard	IEC 62271- 100 amended up to date / IS: 13118:1991
4	Number of poles of outdoor circuit	Three
5	Rated voltage of outdoor circuit breaker in kV.	33
6	Suitable Rated frequency for Outdoor circuit breaker in Hz	50± 3
7	Type of operation	Mechanically coupled gang operated
8	Operating mechanism	A. C. Control & Protective devices, lighting fixtures, space heaters and motor operating on supply single phase, 250 Volts ± 10% A.C., 50 Hz , two pole with one pole grounded
9	Maximum continuous voltage of outdoor circuit breaker in kV	36 KV
10	Rated continuous current of outdoor circuit breaker in amps.	1600 Amp for Incomer 800 Amp for Buscoupler . 400 Amp for Feeder
11	Earthing Offered for VCB suitable	for solid neutral earthing
12	Rated symmetrical short circuit breaking current (for 3 seconds) of outdoor circuit breaker in kA (rms)	25 kA
	a) AC component (kA (rms)	25kA
	b) percentage of DC component	Corresponding to minimum opening time as per standard IEC -62271-100
13	Rated operating sequence of outdoor circuit breaker	o-0.3 sec-co-3 min - co
14	Amplitude factor of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity	1.4

15	First pole to clear factor of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity	1.5
16	Rate of rise of restriking voltage of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity in kv/microsecs)	70
17	Dry-1 minute power frequency withstand voltage of outdoor circuit breaker between line terminal and earth in kvrms	70
18	Dry-1 minute power frequency withstand test voltage for outdoor circuit breaker between terminal with breaker contacts open in kvrms	70
19	1.2 / 50 micro second impulse with-stand voltage for outdoor circuit breaker between line terminal and earth in kvp	170
20	1.2 / 50 micro second impulse with-stand voltage for outdoor circuit breaker between terminals with breaker contacts open in kvp	170
21	Out of phase breaking capacity	100 % of rated breaking capacity
22	Material of main contacts of outdoor circuit breaker	Silver / Nickel coated Copper
23	Material of terminal pad of outdoor circuit breaker (copper/Aluminum)	Copper/Aluminum
24	If Terminal Pads are made of metal other than aluminum, thickness of silver plating on terminal pads	25 microns (Minimum)
25	The current density for copper terminal pad	1.6 A/sq.mm(Maximum)
26	The current density for other than copper terminal pad	1.0 A/sq.mm(Maximum)
27	Net cross section of terminal pad of outdoor circuit breaker in sq mm	Mfg to give details
28	Material of make -break contacts in Vacuum Interrupter	Mfg to give details
29	Material of tips of Main contacts of circuit breaker	Mfg to give details
30	No. Of normally open auxiliary contacts provided for outdoor circuit breaker available	4
31	No. Of normally close auxiliary contacts provided for outdoor circuit breaker available	4
32	Voltage rating of bushing used for outdoor circuit breaker in kv.	36kV
33	Dry-1 minute power frequency withstand voltage of bushing used for outdoor circuit breaker in kvrms	70
34	Dry flashover voltage of bushing used for outdoor circuit breaker in kvrms	70
35	Wet flashover voltage of bushing used for outdoor circuit breaker in kvrms	70
36	1.2/50 micro second impulse withstand voltage of bushing used for outdoor circuit breaker	170
37	Total creepage distance of bushing used for outdoor circuit breaker	900 mm.
38	Center to center minimum clearances in air between phases of outdoor circuit breaker in mm	Mfg to give details

39	Minimum Clearances provided in air between two Phases : in mm	Mfg to give details
40	Minimum clearances in air between live part to live part of phases of outdoor circuit breaker.	430 mm
41	Minimum clearances in air between live part to earth of outdoor circuit breaker	450 mm
42	Minimum clearances in air between live part of outdoor circuit breaker to ground level	3700 mm
43	Minimum height of the lowest part of the support insulator from ground level	3250 mm
44	Class of Insulating Material	B
45	Max. closing time	< 80 ms
46	Max. total break time at 100 % rated interrupting breaking capacity :	45-50 ms
47	Type of closing mechanism of outdoor circuit breaker	Motor assisted spring charged mechanism.
48	Type of tripping mechanism of outdoor circuit breaker	Motor assisted spring charged mechanism with shunt trip coil.
49	Burden of trip coil of outdoor circuit breaker at 30 v d.c. in watts	Mfg to give details
50	Burden of closing coil of outdoor circuit breaker at 30 v d.c. in watts	Mfg to give details
51	On/off and "spring charged" indications for outdoor circuit breaker	Mechanical
52	Trip/close of outdoor circuit breaker	Manual
53	Spring charging for outdoor circuit breaker	Mechanical
54	Voltage rating of spring charging motor of outdoor circuit breaker in volts	Mfg to give details
55	Burden of spring charging motor of outdoor circuit breaker in Vamp	Mfg to give details
56	Control circuit voltage of outdoor circuit breaker	30 volts d. C.
57	The surface finish paints of non galvanized metallic part of VCB	Battleship gray shade No.632 of IS 5.
58	Process of painting of parts of outdoor circuit breaker	Two primer coats of zinc phosphate and two coats of epoxy paint with epoxy base thinner
59	Type of primer used for painting of parts of outdoor circuit breaker	Mfg to give details
60	Type of finish paint used for painting of parts of outdoor circuit breaker	Mfg to give details
61	Degree of protection of Operating Mechanism enclosure	IP 55 as per IEC529/ IS 2147

ANNEXURE - III

GUARANTEED TECHNICAL PARTICULARS FOR 33 kV, 800A/1600A, 25 kA for 3 sec VACUUM CIRCUIT BREAKERS		
1	Name of Manufacturer	Text
2	Type of Outdoor switchgear	Text
3	Designation of outdoor circuit breaker	Numeric
4	VCB conforms to IEC 62271- 100 amended upto date / IS: 13118:1991 : Yes/No	Boolean
5	Whether offered outdoor circuit breaker is porcelain clad type (yes/no)	Boolean
6	Shall outdoor circuit breaker provided 3 number of poles (yes/no)	Boolean
7	Rated voltage of outdoor circuit breaker in k Text kV.	Numeric
8	Is offered out door circuit breaker suitable for 50 Hz rated frequency.(Yes/No)	Boolean
9	Type of operation - Mechanically coupled gang operated : Yes/No	Boolean
10	Operating mechanism, A. C. Control & Protective devices, lighting fixtures, space heaters and motor operating on supply single phase, 250 Volts \pm 10% A.C., 50 Hz , two pole with one pole grounded : Yes/No	Boolean
11	Maximum continuous voltage of outdoor circuit breaker in kV	Numeric
12	Rated continuous current of outdoor circuit breaker in amps.	Numeric
13	Offered VCB shall be suitable for solid neutral earthing : Yes/No	Boolean
14	Rated symmetrical short circuit breaking current (for 3 seconds) of outdoor circuit breaker in ka (rms) 25 kA	Numeric
15	Rated operating sequence of outdoor circuit breaker shall be o-0.3 sec-co-3 min - co	Text
16	Amplitude factor of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity shall be 1.4	Numeric
17	First pole to clear factor of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity shall be 1.5	Numeric
18	Rate of rise of restriking voltage of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity in kv/microsecs) 50/70	Numeric
19	Dry-1 minute power frequency withstand voltage of outdoor circuit breaker between line terminal and earth in kvrms shall be 50/70kV	Numeric
20	Dry-1 minute power frequency withstand test voltage for outdoor circuit breaker between terminal with breaker contacts open in kvrms	Numeric
21	1.2 / 50 micro second impulse with-stand voltage for outdoor circuit breaker between line terminal and earth in kvp	Numeric
22	1.2 / 50 micro second impulse with-stand voltage for outdoor circuit breaker between terminals with breaker contacts open in kvp	Numeric
23	Material of main contacts of outdoor circuit breaker	Text
24	Material of terminal pad of outdoor circuit breaker (copper/Aluminium)	Text
25	If Terminal Pads are made of metal other than aluminum, thickness of silver plating on terminal pads shall be at least 25 microns.	Numeric
26	The current density for copper terminal pad shall not be more than 1.6 A/sq. mm.	Text
27	The current density for other than copper terminal pad shall not be more than 1 A/sq. mm.	Text

28	Net cross section of terminal pad of outdoor circuit breaker in sq mm	Numeric
29	Material of make –break contacts in Vacuum Interrupter	Text
30	Material of tips of Main contacts of circuit breaker	Text
31	Whether electrical anti pumping device provided for outdoor circuit breaker (yes/no)	Boolean
32	Size of auxiliary contacts of outdoor circuit breaker in sq. Mm.	Numeric
33	Material of auxiliary contacts of outdoor circuit breaker	Text
34	Continuous current capacity of auxiliary contacts of outdoor circuit breaker in amps.	Numeric
35	Breaking current capacity of auxiliary contacts of outdoor circuit breaker in amps.	Numeric
36	Insulation level of auxiliary contacts of outdoor circuit breaker in volts.	Numeric
37	1 minute p. F. Withstand voltage of auxiliary contacts of outdoor circuit breaker in kvrms.	Numeric
38	Whether any contact multiplier are used for outdoor circuit breaker (yes/no) (if *yes* then fill 39 to 42)	Text
39	Make of contact multiplier used for circuit breaker	Text
40	Making and breaking capacity of contact multiplier used for outdoor circuit breaker in ka	Text
41	Voltage rating of contact multiplier used for outdoor circuit breaker in kv	Text
42	Capacity of coil of contact multiplier used for outdoor circuit breaker in watts	Numeric
43	No. Of normally open auxiliary contacts provided for outdoor circuit breaker available for use in remote C&R panels	Numeric
44	No. Of normally close auxiliary contacts provided for outdoor circuit breaker available for use in remote C&R panels	Numeric
45	Whether potential free contact available for remote indication of spring charged" of outdoor circuit breaker (yes/no)	
46	Voltage rating of bushing used for outdoor circuit breaker in kv.	Numeric
47	Dry-1 minute power frequency withstand voltage of bushing used for outdoor circuit breaker in kvrms	Numeric
48	Dry flashover voltage of bushing used for outdoor circuit breaker in kvrms	Numeric
49	Wet flashover voltage of bushing used for outdoor circuit breaker in kvrms	Numeric
50	1.2/50 micro second impulse withstand voltage of bushing used for outdoor circuit breaker shall be 125/170 kvp	Numeric
51	Total creepage distance of bushing used for outdoor circuit breaker shall be 300 mm.	Numeric
52	Center to center minimum clearances in air between phases of outdoor circuit breaker in mm	Numeric
53	Minimum Clearances provided in air between two Phases : in mm	Numeric
54	Minimum clearances in air between live part to live part of phases of outdoor circuit breaker shall be 430 mm.	Numeric
55	Minimum clearances in air between live part to earth of outdoor circuit breaker shall be 450mm	Numeric
56	Minimum clearances in air between live part of outdoor circuit breaker to ground level shall be 3700 mm	Numeric
57	Height of the lowest part of the support insulator from ground level (min 2500mm)	Numeric

58	Class of Insulating Material	Text
59	Max. closing time in ms (Max.150 ms)	Numeric
60	Max. total break time at 100 % rated interrupting breaking capacity : 100 ms	Numeric
61	Type of closing mechanism of outdoor circuit breaker shall be motor assisted spring charged mechanism.	Text
62	Type of tripping mechanism of outdoor circuit breaker shall be motor assisted spring charged mechanism with shunt trip coil.	Text
63	Burden of trip coil of outdoor circuit breaker at 30 v d.c. in watts	Numeric
64	Burden of closing coil of outdoor circuit breaker at 30 v d.c. in watts	Numeric
65	Whether mechanical on/off and "spring charged" indications for outdoor circuit breaker provided (yes/no)	Boolean
66	Whether manual trip/close of outdoor circuit breaker possible (yes/no)	Boolean
67	Whether mechanical spring charging for outdoor circuit breaker possible (yes/no)	Boolean
68	Voltage rating of spring charging motor of outdoor circuit breaker in volts	Numeric
69	Burden of spring charging motor of outdoor circuit breaker in VAmp	Numeric
70	Control circuit voltage of outdoor circuit breaker shall be 30 volts d. C. (yes/no)	Boolean
71	The surface finish paints of non galvanized metallic part of VCB shall be battleship gray shade No.632 of IS 5.	Text
72	Process of painting of parts of outdoor circuit breaker	Text
73	Type of primer used for painting of parts of outdoor circuit breaker	Text
74	Type of finish paint used for painting of parts of outdoor circuit breaker	Text
75	Degree of protection of Operating Mechanism enclosure is IP 55 as per IEC529/ IS 2147	Text
76	Mounting of CB On hot dip galvanized steel support structure or on the operating mechanism box, as the case may be, to be supplied by the tenderer	Text
77	Whether all type tests are carried out on outdoor circuit breaker at nabl laboratories within five years from date of opening of tender(yes/No)	Text
78	Whether type tested on offered design of outdoor circuit breaker (yes / no).	Text
79	A list of recommended spares with unit rates for each circuit breaker that may be necessary for satisfactory operation and maintenance of the circuit breaker for a period of 5 years shall be submitted.	Numeric
80	A list and unit rates of all the special tools, equipments and instruments required for erection, testing, commissioning and maintenance of the breaker shall be submitted	Text
81	The list of necessary tools/equipments which will be supplied free of cost with each CB furnished separately.	Text
82	Are following Type test reports submitted with offer for offered equipment	Text
	a. Lightning impulse withstand voltage test. :Yes/No	
	b. Power Frequency Voltage withstand test (dry & wet). :Yes/No	
	c. Temperature rise test. :Yes/No	Boolean

	d. Measurement of resistance of Circuit: Yes/No	Boolean
	e. Short time and peak withstand current tests. :Yes/No	Boolean
	f. Mechanical operation test. :Yes/No	Boolean
	g. Degree of protection (IP55) for all cabinets. :Yes/No	Boolean
	h. Out of phase making and breaking tests. :Yes/No	Boolean
	i. Short Circuit Making and Breaking current Tests a) No load operation before and after test b) Basic test duties no. 1 to 5 c) Single Phase Short circuit test d) Condition of breaker after short circuit tes	Boolean
83	Are the following drawing submitted	Text
	a. General outline drawings showing outside dimensions, shipping dimensions, weights, quantity of insulating media air receiver capacity and such other prominent details. :Yes/No	Boolean
	b. Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance. :Yes/No	Boolean
	c. Schematic diagrams of the scheme for control, supervision and reclosing :Yes/No	Boolean
	d.Structural drawing, design calculations and loading data for support structures. :Yes/No	Boolean
	e. Foundation drilling plan and loading data for foundation design. :Yes/No	Boolean
	f.Type test reports of circuit breakers along with a separate list showing all the tests carried out with date & place of test. :Yes/No	Boolean
	g.Test reports, literatures and pamphlets of bought out items and raw materials. :Yes/No	Boolean
84	Whether bidder adequate in-house testing facilities for conducting acceptance tests in accordance with relevant IS.	Text
85	Type of operation shall be suitable for 3 phase reclosing : Yes/No.	Boolean

ANNEXURE - IV

Details of type tests conducted for Circuit Breaker

Sr. Nos.	Description of Type Test	Type & Make of Circuit Breaker& its rating	IS/IEC Clause No.	Testing Lab. & Date of Testing	Type test report No., dt. & pages	Whether certificate of compliance with IS/IEC is enclosed with T.R.
1	Basic short circuit duties tests.					
2	Out of phase making and breaking tests.					
3	Short time and peak current withstand tests.					
4	Lightening impulse voltage withstand test.					
5	Power Frequency Voltage withstand test (dry & wet).					
6	Temperature rise test.					
7	Mechanical operation test.					
8	Degree of protection (IP55) for all cabinets.					
9	Single phase short circuit test (for 3 phase mechanically gang operated breaker).					