



Maharashtra State Electricity Distribution Company Ltd.

SPECIFICATION NO. STORES/MSC-II/33 kV VCB/2011

TECHNICAL SPECIFICATION

OF

36 kV Vacuum Circuit Breakers

FOR

DISTRIBUTION SYSTEM

IN

MAHARASHTRA

INDEX

CLAUSE	Particulars
1.0	SCOPE
2.0	SCHEDULE OF REQUIREMENTS
3.0	SERVICE CONDITIONS
4.0	PRINCIPAL PARAMETERS
6.0	GENERAL TECHNICAL REQUIREMENTS
7.0	TESTS
8.0	INSPECTION
9.0	QUALITY ASSURANCE PLAN
10.0	PERFORMANCE GUARANTEE
11.0	DOCUMENTATION
12.0	PACKING AND FORWARDING
13.0	TRAINING OF ENGINEERS
14.0	SUPERVISORY ERECTION
15.0	QUALIFYING REQUIREMENTS
16.0	REQUIREMENT OF DOCUMENTS
	ANNEXURE-I

36 kV VACUUM CIRCUIT BREAKERS
SPECIFICATION NO. STORES/MSC-II/33 kV VCB/2011

1. SCOPE:

- 1.1. This specification covers design, manufacture, assembly, testing before supply, inspection, packing and delivery of outdoor type circuit breakers of rated insulation class of 36KV. The Vacuum Circuit Breakers shall be complete with all the accessories and auxiliary equipments required for their satisfactory operation in various sub-stations of the Maharashtra State (India).
- 1.2. 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 listed in Cl.4.0. with recent editions. 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 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.
- 1.3. 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.
- 1.4. The Tenderer/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.
- 1.5. 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. SPARES:

2.1.1. Optional Spares:

- 2.1.2. 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 FOR 36 KV VACUUM CIRCUIT BREAKERS

Sr.No.	Particulars	Unit	Make & Type desn.	Unit Price
1.	Breaking Chamber interrupter with	No.		

	insulator			
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.			

2.2. Recommended spares:

The tenderer 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.

2.3. Erection and maintenance tools:

The tenderer 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.

3. SERVICE CONDITIONS:

3.1. Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions:-

- | | | | |
|--------|---|---|---|
| 3.1.1. | Max. ambient air temperature | : | 50 Deg. C |
| 3.1.2. | Max. relative humidity | : | 100 % |
| 3.1.3. | Max. annual rainfall | : | 1450 mm |
| 3.1.4. | Max. wind pressure | : | 150 kg/sq.m. |
| 3.1.5. | Max. altitude above mean sea level | : | 1000 mtrs. |
| 3.1.6. | Isoceraunic level | : | 50 |
| 3.1.7. | Seismic level(Horizontal acceleration) | : | 0.3 g. |
| 3.1.8. | Climatic Condition | | Moderately hot and humid tropical climate conducive to rust and fungus growth |
| 3.1.9. | Reference Ambient Temperature for temperature rise: | | 50 deg C |

3.2. The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

3.3. 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 tenderer for specified operation of the circuit breaker, shall be suitable for operation on the Ratings

i)	For A. C. Control & Protective devices, lighting fixtures, space heaters and f.h.p. motors.	240 V, 1 phase 2 wire 50 Hz. AC supply with one point grounded
ii)	For D.C. alarm, control and protective device.	One 2 wire DC source from batteries with mid point grounded. The available DC supply voltage is 30 V DC.

3.4. Quality:

The above supply systems may have variations as follows.

i).A.C. supply

Voltage variation : $\pm 10\%$

Frequency variation : $\pm 3\%$

ii).D.C. supply

Voltage variation -15% to +10%.

4. STANDARDS:

The circuit breaker shall conform to the recent editions/ latest revisions, available at the time of placement of order/s of relevant standards, rules and codes listed below. The Indian Standard Specifications can be obtained on payment of requisite charges, from the Bureau of Indian Standards, Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi-110022.

Equipments 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 tenderer 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 tenderer, shall prevail. Further, in the event of conflict between the stipulations of standard adopted by the tenderer and the corresponding Indian Standard Specification, the stipulation of Indian Standard Specification shall prevail.

LIST OF STANDARDS		
SR NO.	STANDARD REF.NO.	TITLE
1	IS 13118	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	IEC529/IS 2147	Degree of protection provided for enclosures for low voltage switch gear and control gear.
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.	

5. PRINCIPAL PARAMETERS:

The breaker shall conform to the specific technical requirements specified below.

SPECIFIC TECHNICAL REQUIREMENTS FOR BREAKERS

SR.NO	ITEM	REQUIREMENTS	REMARKS
1	Rated voltage of the breaker (KV rms.)	36	
2.	System frequency	50 HZ	
3.	System Neutral grounding	Effectively earthed	
4.	Continuous current rating (A)	1600	
5.	Installation	Outdoor	
6.	Type of breaker	Vacuum	
7.	Mounting	On hot dip galvanised steel support structure or on the operating mechanism box, as the case may be, to	

		be supplied by the tenderer	
8.	Number of Poles	3	
9.	Type of operation Individual-	Mechanically coupled Three poles gang operated	
10.	Minimum Inter pole spacing for breaker i.e phase to phase (in mm). in the switchyard	430	
11.	Required ground clearance from the lowest live part from the top of the concrete plinth i) If both the terminals are not in the same horizontal plane. ii) If both the terminals are in the same horizontal plane.	3400 mm 3400 mm	
12.	Height of concrete plinth above ground level (mm) (To be provided by the Purchaser).	300	
13.	Minimum height of the lowest part of the support insulator from ground level (mm).	2500	
14.	Operating mechanism	spring operated	
15.	Auto reclosing duty	Three phase	
16.	Rated operating duty cycle.	0-0.3 seconds-co-3-minutes-co	
17.	"First pole to clear" factor	1.5	
18.	Max. closing time (ms)	150	
19.	Max. total break time at rated breaking capacity	100	
20.	1.2/50 micro second impulse withstand voltage: i) to earth (KVP) ii) Across open contacts: Impulse on one terminal, power frequency voltage on opposite terminal (kvp)	170 170	
21.	One minute power frequency with-stand voltage (KV rms.)	70	
22.	Short Circuit current a) A.C. component (KA rms.)	25 kA for 3Sec	
23.	Rated short circuit making current capacity(KA peak)	62.5	
24.	Permissible limit of temperature rise.	As per given below.	

25	Minimum creepage distance of support insulator (mm)	900	
----	---	-----	--

LIMITS OF TEMPERATURE AND TEMPERATURE RISE FOR VARIOUS PARTS

MATERIAL AND DIELECTRICS

Sr. No.	Nature of the part,of the material and of the dielectric	Maximum Permissible Values of temperature(deg.C)	temperature rise at a max.air temperature not exceeding 50 deg 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 :

- 5.1. 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.
- 5.2. 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.
- 5.3. Care shall be taken to ensure that no damage is caused to the surrounding insulating material.
- 5.4. When contact parts have different coating, the permissible temperature & temperature rises shall be those of the part having the lower value permitted in table.
- 5.5. 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".
- 5.6. For fuse contacts, the temperature rise shall be in accordance with IEC publications on High Voltage Fuses.
- 5.7. When connection parts have different coatings, the permissible temperature rises shall be those of the parts having the higher value permitted in table.
- 5.8. 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.
- 5.9. The values of temperature and temperature rise are valid even if the conductor connected to the terminals is bare.
- 5.10. At the upper of the oil.
- 5.11. Special consideration should be given when low flash point oil is used in regard to vaporization and oxidation.

5.12. The temperature shall not reach a value where the elasticity of the material is impaired.

5.13. 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 fibre, 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 fibre, 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 siliconed elastomer and combination of materials such mica, glass fibre, asbestos etc. with suitable bonding substances such as appropriate silicone resine. 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.

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

6. **GENERAL TECHNICAL REQUIREMENTS:**

6.1. Circuit breakers shall be Vacuum type. Porcelain clad breakers will be accepted.

6.2. The circuit breakers offered shall be 3-pole mechanically coupled gang operated Vacuum circuit breakers having rating 25 kA for 3 seconds. Vacuum Circuit Breaker shall have 1600 Amps continuous current rating.

6.3. First pole to clear factor shall be 1.5.

6.4. Similar parts of the breaker, especially the removable ones, shall be freely interchangeable without the necessity of any modification at site.

6.5. **BREAKER CONTACTS:**

- 6.5.1. 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.
- 6.5.2. 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.

6.6. OPERATING MECHANISM & ASSOCIATED EQUIPMENTS:

- 6.6.1. The circuit breaker shall be designed for electrical local as well as remote control. In addition there shall be provision for local mechanical control .
- 6.6.2. 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.6.7.
- 6.6.3. All metal parts in the mechanism shall be of corrosion resistant material. All bearings which require greasing, shall be equipped with pressure grease fittings.
- 6.6.4. The design of the operating mechanism shall be such that it shall be practically maintenance free. The guaranteed number of years of 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.
- 6.6.5. 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 analyser to facilitate testing of breaker at site.
- 6.6.6. The circuit breaker shall be provided with motor operated spring charged closing. Spring charging motor shall be suitable for 240V, 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.
- 6.6.7. 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.
- 6.6.8. In 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.
- 6.6.9. The technical requirement of spring type operating mechanism shall be as below.

(OPERATING MECHANISM)

1. SPRING OPERATING MECHANISM:

- 1.1. 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 secs for fully charging 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, the mechanism shall be such that the charging of the springs by the motor does not interfere with the operation of the breaker.

- 1.2. 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.
- 1.3. In case of failure of power supply to the spring charging motor, the mechanism shall be capable of performing one sequence of 0 - 0.3 Sec - CO.
- 1.4. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of the closing springs when the breaker is already in the closed position. Provision shall also be made to prevent a closing operation to be carried out with the spring partially charged.
- 1.5. Facility shall be provided for manual charging of the closing springs. The actuating force required for manually charging the spring shall be less than 250N. In support of this requirement the tenderer shall furnish the test report for actual requirement of force based on actual measurement.

6.6.10. SPECIFICATION FOR OPERATING MECHANISM HOUSING AND CONTROL CABINETS

1. 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.
2. 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 IEC:529/IS:2147. 15mm thick neoprene or better type of gaskets shall be provided to ensure degree of protection of at least IP55 as per IEC: 529/IS:2147. It shall have backwards slanting rain hood of 2 mm thick (14 SWG) sheet for protection against rain water.
3. Equipment and devices shall be suitable for operation on specified auxiliary A.C. supply system.
4. Motors would be suitable for operation on a 240V, 1Phase, two pole 50 Hz A.C. supply system, with one pole grounded.

5. Push button shall be rated for not less than ___ Amps, 240 Volts a.c or ___ 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.
6. Contactor shall be provided with a three element, positive acting ambient temperature compensated, time lagged, hand reset type thermal over load relay with adjustable setting. Hand reset button shall be flush with the front door of the cabinet and suitable for resetting with starter compartment door closed. Relays shall be direct connected.
7. Single phasing protection shall be built in the thermal over load protection.
8. Purchaser's power cables will be of 1100 Volt grade stranded aluminum conductor, PVC insulated PVC sheathed single steel wire armoured and PVC jacketed. All necessary cable terminating accessories such as glands, crimp type tinned copper lugs etc. for power as well as control cables shall be included in tenderer's scope of supply. Suitable brass cable glands shall be provided for cable entry.
9. Wiring for all control circuits shall be carried out with 1100 Volts grade PVC insulated tinned copper stranded conductors of sizes not smaller than 2.5 mm. Atleast 10% spare terminal blocks for control wire terminations shall be provided on each panel. The terminal blocks shall be similar to ELMEX type CAT-M4. 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. Terminals for receiving purchaser's cables should be marked as per purchaser's standard.
10. Control cabinet shall be provided with 240 V, 1-phase 50 Hz, 20W fluorescent lighting fixture with on /off switch and a suitably rated 240 V, 1 phase, 5 amp, 3 pin socket for hand lamp.
11. Suitable heaters shall be provided inside each cabinet. Heaters shall be controlled by suitable MCBs.
12. All a-c control equipment shall be suitable for operation on 240V, 1 Phase two wire 50 Hz system, with one pole grounded.
13. Items inside the cabinet made of organic material shall be coated with a fungus resistant varnish.
14. For protection of AC/DC aux. circuits, MCBs of suitable capacity & reputed make to be provided.
15. The schematic/ wiring diagram plate shall be provided on the door of the mechanism Box.

6.7. OPERATING MECHANISM HOUSING:

The operating mechanism housing/control cabinet shall conform to additional requirements specified in Clause 6.18.6.

- 6.7.1.** All the electrical control equipments/switches, the operating point for manual spring charging handle etc. shall not be at a height of 1200mm from ground level

OR from a suitable platform which shall be provided by tenderer on the structure at a height not more than 750mm from ground level. The size of the platform shall be such that clear working space on the platform shall not be less than 300 mm from all sides of operating mechanism/control box. The tenderer shall specifically confirm that the offered breaker meets this requirement and furnish the G. A. Drawing showing the arrangement.

6.8. TAKE OFF TERMINAL PADS:

- 6.8.1. 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 approximate terminal loads, specified below. 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.
- 6.8.2. 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 shown below.

Voltage	jumper length	Size of Conductor	Phase to phase spacing
36 KV	2.0 m	0.4 sq. in eq. Cu	1.25 m

- 6.8.3. 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.
- 6.8.4. The vertical clearance of lowest live part from ground level (including concrete foundation plinth) shall be as given below. In no case the height less than that indicated will be accepted:
36 kV breaker - 3700 mm

6.9. PORCELAIN HOUSING:

- 6.9.1. 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).

6.9.2. 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 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 430mm shall be acceptable subject to withstanding the lightning impulse voltage test in absence of barrier on any pole.

6.10. 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.

6.11. GALVANISING:

All ferrous parts including nuts, bolts, plain and spring washers of size M 10 and above, support channels, structures, etc. shall be hot dip galvanised 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.

6.12. EARTHING:

6.12.1. 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.

6.13. NAME AND RATING PLATE:

6.13.1. 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.

6.13.2. Manufacturer's name or trade mark by which he may be readily identified.

6.13.3. Serial number and type designation of CB & Operating mechanism

6.13.4. Year of manufacture

6.13.5. Voltage

6.13.6. Lightning impulse withstand voltage

6.13.7. Normal current

6.13.8. Short circuit breaking current

6.13.9. Duration of short circuit

6.13.10. Mass of circuit breaker with support structure.

6.13.11. Auxiliary D.C. supply voltage of closing and opening devices

6.13.12. Out of phase **making** & breaking current

6.13.13. A.C. supply voltage of auxiliary circuits.

6.13.14. Insulation level

6.13.15. Frequency

6.13.16. Purchase order reference

6.13.17. Operating sequence.

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

6.14. The coils of operating devices shall be marked clearly with the catalogue number/reference number as indicated in control wiring diagram.

6.15. **CONTROL CIRCUITS:**

6.15.1. The control circuit shall include the following features:

6.15.2. 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.

6.15.3. One local/remote selector switch.

6.15.4. Conveniently located manual emergency trip

6.15.5. Anti-pumping feature

6.15.6. Auxiliary switches as specified elsewhere.

6.15.7. Independence of trip circuit from local/remote selection.

6.15.8. Alarms, indications, monitoring equipments and interlocks as specified elsewhere.

6.15.9. Trip circuit supervision for pre trip as well as post trip.

6.16. **AUXILIARY SWITCHES:**

Each operating mechanism of the circuit breaker shall be provided with Cam/Snap type auxiliary switches with 4NO+4NC contacts exclusively for the purchaser's use with continuous current rating of 10 A D.C. Breaking capacity of the contacts shall be minimum 2 A with circuit time constant less than 20 milliseconds at the rated D.C. voltage. Normal position of auxiliary switches refers to contact position when circuit breaker is open.

6.17. **ALARMS AND INDICATIONS: (AS APPLICABLE)**

Potential free contacts shall be provided, duly wired up to the operating mechanism housing/control cabinet for the following alarms and indications to be provided by the purchaser on his control panel.

6.17.1. **Alarms:**

a. Auxiliary A.C./D.C. supply failure

6.17.2. **Indications:**

a. Breaker on-off

b. Spring charged.

6.18. **INDICATIONS IN OPERATING MECHANISM:**

The operating mechanism housing shall be provided with the following mechanical and Electrical indications/counters:

a. Breaker on-off

b. Spring Charged

- c. Operation counter to register the number of breaker operations.

6.19. 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 tenderer. The requirement of auxiliary contacts to be provided in breaker operating mechanism by the tenderer for successful operation of the scheme has been specified in clause 6.13.

6.20. MOUNTING:

6.20.1. The design and supply of support structure, required for mounting the Circuit Breaker in Purchaser's switch yard, shall be in the tenderer's scope. The tenderer'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.

- a. Vertical clearance of lowest live part as specified in clause 6.4.4.
- b. Minimum height of 2200 mm above the top of concrete plinth (This is a Statutory Regulation)

6.20.2. The Circuit Breaker shall be connected to adjacent equipment in the switch yard through ACSR conductor. The maximum unsupported length of conductor on both sides of the Circuit Breaker have been specified in clause 6.4.2.

6.20.3. The loading data to be considered by the tenderer for design of support structure shall include the following.

- a. Dead weight of the Circuit Breaker, Structure, Bus Bars
- b. Operational steady state and impact loading
- c. Wind load on a Circuit Breaker, Structure, Bus Bars
- d. Short circuit forces

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

7. TESTS

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

LIST OF TYPE TESTS

Sr.No	Type test
1	Basic short circuit tests.
2	Out of phase making and breaking tests.
3	Cable charging breaking current tests
4	Short time and peak withstand current tests.
5	Lightening impulse voltage test.

6	P.F.Voltage withstand test (dry & wet).
7	Temperature rise test.
8	Mechanical operation test.
9	Degree of protection (IP55) for all cabinets.
10	Single phase short circuit test (for 3 phase mechanically gang operated breaker).

NOTE:

1. The type test shall be carried out at following Laboratories or at any other Laboratories accredited by National Accreditation Board for Testing & Calibration Laboratories (NABL).
 - 1.1. Central Power Research Institute (CPRI).
 - 1.2. Electrical Research and Development Association, Vadodara (ERDA).
 - 1.3. Following Short Circuit Test Laboratories:
 - a. CESI, Italy.
 - b. KEMA, Holland.
 - c. SATS, Ludvica, Sweden.
 - d. PEHLA, Germany.

7.2. TYPE TESTS:

- 7.2.1. 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 rating 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.
- 7.2.2. 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.
- 7.2.3. 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.
- 7.2.4. 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.
- 7.2.5. 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 authorised 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 :-

- a. 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.
- b. For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.

AND

- c. 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.
- d. For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.
- e. balance quantity against the order including the rejected qty. shall be cancelled without any liability on either side.
- f. The firm will be debarred from dealing with the company upto a period of three years from the date of rejection.

7.3. ACCEPTANCE & ROUTINE TESTS:

7.3.1. All acceptance and routine tests as stipulated in relevant standards, amended upto 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.)

7.3.2. After finalisation of the programme 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.

8. INSPECTION:

- 8.1. The inspection may be carried out by the purchaser or his representative at any stage of manufacture. The successful Tenderer 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.
- 8.2. The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for stage inspection.
- 8.3. 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 programme.

9. QUALITY ASSURANCE PLAN:

- 9.1. The tenderer shall invariably furnish following information along with his offer, failing which his offer shall be liable for rejection. Information shall be separately given for 36 KV rating of circuit breaker
 - 9.1.1. Statement giving information about names of sub-suppliers, list of testing standards, list of tests normally carried out in presence of tenderer's representative and copies of test certificates in respect of following items of raw-materials.
 - a. Contact material
 - b. Porcelain
 - 9.1.2. Information and copies of test certificates as in (i) above in respect of bought out accessories.
 - 9.1.3. List of areas in manufacturing process, where joint stage inspections are normally carried out by the tenderer/purchaser for quality control and details of such tests and inspections.
 - 9.1.4. Special features provided in the equipment to make it maintenance free.
 - 9.1.5. List of testing equipments available with the tenderer for final testing of breakers vis.a.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.
- 9.2. The successful tenderer shall, within 30 days of placement of order, submit following information to the purchaser.
 - 9.2.1. List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with the offer.
 - 9.2.2. Type test certificates of the raw material and bought out accessories.
 - 9.2.3. 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 finalised.
- 9.3. The successful tenderer 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.

10. PERFORMANCE GUARANTEE:

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

11. DOCUMENTATION:

- 11.1. All drawings shall conform to international standards organisation (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.
- 11.2. **DRAWINGS:**
- 11.3. The tenderer shall furnish four sets of relevant descriptive and illustrative published literature/pamphlets and the following drawings for preliminary study:
- General outline drawings showing outside dimensions, shipping dimensions, weights, quantity of insulating media air receiver capacity and such other prominent details.
 - Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance.
 - Schematic diagrams of the scheme for control, supervision and reclosing.
 - Structural drawing, design calculations and loading data for support structures.
 - Foundation drilling plan and loading data for foundation design.
 - Type test reports of circuit breakers along with a separate list showing all the tests carried out with date & place of test.
 - Test reports, literatures and pamphlets of bought out items and raw materials.
- 11.4. The successful tenderer 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 (Stores)**. 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 C.B. **to the office of Chief Engineer (Stores)**.
- 11.5. The successful tenderer 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 main equipment 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.
- 11.6. The manufacturing of the equipments 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 equipment prior to the approval of the drawings shall be at the supplier's risk.

11.7. 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.

12. PACKING AND FORWARDING:

12.1. The equipment 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.

12.2. 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.

13. TRAINING OF ENGINEERS:

13.1. The successful tenderer shall be required to provide facilities for in-plant training at no extra cost to the purchaser to atleast four engineers to be nominated by the purchaser for a period of three weeks(i.e. 12 man weeks) at his works, where the equipments 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.

13.2. If the equipment 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).

13.3. 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.

13.4. 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 finalising tender. The expenditure incurred by the successful tenderer in this regard shall be paid to him by the purchaser. This amount, however, will not be considered for loading his offer.

13.5. The period and the programme of the training (generally for three weeks) shall be mutually discussed and finalised by the purchaser with the supplier/s.

14. SUPERVISORY ERECTION AND COMMISSIONING;

14.1. 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 tenderer 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 equipment 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 tenderer and expenses such as Erector's salary, insurance against personal injuries to the Erector etc., shall be to tenderer'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.

14.2. The tenderer shall quote the lumpsum 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 tenderer shall also indicate estimated time period for erection, testing and commissioning of each type of breaker.

14.2.1. The separate rates shall be quoted for following works at purchasers premises.

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

15. QUALIFYING REQUIREMENTS : As per Tender.

16. REQUIREMENT OF DOCUMENTS

16.1. Following documents should be furnished electronically

16.2. 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-I 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).

16.3. 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. 7.0 (A) duly sealed and signed on each.
- d. General arrangement drawing for C.Bs.

All documents in physical form shall be submitted

ANNEXURE - I

1. PRICE AND DELIVERY SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT PRICE		TOTAL PRICE		GUARANTEED DELIVERY IN MONTHS EX-WORKS FROM DATE OF ORDER
			EX-WORKS	FOR DESTINATION	EX-WORKS	FOR DESTINATION	
	36KV, 25KA, 1600A, 3 Phase Reclosing type Mechanically gang operated Circuit Breakers.						

**GENERAL TECHNICAL PARTICULARS
FOR 36 KV, 1600A, 25 kA VACUUM CIRCUIT BREAKERS**

1	Name of Manufacturer	Text
2	VCB conforms to IS: 13118:1991 : Yes/no	Boolean
3	Type Designation	Text
4	Offered VCB shall be suitable for outdoor Installation : (Yes/No)	Boolean
5	Offered VCB shall be suitable for System frequency 50 HZ \pm 3% Yes/No	Boolean
6	Operating mechanism, A. C. Control & Protective devices, lighting fixtures, space heaters and f.h.p.motors shall be suitable for Single phase, 240 Volts \pm 10% A.C. supply with one point grounded : Yes/No	Boolean
7	D.C. alarm, control and protective device shall be suitable for 30 Volts D. C. Supply with variation -15% to +10% : Yes/No	Boolean
8	Offered VCB shall be suitable for solid neutral earthing : Yes/No	Boolean
9	Type of breaker - Vacuum Circuit Breaker : Yes/No	Boolean
10	Number of Poles - 3 Nos : Yes/No	Boolean
11	Type of operation - Mechanically coupled gang operated : Yes/No	Boolean
12	Type of operation shall be suitable for 3 phase reclosing : Yes/No	Boolean
13	Class of Insulating Material	Text
14	Clearances provided in air between Phases : in mm	Numeric
15	Clearances provided in air Live part to live part in mm	Numeric
16	Clearances provided in air Live parts to earth in mm	Numeric
17	Clearances provided in air Live parts to ground level : min 3700 mm	Numeric
18	Height of the lowest part of the support insulator from ground level (min 2500 mm).	Numeric
19	Control Circuit Voltage : 30 V DC : Yes/No	Boolean
20	Rated voltage of the breaker : 36 KV rms. : Yes/No	Boolean
21	Continuous current rating of VCB shall be min 1600 Amps	Numeric
22	A.C. component Short Circuit current shall be min 25 kA for 3 sec.	Numeric
23	Rated short circuit making current capacity shall be min 62.5 kA peak	Numeric
24	Operating mechanism - spring operated: Yes/No	Boolean
25	Rated operating duty cycle. - O-0.3 seconds-co-3-minutes-co : Yes/No	Boolean
26	Data on re striking voltage at 100% at rated breaking capacity	Text
27	Amplitude factor : 1.4 : Yes/No	Boolean
28	1 st Pole to clear factor : 1.5 : Yes/No	Boolean

29	Rate of rise of re striking voltage : 0.57 volts/micro second : Yes/No	Boolean
30	Max. closing time in ms (Max.150 ms)	Numeric
31	Max. total break time at 100 % rated interrupting breaking capacity : 100 ms	Numeric
32	1.2/50 micro second impulse withstand voltage: 170 kVp : Yes/No	Boolean
33	One minute power frequency with-stand voltage 70 kV rms. : Yes/No	Boolean
34	Continuous current rating of Auxiliary switches shall be min 10 A D.C.	Numeric
35	Breaking capacity of the contacts shall be minimum 2 A with circuit time constant less than 20 milliseconds at the rated D.C. voltage.	Numeric
36	Material of Terminal pad : Copper/Aluminium	Text
37	If Terminal Pads are made of metal other than aluminum, thickness of silver plating on terminal pads shall be at least 25 microns.	Text
38	The current density for copper terminal pad shall not be more than 1.6 A/sq. mm.	Text
39	The current density for other than copper terminal pad shall not be more than 1 A/sq. mm.	Text
40	Net surface area of Terminal Pad in sq. mm.	Text
41	Net cross section of Terminal Pad in sq. mm.	Text
42	Material of main contacts	Text
43	Is main contacts contact silver plated	Text
44	Thickness of silver plating of contacts : mm	Text
45	The surface finish paints of non galvanized metallic part of VCB shall be battleship gray shade No.632 of IS 5.	Text
46	Degree of protection of Operating Mechanism enclosure is IP 55 of IS 2147	Text
47	Number of auxiliary contacts provided for purchaser's use : 4 NO +4 NC	Text
48	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
49	Rated Voltage of Bushing : 36 kV : Yes/No	Boolean
50	Material of bushing : Porcelain : Yes/No	Boolean
51	Dry – 1 min Power frequency withstand test voltage 75 kV rms : Yes/No	Boolean
52	Dry flashover voltage of bushing : 125 kVrms : Yes/No	Boolean
53	Dry flashover voltage of bushing : 195 kVrms : Yes/No	Boolean
54	1.2/50 micro second Impulse withstand voltage 170 kVp : Yes/No	Boolean
55	Creepage distance of support insulator : min. 900 mm	Numeric
56	A list of recommended spares with unit rates for each circuit breaker that may be necessary for satisfactory operation and maintenance of the circuit	Text

	breaker for a period of 5 years shall be submitted.	
57	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
58	The list of necessary tools/equipments which will be supplied free of cost with each CB furnished separately.	Text
59	Are the following tests reports submitted with offer valid for offered equipment	
60	Basic short circuit tests. : Yes/No	Boolean
61	Out of phase making and breaking tests. :Yes/No	Boolean
62	Cable charging breaking current tests. :Yes/No	Boolean
63	Short time and peak withstand current tests. :Yes/No	Boolean
64	Lightning impulse voltage test. :Yes/No	Boolean
65	Power Frequency Voltage withstand test (dry & wet). :Yes/No	Boolean
66	Temperature rise test. :Yes/No	Boolean
67	Mechanical operation test. :Yes/No	Boolean
68	Degree of protection (IP55) for all cabinets. :Yes/No	Boolean
69	Single phase short circuit test (for 3 phase mechanically gang operated breaker). :Yes/No	Boolean
70	Are copies of test certificates in respect of following raw-materials submitted with offer.	Text
71	a. Contact material :Yes/No	Boolean
	b. Porcelain :Yes/No	Boolean
72	Are the following drawing submitted	Text
73	General outline drawings showing outside dimensions, shipping dimensions, weights, quantity of insulating media air receiver capacity and such other prominent details. :Yes/No	Boolean
74	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
75	Schematic diagrams of the scheme for control, supervision and reclosing :Yes/No	Boolean
76	Structural drawing, design calculations and loading data for support structures. :Yes/No	Boolean
77	Foundation drilling plan and loading data for foundation design. :Yes/No	Boolean

78	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
79	Test reports, literatures and pamphlets of bought out items and raw materials. :Yes/No	Boolean
80	Manufacturing experience is more than 5 years.	Numeric
81	Whether bidder has collaboration with manufacturer who has 10 years experience in the Design, Manufacture and Testing of the equipment of the type and class offered which have been in satisfactory service for a period of at least 7 years.	Text
82	Whether bidder adequate in-house testing facilities for conducting acceptance tests in accordance with relevant IS.	Text
83	Whether bidder has minimum turnover of 60 % of the value of the material offered in any one financial year during the previous 3 years.	Text
84	Type of operation shall be suitable for 3 phase reclosing : Yes/No.	Boolean