Kashmir Power Distribution Corporation Ltd.

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TECHNICAL SPECIFICATION

FOR

33KV, 3Phase, 50 C/S, 1600A, 25KA, OUTDOOR TYPE,

VACUUM CIRCUIT BREAKERS.

Prepared By	Checked by	Checked by	Checked by	Approved by
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SECTION

CLIMATIC AND ISOCERAUNIC CONDITIONS

(CIC)

CLIMATIC AND ISOCERAUNIC CONDITIONS (CIC)

1.	The climatic and Iso-ceraunic conditions at the site of work are approximately given as under:	
	Description	Kashmir
i)	Max. temp of air in shade	30.6^0C
ii)	Min. temp of air in shade	-20^0C
iii)	Max. temp of air in sun	45^0C
iv)	**Height above sea level (App.)**	**1600 Mtrs**
v)	Max. relative humidity	90%
vi)	Min. relative humidity	15%
vii)	Average no. of thunder storm days per year	54
viii)	Average rainfall	80 cm
ix)	Wind Zone	WZ – 3
x)	Average number of rainy days per year	106
xi)	Seismic Zone	SZ – 5
xii)	Area of installation	Heavy Snow Zone
2.	**Communication and Transport**	
	The nearest railway station is Jammu on the broad gauge line and is connected to the Divisional Stores by a metal road. The equipment is required to pass en-route through various tunnels on NH-44/1A (Nandni, Nashri and Jawahar Tunnel). The weights and maximum dimension of the packages suitable for transportation through tunnel route are as follows:- 1. Length = 7.0 m 2. Width = 3.0 m 3. Height = 4.55 m 4. Weight = 40 Ton (metric) The supplier shall get the permissible weight and dimensions confirmed from the Highway Authorities before proceeding with the manufacture of the equipment. It will be the responsibility of the supplier to ensure timely and proper delivery of the equipment on door delivery basis, at Srinagar, through road transport. The supplier shall also ensure that the weights and dimension of the packages which are suitable to be carried by road transport up to Srinagar.	

Sd/- **Sd/-** **Sd/-** **Sd/-**
JE **AEE** **AEE** **Executive Engineer**
Sd/-
Superintending Engineer
Planning, (KPDCL

TECHNICAL SPECIFICATION FOR 33KV, 3Phase, 50 C/S, 1600A, 25KA, OUTDOOR TYPE, VACUUM CIRCUIT BREAKERS.

1) SCOPE

1.1 This specification covers design, engineering, manufacture, testing, inspection before dispatch packing, forwarding, transportation, insurance during transit, delivery to site/ stores, **for 33KV Outdoor Type Vacuum Circuit Breakers** for use at the 33/11KV Substations in Kashmir Region of J&K UT.

1.2 All vacuum circuit breakers must be manufactured by ISO 9000 certified Organization and shall have been type tested at **CPRI or any NABL Accredited laboratory within ten (10) years** as on the date of bid opening and in satisfactory operation for a period not less than three years. The Bidder shall demonstrate compliance with this requirement by supplying with the bid, copies of the type test certificates together with performance certificates from purchasers/ users.

1.3 The scope of supply includes the provision of type tests at CPRI or any NABL Accredited laboratory within last ten years

1.4 The scope also includes the circuit breaker, supporting structures, operating mechanism, local control cabinet, foundation bolts, all the accessories and auxiliary equipment mandatory spares and special tools for Satisfactory installation and operation.

1.5 The circuit breakers shall conform in all respects to the highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the purchaser shall have the power to reject any work or materials, which, in his judgment, is not in full accordance therewith.

2) STANDARDS

Except where modified by this specification, the circuit breakers and the accessories shall be designed, manufactured and tested in accordance with latest editions of the following standards.

IEC/ISO/BS	IS	Subject
IEC: 56 IEC:62271-100 / 200	IS : 13118	High voltage alternating current circuit breakers general requirement
IEC: 694	IS : 12729	Common clauses of high voltage switch-gear and control gear standards (for voltage exceeding 1000 V).
IEC: 60	IS : 9135	High Voltage testing techniques.
IEC: 427	IS:13516	Method of synthetic testing of HV .A.C circuit breakers.
IEC: 1233		HV. AC. Circuit breakers- inductive load switching.
IEC: 17A/CD: 474		HV. AC. Circuit breakers- capacitive switching.

IEC: 529	IS: 13947	Degree of protection provided by enclosure.
IEC:137	IS: 2099	Insulating bushing for A.C. voltages above 1000V
IEC:233	IS : 5621	Hollow insulators for use in electrical equipment & testing.
IEC:273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC:815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
IEC: 34	IS : 996	A.C motors
ISO:1460 BS:729	IS:2629	Hot dip galvanizing
	IS:2633	Method of testing uniformity of zinc coated articles.
	IS: 5	Colour for ready missed paints and enamels
	IS: 6005	Code of practice for phosphating or iron and steel.
IEC: 227	IS:1554	P.V.C Insulated cables for voltages up to and including 1100 Volt.
IEC:269	IS:13703	Low voltage fuses for voltages not exceeding 1000volt.
ISO:800	IS:1300	Phenolic moulding materials.
	IS:13118	Guide for uniform marking and identification of conductors and apparatus terminals.

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the Supplier of the necessity of providing the goods and services complying with other relevant standards or recommendations.

3) TYPE AND RATING

The circuit breakers shall be suitable for outdoor operation under the climatic conditions, as specified in Tender specification, without any protection from sun and rain.

The vacuum circuit breakers are required to meet the following basic technical requirements. (Reference standards IEC:56, IEC:62271-100&200, IS:13118 and associated standards listed in this specification.

The circuit breakers shall have the following rating:-

S. No.	PARTICULARS	Requirements
i)	Number of Poles	3 Nos.
ii)	Frequency	50 Cycles/ Sec.
iii)	Nominal System Voltage	33 KV
iv)	Highest System Voltage	36 KV
v)	Interrupting Capacity at nominal system voltage	1500 MVA
vi)	Rated Continuous Current	1600 Amps
vii)	Short-time Current Rating for 3 Secs.	25 KA
viii)	Basic Insulation Level	170 KV
ix)	Power Frequency Withstand Voltage for one Minute	70 KV
x)	Total Break-time for any Current up to the rated breaking current	5 cycles (max.)
xi)	Control Circuit Voltage	30 Volt D.C.
xii)	Operating duty for gang operation	O – 0.3 Sec – CO – 3 Min – CO
xiii)	The VCBs shall be suitable for one reclosing followed by one delayed reclosing and lock out	
	Minimum clearances	
a)	Between Phases	430 mm
b)	Between Live Parts & Ground	3700 mm
c)	Creepage Distance	900 mm

The above are our minimum requirements. The manufacturers may offer their standard design, keeping in view our minimum requirements.

4) GENERAL

The circuit breaker shall be of porcelain clad vacuum type. The breaker, complete in all respect, shall be supplied with all accessories in-place and all internal wiring installed and terminated in the mechanism housing and the equipment shall be complete in all respects.

The circuit breakers shall provide rapid and smooth interruption of current under all conditions, completely suppressing all undesirable phenomena, even under the most severe and persistent short-circuit conditions or when interrupting small currents or

leading/ lagging reactive currents. The details of any device incorporated to limit or control the rate of rise of Re-striking voltage across the circuit breaker contacts shall be stated. The over voltage caused by the circuit breaker switching on inductive or capacitive load shall not exceed 3.2 times the normal phase to neutral voltage. The total break-time for the circuit breaker, throughout the range of breaker operating duty, shall be stated in the tender and shall be guaranteed. The breaker shall be fit for capacitor switching for 5 MVAr Bank.
The breakers shall be provided with trip free mechanism.

The circuit breakers shall be suitable for mounting on steel structures. All the structures shall be hot dip galvanized with 3 dips. **Please note that cantilever type supports for mechanism box are not acceptable**. The mechanism box shall have firm supports from bottom. This is necessary to minimize vibration of mechanism box, which in turn may disturb various settings. The supplier shall indicate clearly the vibration level of the breaker during fault / normal ON OFF operations in all three directions.

On the occurrence of a fault the concerned protective relay will open the circuit breaker as per its own characteristic. Thereafter, the breaker shall re-close but after pre-set time delay, which shall be adjustable (say range 4 to 10 secs or near about). There shall be no further automatic reclosing.

5) SPECIFICATION FOR CIRCUIT BREAKERS

The circuit breakers shall consist of three identical phase units with a common operating mechanism. While offering the circuit breaker, the following details should be confirmed and furnished with the tender:-

i. Complete construction details of the equipment offered. It should be noted that the breakers should be suitable for out-door duty. Indoor breakers accommodated in out-door kiosks are not acceptable.
ii. Type, make & source of vacuum bottles with relevant details shall be indicated in the offer, clearly.
iii. The capacity of breaker to interrupt inductive and capacitive currents shall be indicated in the offer (rating of capacitor bank should be stated and type test report shall be furnished).
iv. Spare availability of vacuum interrupter should be confirmed by the bidder for the designed expected life of the breakers being offered.

6) VACUUM INTERRUPTER

The design of the vacuum interrupter shall be such that it gives trouble free operation under normal load and fault conditions throughout the life of the equipment. As the efficiency of the breaker depends on the degree of vacuum inside the interrupter, manufacturer shall ensure that the same is maintained consistently during service. To know the residual life of vacuum interrupter, an indicator to indicate the status of contact erosion shall be provided.

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

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

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

The metallic bellow or any other similar vacuum sealing arrangement should be provided at the moving contact and should have a long fatigue life.

Manufacturer‘s catalogue on vacuum bottle, indicating all the details shall essentially be submitted with the tender.

The Vacuum Interrupter to be supplied should be supported with <u>submission of the type test reports in Technical offer.</u>

7) INSULATORS

The basic insulation level of the Insulator and insulating porcelains shall be as specified and porcelain shall be homogenous and free from cavities and other flaws. They shall be designed to have ample insulation, mechanical strength and rigidity for satisfactory operation under conditions specified above. All insulators of identical ratings shall be inter-changeable. The puncture strength of the insulators shall be greater than the flash over value. **The insulators shall be type tested from independent Govt. Laboratory as per relevant standards or at any recognized and reputed international laboratory or testing institutions**.

8) INSULATION OF THE CIRCUIT BREAKER

The insulation to ground, the insulation between open contacts and the insulation between phases of the completely assembled circuit breaker shall be capable of withstanding satisfactorily di-electric test voltage corresponding to specified basic insulation level in the standard.

9) AUXILIARY CONTACTS

Eight numbers each of auxiliary contacts both of the normally open and normally closed types shall be provided in each circuit breaker for use in the remote indication and control scheme of the circuit breaker and for providing safety interlocking. Special contacts for use with trip coils, which permit for relative adjustment with respect to the travel of the circuit breaker contact, shall also be provided, wherever required. There shall be provision to add more auxiliary contacts at a later date, if required.

10) Indication

A mechanically operated circuit breaker position indicator of non corroding material shall be provided in a location visible from the operating side of the breaker without the necessity to open the mechanism door. The word "OFF" in white letter on green background shall be used to indicate that the breaker is in the opening position and the word "ON" in white letters on a red background to indicate that the breaker is in the closed position. The drive for the device shall be positive in both directions and provision shall be made for local and remote electrical indication. Indication of spring charging condition shall be provided as mentioned in this specification. Mechanical counters to record the number of closing operations shall be provided for each circuit breaker mechanism.

11) TEMPERATURE RISE

The temperature rise and the maximum temperature of any part of the circuit breaker under continuous load condition and exposed in the direct rays of the sun shall not exceed 45 degree centigrade, above Ambient Temp**.** These limits shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the tender.

12) OPERATING MECHANISM

The circuit breakers shall be designed for remote control from the control room and in addition there shall be provision for manual operation of circuit breakers during maintenance and for local tripping and closing by the normal means.
The circuit breakers shall have operation control and mechanical —open‖ —close‖ indicator, in addition to facilities for remote electrical indication.

The following facilities shall be provided in the circuit breaker local control cabinet:

- LOCAL/ REMOTE selector switch of stay put type. The selection of "local" operation shall inhibit the operation of the breaker from any remote source.
- **ON/NEUTRAL/ OFF control switch or ON and OFF push buttons. The push buttons shall be momentary contract type with rear terminal connections. The close push button shall be of green colour and the open push button red colour. ---- Demands Check for RED/GREEN**
- MECHANICAL EMERGENCY TRIP DEVICE: suitable for manual operation in the event of failure of electrical supplies. The device shall be accessible without opening any access doors and distinctly labeled. It shall be shrouded and protected against inadvertent operation.
- Means shall be provided for manual operation of these circuit breakers during failure of auxiliary power in addition to electrical operation.
- Means shall be provided to prevent the mechanism from responding to a close signal when the trip coil is energized or to reclosing from a sustained close signal either opening due to a trip signal or failure to hold in the closed position.

The operating mechanism shall be of the spring charging type, by electric control under normal operation. The mechanism shall be trip free electrically and mechanically. The mechanism shall be capable of performing satisfactorily, the reclosing duty cycles indicated above, within the time specified. All working parts in the mechanism shall be of corrosion resistant material and all bearings, which require greasing, shall be equipped with pressured grease fittings. The mechanism shall be strong positive quick in action and shall be removable without disturbing the other parts of the circuit breaker. The mechanism and breaker shall be such that the failure of any spring will not prevent tripping and at the same time will not cause any false tripping or closing. The operating Mechanism should be motor operated spring charged type preferably without chain drive. The motor for spring charging shall be suitable to perform satisfactorily for input supply voltage of 230 Volt A.C. 50 Hz with a variation of **plus 10 and minus 20 percent**. The A.C. Motor should have overload protection. Provision should also be made for mounting of mechanism box at an adequate height and gear ratios shall be so chosen that one man should be able to charge the spring, without any additional efforts.

13) CONTROL CUBICLE

A common control cubicle shall be provided to house electrical, controls, monitoring devices and all other accessories, except those which must be located on individual poles. The cubicle shall be gasketed and shall have weather-proof construction, fabricated from sheet steel of minimum **2.5 mm thickness**. The type test report on degree of protection test (IP-55) shall also be furnished.

The cubicle shall have front access door with lock and keys, space heater, internal illumination lamp, 3 pins 5 Amp socket with individual ON-OFF switches shall be provided in the cubicle.

For Local operation following shall be provided:-

a) LOCAL/REMOTE selector switch
b) TRIP/ NORMAL/CLOSE control switches with pistol grip handle.

The control circuits shall be designed to operate on 30 Volt DC, as indicated in the schedule and it shall be possible to adopt to work on other voltages by simply changing the operating coils. The shunt tripping coils shall be designed to operate satisfactorily within **110 % and 70% of the rated DC supply voltage** and the shunt closing coils should operate up to 70% of the rated DC voltage. These checks shall be repeated during pre-commissioning checks at site before putting the breakers in service.

AC Power supply for auxiliaries will be available at 230 Volt (+/- 15% variation) single phases 50 Hz (± 5% variation) at substation. The supplier shall be required to extend this supply, using proper protection, to desired location through cable.

Necessary double compression type cable glands for the cables of the operating mechanism shall be provided. The cables used for operation are all un-armoured **2.5**

sq. mm copper control cables of 1100 V grade. The cable glands shall be suitable for 1 no. 8 core and 2 nos. 4 core cables and cables as per site requirements. The gland plate should be made of non-magnetic materials and suitably drilled at site to suit the cable entry.

The Circuit breaker shall be provided with trip free Mechanism so that tripping instructions could over-ride the closing instructions. An additional tripping coil shall also be provided in the trip circuit. The second coil shall have separate tripping lever arrangements in the mechanism, so as to avail full advantage of second trip coil. Also the two trip coils shall have separate fuses in the DC circuit, so that in the event of any short circuit/damage in any one of the trip coils, the supply is available to the other one.

The circuit diagram of Control circuit of VCB along with operating instructions (DOS/ DON'T) shall be embossed on metallic plate duly laminated and the same shall be fixed on the rear door of the control cubicle from inside.

14) WIRING

Wiring shall be completed in all respects to ensure proper functioning of the control, protection, monitoring and interlocking schemes.

All the wiring shall be carried out with 1100 V grade, PVC insulated stranded copper conductor of 2.5 sq. mm as per IS: 1554. Each wire shall be identified at both ends with permanent markers bearing wire numbers as per wiring diagram.

Wire termination shall be done with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.

All spare contacts of auxiliary switches etc. shall be wired up to terminal blocks in the control cubicle.

15) TERMINAL BLOCKS

Terminal blocks shall be of 1100 V grade, box clamp type ELMEX 10 sq. mm or approved equivalent. Not more than two wires shall be connected to any terminal. Spare terminals, **equal in number to 20% of active terminals, shall be provided.**

Terminal block shall be such located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

16) TERMINAL CONNECTORS

6 Nos. Terminal bi-metallic connector suitable for 200mm^2 ACSR shall be supplied with each breaker. For ensuring quality and uniformity, the purchaser may decide to specify the design of terminal connector, the material of terminal connector and thickness of clamps. Further compliance of which will have to be done by the supplier without any extra cost. Suitable earth connector for earthing connections shall also be supplied. The connector drawing shall be got approved from the purchaser.

17) ACCESSORIES

The vacuum circuit breaker shall be supplied as a complete unit with internal wiring installed and terminated in mechanism box and equipped with the following accessories:

1	Motor operated spring charged mechanism (Motor voltage – 230 V AC)	1 No.
2	Trip coil suitable for 30 V DC	2 Nos.
3	Closing Coil suitable for 30 V DC	1 No.
4	Pistol grip C.B. Control switch having Trip/ Normal/ Close	1 No.
5	Local/ Remote selector switch	1 No.
6	Spring Charged indicator	1 No.
7	Manual operating handle for maintenance	1 No.
8	Facility for manual charging of spring	1 No.
9	Operation counter	1 No.
10	Auxiliary contacts (8 NO-8 NC)	1 Set
11	Anti-pumping device suitable for 30 V DC	1 No.
12	Terminal connectors suitable for connecting **200 mm^2 ACSR**	6 Nos.
13	Cubicle illuminating lamp with cage and switch	1 No.
14	Spare terminals connectors	20% of Total Terminals
15	Mechanical ON/OFF Indicator	1 No.
16	MCB for both AC and DC supply	1 No. each
17	Space heater and ON-OFF switch in the mechanism box	1 No.
18	Power Type 3 Pin Socket with ON-OFF switch	1 Set
19	Earthing Terminals	2 Nos.
20	LED indicating lamps	Complete set

Indicating Bulbs:

The indicating lamps should be supplied with Low Voltage protection Circuit (LVGP) and surge suppressor circuit having LED indication. Lamp assembly should be of fire – retardant glass epoxy PCB, industrial heat resistant, fire resistant, non- Hygroscopic DMC material, chrome – plated corrosion resistant solid brass bezel, polycarbonate lens in desired colour shades of Red , Green, Amber, Yellow etc. the intensity of light should be minimum 100 mcd at 20 mA . Indication lamp should be suitable to operate on 30 V Direct Current supply source.

18) TYPE TESTS

Type test certificates on VCB for the following tests, strictly as per IS 13118, with latest amendment thereof, from CPRI/any NABL accredited lab, shall invariably be furnished :-

- Short Circuit Duty Tests
- Short Time Current Rating Tests
- Mechanical Endurance Test
- Temperature Rise Test
- Lightning Impulse Voltage withstand Test

- Capacitor Switching Duty Test for Single Bank of 5 MVAR capacity
- Power Frequency withstand Voltage Test dry & wet
- Degree of protection IP-55 for control cubicle

The above type test certificates must accompany drawing of type tested equipment, duly signed by type testing authority.

The above tests must not have been conducted on the equipment earlier than 10 years from the date of opening of bids.

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

19) ACCEPTANCE AND ROUTINE TESTS

All acceptance and routine tests, as stipulated in relevant standards, shall be carried out by the manufacturer, in presence of purchaser‘s representative.

Immediately after finalization of the programme for testing, the manufacturers shall give, fifteen days advance intimation to the purchaser, to enable him depute his representative for witnessing the tests.

20) RATING PLATES

The detailed rating plate shall be as per IS and in addition, shall indicate serial number of the equipment, manufacturer‘s name, Purchaser’s Order Number and Date.

21) EXPERIENCE

Minimum 3 years experience in the field of design and manufacture of the equipment offered is essential for the bidder. Details in this regards shall be clearly stipulated in the offer.

22) CHALLENGE CLAUSE:

Purchaser reserves the right to have the material, received after the inspection by the authorized inspecting officer, again tested for any parameter(s) from approved/NABL Accredited testing house / in house technique of the Purchaser. The results if found deviating / unacceptable or in non-compliance with the approved GTPs, the lot shall be rejected and bidder shall arrange to replace the rejected LOT within thirty (30) days of such detection at his cost including to & fro transportation.

23) REQUIREMENT OF MATERIAL

S. No.	Particulars	Site	Total
1	33KV Outdoor Type Vacuum Circuit Breakers for use at 33/11KV Substation.	ECSD Pampore	_____Nos.

Sd/-
Superintending Engineer,
Electric Planning, KPDCL

TECHINICAL DATA SCHEDULE FOR 33 KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER

S. NO	DESCRIPTION	UNITS	BIDDER'S OFFER
1	**GENERAL**		
	- Name of manufacture		
	- Manufacturers type designation		
	- Governing standards		
	- No. of poles of circuit breaker	No.	
	- No. of breaks per phase	No.	
	- Total length of break per phase	mm	
	Type – Vacuum	Yes/No	
2	**NOMINAL VOLTAGE**		
	- Rated voltage	KV	
	Maximum(continuous)service rated voltage	KV	
3	**RATED NORMAL CURRENT**		
	- Under normal condition	Amps	
	- Under site condition	Amps	
4	**SHORT CIRCUIT PERFORMANCES**		
	- Rated short circuit breaking current:		
	Symmetrical, rms	KA	
	Asymmetrical including DC component	KA	
	- Rated short circuit making current; peak	KA	
	- Short time current withstand capability:		
	Peak value	KA	
	Rms value	KA	
	Duration	Sec	
5	**MAX. TEMP. RISE OVER AMBIENT TEMPERATURE**		
	- At normal continuous current	^{0}C	
	- After performing the operating sequence	^{0}C	
	- At 10% rupturing capacity		
6	**Make & Break Times**		
	Total break times		
	At 10% rupturing capacity	milli-sec	
	At rated rupturing capacity	milli-sec	
	Arcing time at rated breaking current	milli-sec	
	Make time form giving close command	milli-sec	
	- Minimum reclose time at full rated interrupting Capacity from trip coil energization	sec	
	- Minimum dead time for 3 phase reclosing	mill-sec	
	- Circuit breaker opening time:		
	at 125% of rated voltage of opening device	milli-sec	
	at 100% of rated voltage of opening device	milli-sec	
	at 70% of rated voltage of opening device	milli-sec	
	- Circuit breaker closing time:		
	at 125% of rated voltage of closing device	milli-sec	
	at 100% of rated voltage of closing device	milli-sec	

	at 70% of rated voltage of closing device	milli-sec	
7	**RESTRIKING VOLTAGES FOR 100% RATED CAPACITY**		
	- Amplitude factor	KV	
	- Phase factor	KV	
	- Natural frequency	KHz	
	- Rate of rise of recovery voltage	kv/µs	
8	**RATED INSULATION LEVEL**		
	- Dry and wet power frequency withstand test voltage (rms) for 1 minute		
	Between live terminals and grounded objects	KV	
	Between terminals with breaker contacts open	KV	
	- 1.2/50 µsec full wave impulse withstand voltage +ve and - ve polarity (peak)		
	Between live terminals and grounded object	KV	
	Between terminals with breaker contacts open	KV	
	One minute power frequency voltage of auxiliary wiring	KV	
9	**OPERATING PERFORMANCE**		
	- Rated transient recovery voltage	KV/µs	
	Rated cable charging breaking current	Amps.	
	Rated single capacitor bank breaking current	Amps.	
	Rated back-to-back capacitor bank breaking current	Amps	
	Rated capacitor bank in-rush making current	KA	
	Rated small inductive breaking current	KA	
	First pole-to-clear factor		
	Rated operating sequence		
	Rated out-of-phase breaking current	KAmp	
	Re-ignition and Re-strike free	Yes/ No	
10	**NUMBER OF OPERATION POSSIBLE WITHOUT MAINTENANCE**		
	at full rated interrupting current	No.	
	at 50% of rated interrupting current	No.	
	at 100% of full load current	No.	
	at no load	No.	
11	**MINIMUM CLRARANCE IN AIR**		
	- Between phases	mm	
	- Live parts to earth	mm	
	- Live parts to ground level	mm	
12	**WEIGHTS AND DIMENSIONS**		
	Total weight of one complete breaker, including mounting structure	kg	
	Mounting structure weight	kg	
	Control cabinet weight	kg	
	Dimensions: Height	mm	
	Width	mm	
	Depth	mm	
	Drawings must be provided		

13	**HOLLOW INSULATOR HOUSING**		
	Type and make of insulators.		
	Power frequency withstand test voltage for one minute:		
	- Dry	KV	
	- Wet	KV	
	Flash over value		
	- Dry	KV	
	- Wet	KV	
	1.2/50 impulse voltage withstand capability		
	- positive polarity	KV	
	- negative polarity	KV	
	Creepage distance total	mm	
	Creepage distance protected	mm	
	Weight of assembled housing	kg	
	Corona shield provided or not		
14	**SUPPORT INSULATOR**		
	Type and make of insulators		
	Power frequency withstand test voltage for one minute:		
	- Dry	KV	
	- Wet	KV	
	Flash over value		
	- Dry	KV	
	- Wet	KV	
	1.2/50 impulse voltage withstand capability		
	- positive polarity	KVp	
	- negative polarity	KVp	
	Creepage distance, total	mm	
	Creepage distance, protected	mm	
	Weight of assembled housing	kg	
	Corona shield provided or not		
15	**CONTACTS**		
	Type of main contacts		
	Type of auxiliary contacts		
	Material of auxiliary contacts		
	Type of plating, if any		
	Thickness of plating	micron	
	Contact pressure	gm/sq.mm	
	No of auxiliary contacts provided:		
	Those closed when breaker is closed	No.	
	Those open when breaker is closed	No.	
	Those adjustable	No.	
16	**OPERATING MECHANISM**		
	Opening type		
	Closing type		

	Force applied by charged spring for closing	Kg	
	Time taken by motor for charging the spring form fully discharged to fully charged position	sec	
	Full sequence of operation		
	Whether limit switches are provided with spring	yes/no	
	Whether spring limit switches start & stop the motor	yes/no	
	Type and material of spring employed		
	Whether trip free		
	Whether anti pumping device provided		
17	**AUXILIARY AND CONTROL POWER SUPPLY**		
	Normal auxiliary A.C		
	supply voltage	Volts	
	Voltage limits for proper operation	Volts	
	Maximum	Volts	
	Minimum	Volts	
	Frequency limits for proper operation		
	Maximum	Hz	
	Minimum	Hz	
	for circuit breakers :	Volts	
	Normal DC control circuit voltage	Volts	
	Voltage limits for proper operation		
	Maximum	Volts	
	Minimum	Volts	
	Power required for trip coil	Watts	
	Power required for closing coil	Watts	
18	**LOCAL CONTROL PANEL**		
	- Material		
	- Degree of protection		
	- Vermin proof provisions	Yes/no	
	- Weather proof provision	Yes/no	
	- Dust proof provision	Yes/no	
	- Ventilation provision	Yes/no	
	- Thickness of sheet materials used	mm	
	- Overall dimensions	Mm	
	- Total weight	kg	
	- Mounting arrangement		
19	**TERMINAL CONNECTOR**		
	- Material		
	- Bi-metallic or not		
	- Weight	kg	
	- Dimensions	mm	
	- Size and type of conductor it can accommodate	sq mm	
	- Terminal pads silver plated or not		
	- Thickness of silver plating	microns	
20	**CORROSION PREVENTION SYSTEM FOR CIRCUIT BREAKER AND CONTROL CABINET**		

	- Surface preparation		
	- Rust inhibition		
	- Zinc thickness/paint thickness	Microns	
	- Treatment of fasteners		
21	**CORROSION PREVENTION SYSTEM FOR SUPPORT STRUCTURE**		
	Surface preparation		
	Rust inhibition		
	Zinc thickness	microns	
	Treatment of fasteners.		
22	**VACUUM CIRCUIT BREAKER SEALING**		
	Degree of protection of circuit breaker pole enclosure. (IEC 529, IS 13947)		
	Method of sealing the circuit breaker pole enclosure.		

Signature of the Tenderer.