SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

33KV VACUUM CIRCUIT BREAKER

APPLICABLE TO KSEBL	DOC. NO.: **SCM-SPEC/XT/ VCB**
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Technical Specification and Evaluation Committee for Transmission Material

(i) Document Approval & Control Status

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Date	23/04/2021	23/04/2021	03/05/2021
Signature	**Sd/-**	**Sd/-**	**Sd/-**

(ii) Amendments and History

Sec. #	*Rev. #*	*Date*	*History of Change*

1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **33kV Vacuum Circuit Breakers** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **33kV Vacuum Circuit Breakers** used in field by KSEBL

3. RESPONSIBILITY :

The Executive Engineer (T), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions.** Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **"(ii)-Amendments and history"** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM).** Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**

CONTENTS

TECHNICAL SPECIFICATION FOR 33kV VACUUM CIRCUIT BREAKERS

1.0) **Scope:-** This specification covers the design, engineering, manufacture, assembly, testing, inspection at manufacturer's works, delivery and commissioning of 3 Pole, 50 Hz, 33kV Porcelain clad Vacuum Circuit Breakers complete with all accessories including supporting structures. The Power system is with neutral solidly earthed for the use of 33/11kV KSEB Limited Substation .

1.1. **General:-** The circuit breakers shall comprise of three identical pole units, linked suitably, complete in all respects with fittings and wiring. Standard Supporting structure for mounting the Breakers also to be offered by the supplier.

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/ PHELA/ KERI/ KEMA/ CESI laboratory within five 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.

2.0) **Standards:-** Expect where modified by this specification, the circuit breakers and the accessories shall be esigned, 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
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
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.

Equipment conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned, would also be acceptable.

3.0. **Climatic Conditions: -** The climatic conditions at site under which the equipment shall operate satisfactorily, are as follows:

I) Peak ambient temperature in shade : 50°C

ii) Maximum average ambient temperature over a 24hour period in shade. : 40°C

iii) Maximum temperature attainable by an object exposed to sun. : 60°C

iv) Minimum temperature of air in shade : 17°C

v) Maximum relative humidity : 100%

vi) Average number of thunder storm days per annum. : 50

vii) Average number of dust storms per annum : 10

viii) Average number of rainy days per annum : 90

1) Average annual rainfall : 3000mm

2) Number of months of tropical monsoon conditions per annum : 5 months.

xi) Maximum wind pressure : 100 kg/sq.m.

For the purpose of this specification, the reference ambient temperature would be 40°C.

3.1 Basic Technical Requirements:- 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.

Sl. No	Particulars	Requirements
1	Service type	Outdoor
2	No. of Poles	3
3	Nominal system voltage	33KV
4	Highest system voltage	36KV
5	Rated normal current at 50^0C	
i)	For Bus-bar of Circuit Breaker	1250A
ii)	For Interrupter	2000A
iii)	For Outgoing Feeders	-
6	Rated short circuit breaking current (rms)	25KA
7	Rated short circuit making current (peak)	63KA
8	Rated short time current withstand capability for 1 sec.	25KA(Panel)/ 25KA (Interrupter)

9.	Rated insulation level:	
i)	One minute power frequency withstand voltage to earth (wet and dry)rms	70KV
ii)	Impulse withstand voltage to earth with 1.2/50□sec, wave of +ve and	170KV
10	First – pole – to clear factor	1.5
11	Rated operating sequence (for auto reclosing)	O-0.3 Sec- CO-3 min-CO
12	Maximum break time	3 cycles
13	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current
14	Maximum pole scatter	10 mili seconds
15	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.C
16	Rated supply voltage for trip/close coil	110V D.C
17	Minimum creepage distance (mm)	900mm
18	Minimum protected creepage distance (mm)	580mm

The circuit breakers to be supplied against this specification shall be required to control the primary side of 33/11 KV power transformers in the primary sub-stations (incoming 33KV feeders) or Bus coupler or the outgoing feeders in these sub-stations. The circuit breakers shall be suitable for 3 phase 50Hz solidly grounded neutral system and shall have normal current carrying capacity and symmetrical short circuit current breaking capability as mentioned hereunder.

The required 33KV Vacuum Circuit Breakers suitable for outdoor installations are to be quoted by Manufacturers only with a valid ISO 9000 certification.

4.0. 33 kV Vacuum Circuit Breakers:-

4.1. General:- The circuit breakers shall be structure mounted open type with vacuum as interrupting media incorporating separate interrupters **of 2000 A rating** for each phase mounted on single frame. There shall be a common drive mechanism actuating the interrupters, which must work in synchronism These breakers shall be provided with suitable local control while provision shall be made for remote control.

The circuit breakers shall be fitted with spring mechanism. The inherent design of these circuit breakers shall be such that they shall satisfactorily perform all test duties and interrupt out-of- phase current and produce very low over voltage (<2.0p.u.) on all switching circuits, capacitive and inductive to IEC:56, IS:13118 and other associated standards mentioned in the clause of this specification.

The terminal pads shall have aluminium alloy with smooth finishing. The design of the circuit breakers shall be such that inspection and replacement of contracts, coils, vacuum bottles and any worn or damaged components can be carried out quickly and this ease. The contract gaps shall be adjustable to allow for wear.

The mechanism and the connected interrupters shall satisfy the mechanical endurance requirements of IEC:56, IS:13118 and all additional requirements specified herein.

4.2. **Porcelain Insulator:-** External parts of the circuit breakers, which are under continuous electrical stress, shall be of hollow porcelain. The creepage and flashover distance of the insulators shall be dimensioned and the type and profile designed in accordance with IEC:815 or IS: 13134 and shall be suitable for the worst environmental conditions specified in this specification. The creepage distance across the interrupting chambers shall suite the outdoor service conditions mentioned in the relevant standards for heavily polluted atmosphere and shall be not less than 900 mm with protected creepage distance 50 percent of the total. Internal surfaces of hollow insulators shall also be glazed. The insulators shall comply with IS:5621 and tested in accordance with IEC:233. All porcelain whether, used on the interrupting chamber or on the support insulator shall have the following properties:

Higher strength, homogeneity, uniform glaze, free from cavities and other flaws and high quality uniform finish porcelain components and shall withstand the maximum expected static and dynamic loads to which the circuit breakers may be subjected during their service life.

4.3. **Interrupting media:-**

4.3.1. **Vacuum:-** In vacuum circuit breakers, facilities shall be provided for monitoring the contract erosion and any change in contact gap. The vacuum bottles shall be easily replaceable on site and the mechanism shall be conveniently adjustable to permit resetting the contact gap.

The vacuum circuit breaker poles shall be sealed to prevent contamination of the spaces surrounding the interrupters. The Bidder shall demonstrate how this is achieved by supplying technical details with the bid.

4.4. **Auxiliary contracts:-**12 Nos. of auxiliary contacts (6N.O. + 6N.C.) of 110 Volt D.C grade and 10 amps DC rating shall be provided in each circuit breaker.

4.5. **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.

4.6. **Operation and controls:-** The breaker shall normally be operated by remote electrical control with electrical tripping by shunt trip coil. Provision shall be made for local electrical operation and mechanical operation. 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.
- 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 labelled. 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 circuit breaker shall be able to perform 10,000 operating cycles at no load in accordance with IEC:17A/474/CD for circuit breakers for auto reclosing duties.

5.0. **Bushing Insulators:-** Bushing Insulators for circuit breakers shall comply with IS.5621/.IEC233-Specifications for tested for High Voltage Porcelain Bushings & type.

6.0. **Schedule of Requirement:-**

6.1. **Circuit Breakers: -**

1) Vacuum circuit breaker complete with suitable galvanized steel support structure for mounting the VCB comprising 1 No. circuit breaker - 3 poles

2) Mechanism box containing:

a) Operating mechanism.

b) Mechanical indicator for 'ON' and 'OFF' coupled to VCB operating mechanism.

c) Mechanical close and trip lever / Push Button.

d) Terminal blocks for control wiring and a spare terminal block.

e) Operation counter.

f) 1 No. operating handle for manual charging of springs.

g) Electric space heater of 230 V AC with 'ON' and 'OFF' switch and thermostat.

h) 2 Nos. cable glands over and above those provided for control cables with suitable dummies.

i) Not less than four numbers normally open and four numbers normally closed spare auxiliary contacts over and above those required for normal operation.

j) 240 V single phase AC motor operated spring charging mechanism complete with electrical spring release coil, shunt trip coil, anti pumping relay and ON-OFF indicator.

k) Local / Remote selector switch.

l) Cubicle illumination lamp with door switch and 5A single phase socket for 230V AC power.

m) Earth bar.

n) Set of terminal connectors for outgoing connections and

o) Circuit Breaker Trip / Close push button control.

7.0. **Constructional Features:-**

7.1. **Circuit Breaker:-** The circuit breaker shall have fixed type construction consisting of three single identical poles, complete with a gang operated sealed porcelain housing conforming to relevant standards. The three poles of circuit breaker shall be linked together electrically/mechanically to ensure simultaneous closing of all poles. The circuit breaker shall be complete with operating mechanism, other accessories/materials to ensure complete assembly and proper functioning.

Neither the circuit breaker nor any part of the switchgear or its supporting structures shall be permanently strained due to vibration etc when making or breaking the rated short circuit currents.

The details of any device incorporated in the circuit breakers to limit or control the rate of restriking voltage across the circuit breaking contacts shall be stated.

7.2. **Supporting Structures:-** The circuit breakers shall be suitable for mounting on galvanized steel structures. The minimum height of such supporting structures shall be sufficient to maintain the safety working clearance of 2.2 meters. The upper terminal of the equipment shall be approximately 4.5 ± 0.5 m from the foundation level to be designed with structural stability meeting ASTM standard.

8.0. **Operating Mechanism:-**

8.1. **General:-** The operating mechanism of the circuit breaker shall be motor wound spring charged type. It shall be electrically and mechanically trip free with anti pumping device (as per IEC:694 definition). All working parts in the mechanism shall be of corrosion resistant material. Self lubricating, wearing resistant bearings shall be provided in the mechanism.

The mechanism shall fully close the circuit breaker and sustain it in the closed position against the forces of the rated making current and shall fully open the circuit breaker without undue contact bounce at a speed commensurate with that shown by tests to be necessary to achieve the rated breaking capacity in accordance with IEC:56 or IS:13118. The mechanism shall be capable of being locked in either the open or closed position. The mechanism shall be

capable of fully closing and opening again after the auto-reclose time interval specified as 0.3 second in this specification.

8.2. **Spring mechanism:-** The spring operating mechanism shall be with spring charging motor, opening and closing springs with limit switches and all accessories necessary for automatic charging. In normal operation, recharging of the operating springs shall commence immediately and automatically upon completion of the closing operation so that a complete sequence of closing and opening operation should be possible.

It shall be possible to hand charge the operating spring with the circuit breaker in either the open or closed position conveniently from the ground level. Closure whilst a spring charging operation is in progress shall be prevented and release of the springs shall not be possible until they are fully charged.

The state of charge of the operating springs shall be indicated by a mechanical device showing "**SPRING CHARGED**" when closing spring is fully charged and operation is permissible and "**SPRING FREE**" when closing spring is not fully charged and the operation is not possible. Provision shall be made for remote electrical indication of "Spring Charged" and "Spring Free" conditions.

The operating mechanism shall be such that the failure of any auxiliary spring shall not cause tripping or closing the circuit breaker but shall not prevent tripping against trip command.

Closing action of the circuit breaker shall charge the opening spring ready for tripping. From the close position with spring charged, one open-close-open operation shall be possible without recharging the spring.

8.3. **Motor:-** The motor for spring charging shall be single phase 230 Volt A. C Motor. Continuous motor rating shall be at least ten percent above the maximum load demand of the driven equipment. It shall remain within its rated capacity at all operating points that will arise in service. It shall be protected by H.R.C cartridge fuses or MCB. The motor shall comply with IEC: 34 or IS:996.

9.0. **Auxiliary Power Supply:-** The operating mechanism shall be suitable to operate with the following auxiliary power supplies.

a) 230V,50Hz Single phase A.C - For spring charging motor,

b) DC supply 110 Volts - For close and open coils, indication &Alarm

The mechanism shall be designed to operate satisfactorily despite fluctuations of auxiliary power supplies as under:

• AC supply	:	Voltage	From 115% to 85% of normal voltage
		Frequency	From 105% to 95% of normal frequency
		Combined voltage	From 115% to 85% of normal and frequency variation.
• DC supply	:	Voltage	From 120% to 70% of normal voltage

10.0. **Interlocks:-** The circuit breaker shall be capable of being mechanically and electrically interlocked with the associated line isolator so that the isolator cannot be operated with the breaker in the closed position.

All doors or shutters which give access to live parts shall be interlocked in such a way that these cannot be opened unless the circuit breaker is in the open position. Other interlocks shall be provided as deemed necessary for safety.

11.0. T**erminal connector:-** Suitable terminal connectors of bi-metallic type suitable for both horizontal and vertical connection shall be provided on the terminal pad both on the incoming and the outgoing side for connection of jumpers of ACSR Wolf conductor. The size of the conductor may vary between 50mm^2 and 232mm^2 depending upon the location of the circuit breaker. The terminal connection drawing and details are to be approved by the Purchaser before fabrication. The terminal connectors shall be bi-metallic type to avoid bi-metallic corrosion.

12.0. **Insulation And Clearance:-**

a) The insulation to ground, the insulation between open contacts and insulation between phases of the circuit breaker shall be capable of satisfactorily withstanding dielectric test voltages.

b) The minimum clearance in open air shall be as follows:

Between poles	-	460mm
Phase to earth	-	400mm
Ground clearance for live part	-	3700mm

13.0. **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 the permissible limits as provided in Table V of IEC publication 694 or table 4 of

IS:12729. 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.

14.0. **TESTS:-**

14.1. **Type and routine tests:-** The circuit breakers shall be subjected to routine and type tests in accordance with the standards listed in this specification including the following IEC and IS standards with the latest amendments:

- Circuit breaker IEC : 56 and IS:13118 and relevant other standards
- Porcelain insulator IEC: 233 and IS:5621 and relevant other standards

The tests shall include but not limited to the following:

14.2. **Short circuit tests:-** The circuit breaker shall satisfactorily perform the out of phase and short circuit duties specified in IEC: 56, IEC: 17A(Sect.) and IEC:17A/CD/474, IS-13118 and IS:13516.

The circuit breaker shall be capable of performing at least twenty five (25) open operations at the rated short circuit current before maintenance or inspection is required.

14.3. **Capacitive current switching:-** Capacitive switching tests shall be performed in accordance with IEC:56 or IS:13118 and IEC:17A/CD/474 at 1.3U preferably by direct test method or alternatively using synthetic method to IEC:427 or IS:13516. The test circuits shall simulate the most onerous site conditions.

16.4. **Reactor Switching:-** In addition to the capacitive current switching tests to IEC:56 or IS:13118 and IEC:17A/CD/474, the circuit breakers shall be tested for shunt reactor switching in accordance with IEC:1233, Examination of the interrupter after the tests shall not show any evidence of surface tracking or erosion of contracts.

14.5. **Dielectric tests:-** At zero gauge loss of vacuum inside the interrupter chamber, the open contracts shall withstand continuously, the rated phase to ground voltage and it shall be possible to break normal current in these conditions. During the dielectric type tests, no flashover external or internal shall be acceptable.

The circuit breakers shall be subjected to a power frequency AC voltage test for one minute in dry and wet conditions and there shall be no external flash over to earth.

14.6. **Mechanical endurance:-** In addition to the requirements of IEC:56, an extended mechanical endurance test is required to show that the circuit breaker is capable of at least 10,000 operations at no load in accordance with IEC:17A/474/CD. Between the specified test series

in IEC:17A/474/CD, some maintenance such as lubrication and mechanical adjustment is allowed and shall be performed in accordance with manufacturer's instructions. Change of contracts is not permitted.

14.7. **Low current switching:-** The circuit breakers shall produce very low over voltage (<2.0 pu) on all switching circuits inductive current including reactor switching to IEC-1233 and capacitive current switching to IEC:17A (Secretariat) 438 and IEC 17A/CD/474 the circuit breaker shall be re-ignition or re- strike free for all duties.

14.8. **Duty requirement tests:-** Apart from auto-reclosing and the other duties mentioned above, the breakers shall be able to perform the following duties for which type tests are to be conducted as per IEC:56 or IS:13118.

1) Breaking the steady and the transient magnetizing current of the transformer.
2) Breaking 25% of rated fault current at twice the rated voltage as per IEC/IS.
3) Cable charging breaking current.
4) Back-to-back capacitor bank breaking current.
5) Single capacitor bank breaking current.
6) Capacitor bank in rush making current.

Test for the resistance of the main circuit shall also be conducted.

14.9. **Temperature rise test:-** Temperature rise test is to be conducted on the circuit breaker and the accessories in accordance with IEC:56 or IS:13118. The temperature rise shall be limited as per this specification.

15.0. **Performance Requirements:-** The supplier shall declare the circuit breaker opening and closing times at 120 percent, 100 percent and 70 per cent of the rated voltage of the opening and closing devices when measured at the terminals of the trip and closing coils. The minimum make break time at rated voltage and total break time of the CB shall be stated. The total break time must not exceed 60m.sec.

16.0. **Earthing:-** All metal parts not intended for carrying current or not alive shall be connected to duplicate earthing system and suitable electroplated brass earthing terminals

shall be provided on each circuit breaker in conformity with IEC:56 or IS:13118. Suitable identification mark for the earth terminals shall be provided adjacent to the terminal.

Earth continuity conductors shall be provided down to the ground level for earth connection to purchaser‟s earthing grid. It shall have sufficient cross sectional area to afford a low resistance path for the full fault current envisaged. Such conductor shall also be provided for the CTs up to the ground level.

The size of the earth continuity conductor shall be large enough to reduce the potential rise of the metal frame of the breaker in the even of fault to minimum but in any case not more than 10V. The size of the conductor shall also be adequate to restrict the temperature rise without causing any damage to the earth connection in the case of fault. No riveted joints in the earth conducting path shall be permissible and only bolted joints of adequate size shall be provided with nuts, bolts and plain and spring washers. The surfaces to be jointed shall be perfectly flat without any unevenness to ensure that there is no contact resistance.

17.0. **Mandatory Spare Parts for 33KV VCB:-** The supplier shall provide the mandatory spares as if any additional cost charged it should separately shown in price bid.

Sl. No	Description	Qty.
1	Complete pole assembly of the circuit breaker	2
2	Vacuum interrupter bottle (for vacuum type only)	4
3	Tripping coils	6
4	Closing coils	6
5	Insulated drive rod	6
6	Spring charging motor	4
7	Set of spring charging limit switches	4
8	Set for gaskets complete for one circuit breaker	4
9	Upper Housing assembly	2
10	Lower Housing assembly	2

18.0. **Terminals and Earth Connectors for Circuit Breakers:-**Terminal connectors suitable for ACSR Wolf shall be supplied. Suitable terminal earthing connectors for earthing connections shall also be supplied.

19.0. **Painting:-** Before painting, all ungalvanised parts shall be completely cleaned and made free from rust, scale and grease and all external rough surface cavities on castings shall be filled by metal disposition.

The interior parts and internal structural steel work shall be cleaned of all scale and rust by sand blasting or other approved method.

All external surface shall receive a minimum of 3 coats of paint.

20.0. **Name / Rating Plate**:- Each circuit breaker shall be provided with a nameplate or plates legibly and indelibly marked with at least the following information.

a) Name of manufacturer.
b) Type
c) Year of manufacture.
d) Rated voltage and current.
e) Rated frequency.
f) Rated symmetrical breaking capacity
g) Rated making capacity
h) Rated short time current and its duration (which shall be either one or three seconds)
i) Purchase Order No. and date.
j) Nature of auxiliary supply.
k) Guarantee Period

21.0. **Documentation:-** All drawings shall conform to International Standards Organisation (ISO) ' A' series of drawing sheet / Indian Standards Specification IS:656. All dimensions and data shall be in S.I units.

1. **List of Drawings and Documents:-** The bidder shall furnish one set of soft copy and four sets of hard copies of following drawings / documents along with the offer.

a) General outline and assembly drawing of the equipment.
b) Name Plate.
c) Schematic drawing, Typical.
d) Supporting structure and foundation drawings.
e) Terminal connector
f) Breaker Constructional drawings.

The supplier shall, within 2 weeks of placement of order, submit four sets of final versions of all the above said drawings for purchaser's approval. The purchaser shall communicate his comments / approval on the drawings to the supplier. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for approval.

Six sets of the type test reports, duly approved by the purchaser, shall be submitted by the supplier for distribution before commencement of supply. Adequate copies of acceptance and routine test certificates, duly approved by the purchaser, shall accompany the despatch consignment.

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 drawing shall be at the supplier's risk.

Copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English language, for each type and rating of equipment supplied shall be submitted by the supplier for distribution, prior to the despatch of the equipment. The manual shall contain all the drawings and information required for erection, operation and maintenance of the circuit breaker. The manual shall also contain a set of all the approved drawings, type test reports etc.

Approval of drawings / work by purchaser shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revision of application standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and purchaser shall have the power to reject any work or materials which, in his judgement is not in full accordance therewith.

Sd/-

Chief Engineer (SCM)

ANNEXURE -II

GUARANTEED TECHNICAL PARTICULARS FOR 33kV OUTDOOR VACUUM CIRCUIT BREAKERS

SL NO	DESCRIPTION	As Per Specification	UNITS	BIDDER'S OFFER
	GENERAL			
	- Name of manufacture			
	- Manufacturer‟s type designation			
	- Governing standards	IS : 13118 & IEC : 56		
	- No. of poles of circuit breaker	3	no.	
	- No. of breaks per phase	1	no.	
	- Total length of break per phase		mm	
	Type – Vacuum	Yes, Vacuum	Yes/No	
2)	**NOMINAL VOLTAGE**			
	- Rated voltage	33	KV	
	Maximum(continuous)service rated voltage	36	KV	
3)	**RATED NORMAL CURRENT**			
	- Under normal condition	1250	Amps	

	- Under site condition	1250	Amps	
4.	**SHORT CIRCUIT PERFORMANCES**			
	- Rated short circuit breaking current:			
	Symmetrical, rms	25	KA	
	Asymmetrical including DC component	31.25	KA	
	- Rated short circuit making current; peak	62.5	KA	
	- Short time current withstand capability:			
	Peak value	62.5	KA	
	Rms value	25	KA	
	Duration	3 Seconds	Sec	
5.	**MAX. TEMP. RISE OVER AMBIENT OF 50^0C**			
	- At normal continuous current		0_C	
	- After performing the operating sequence		0_C	
	- At 10% rupturing capacity		milli-sec	
6_	**Make & Break Times**			

	Total break times			
	At 10% rupturing capacity	60	milli-sec	
	At rated rupturing capacity	60	milli-sec	
	Arcing time at rated breaking current	60	milli-sec	
	Make time form giving close command	60	milli-sec	
	- Minimum reclose time at full rated interrupting Capacity from trip coil energisation		sec	
	- Minimum dead time for 3 phase reclosing		mill-sec	
	- Circuit breaker opening time:			
	at 125% of rated voltage of opening device	60	milli-sec	
	at 100% of rated voltage of opening device	60	milli-sec	
	at 70% of rated voltage of opening device	60	milli-sec	
	- Circuit breaker closing time:			
	at 125% of rated voltage of closing device	60	milli-sec	

	at 100% of rated voltage of closing device	60	milli-sec	
	at 70% of rated voltage of closing device	60	milli-sec	
7)	**RESTRIKING VOLTAGES FOR 100% RATED CAPACITY**			
	- Amplitude factor		KV	
	- Phase factor		KV	
	- Natural frequency		KHz	
	- Rate of rise of recovery voltage	0.57	kv/µs	
8)	**RATED INSULATION LEVEL**			
	- Dry and wet power frequency withstand test voltage (rms) for 1 minute			
	Between live terminals and grounded objects	70	KV	
	Between terminals with breaker contacts open	70	KV	
	- 1.2/50 µsec full wave impulse withstand voltage +ve and - ve polarity (peak)			

	Between live terminals and grounded object	170	KV	
	Between terminals with breaker contacts open	170	KV	
	One mimute power frequency voltage of auxiliary wiring	2	KV	
9)	**OPERATING PERFORMANCE**			
1	- Rated transient recovery voltage	0.57	KV/µs	
2	Rated cable charging breaking current	50	Amps	
3	Rated single capacitor bank breaking current	400	Amps	
4	Rated back-to-back capacitor bank breaking current		Amps	
5	Rated capacitor bank in-rush making current		kA	
6	**Rated small inductive breaking current**	25	kA	
7	**First pole-to- clear factor**	1.5		
8	**Rated operating sequence**	O-0.3 Sec-CO-3		

		Min-CO		
9	**Rated out-of-phase breaking current**	25	KAmp.	
10	**Re-ignition and Re strike free**	Yes	Yes/No	
10	**NUMBER OF OPERATION POSSIBLE WITHOUT MAINTENANCE**			
	at full rated interrupting current	> 100	no.	
	at 50% of rated interrupting current	> 100	no	
	at 100% of full load current	10,000	no	
	at no load		no	
11	**MINIMUM CLRARANCE IN AIR**			
	- Between phases	460	mm	
	- Live parts to earth	400	mm	
	- Live parts to ground level	3700	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	
13)	**HOLLOW INSULATOR HOUSING**			
	Type and make of insulators.			
	Power frequency withstand test voltage for one minute:			
	- Dry	70	KV	
	- Wet	70	KV	
	Flash over value			
	- Dry	135	KV	
	- Wet	95	KV	

	1.2/50 impulse voltage withstand capability			
	- positive polarity	170	KV	
	- negative polarity	170	KV	
	Creepage distance total	900	mm	
	Creepage distance protected	450	mm	
	Weight of assembled housing		kg	
	Corona shield provided or not	Yes		
14)	**SUPPORT INSULATOR**			
	Type and make of insulators			
	Power frequency withstand test voltage for one minute:			
	- Dry	70	KV	
	- Wet	70	KV	
	Flash over value			
	- Dry	135	KV	
	- Wet	95	KV	

	1.2/50 impulse voltage withstand capability			
	- positive polarity	170	KVp	
	- negative polarity	170	KVp	
	Creepage distance, total	900	mm	
	Creepage distance, protected	450	mm	
	Weight of assembled housing		kg	
	Corona shield provided or not	Yes		
15)	**CONTACTS**			
	Type of main contacts	Butt		
	Type of auxiliary contacts			
	Material of auxiliary contacts	Silver Plated Brass		
	Type of plating, if any	Silver		
	Thickness of plating	20	micron	

	Contact pressure		gm/sq.mm	
	No of auxiliary contacts provided:	6 NO + 6 NC		
	Those closed when breaker is closed	6	no	
	Those open when breaker is closed	6	no	
	Those adjustable		no	
16	**OPERATING MECHANISM**			
	Opening type	Shunt Trip		
	Closing type	Motor / Manual spring charge, Shunt/Magnetic actuator operation		
	Force applied by charged spring for closing		kg	
	Time taken by motor for charging the spring form fully discharged to fully charged position	<30	sec	
	Full sequence of operation	O-0.3sec-CO-3min-CO		

	Whether limit switches are provided with spring	Yes	yes/no	
	Whether spring limit switches start & stop the motor	Yes	yes/no	
	Type and material of spring employed			
	Whether trip free	Yes		
	Whether anti pumping device provided	Yes		
17)	**AUXILIARY AND CONTROL POWER SUPPLY**			
	Normal auxiliary A.C supply voltage	230	Volts	
	Voltage limits for proper operation		Volts	
	Maximum	115%	Volts	
	Minimum	85%	Volts	
	Frequency limits for proper operation			
	Maximum	+5%	Hz	
	Minimum	-5%	Hz	

	for circuit breakers :		Volts	
	Normal DC control circuit voltage	110	Volts	
	Voltage limits for proper operation			
	Maximum	120%	Volts	
	Minimum	70%	Volts	
	Power required for trip coil	300	Watts	
	Power required for closing coil	300	Watts	
18)	**LOCAL CONTROL PANEL**			
	- Material			
	- Degree of protection			
	- Vermin proof provisions	Yes	Yes/no	
	- Weather proof provision - Dust proof provision	Yes Yes	Yes/no Yes/no	
	- Ventilation provision	Yes	Yes/no	
	- Thickness of sheet materials used	3	mm	

	- Overall dimensions		mm	
	- Total weight		kg	
	- Mounting arrangement			
19	**TERMINAL CONNECTOR**			
	- Material			
	- Bi-metallic or not	Yes		
	- Weight		kg	
	- Dimensions		mm	
	- Size and type of conductor it can accommodate	100	sq mm	
	- Terminal pads silver plated or not	Yes		
	- Thickness of silver plating		microns	
20	**CORROSION PREVENTION SYSTEM FOR CIRCUIT BREAKER AND CONTROL CABINET**	Preferable Galvanized		
	- Surface preparation			
	- Rust inhibition			
	- Zinc thickness/paint thickness		microns	

	- Treatment of fasteners			
21	**CORROSION PREVENTION SYSTEM FOR SUPPORT STRUCTURE**	Hot Dip Galvanized		
	Surface preparation			
	Rust inhibition			
	Zinc thickness		microns	
	Treatment of fasteners.			
	Weight of supporting structure			
22	**VACUUM CIRCUIT BREAKER SEALING**	Hermetically Sealed		
	Degree of protection of circuit breaker pole enclosure. (IEC 529, IS13947)			
	Method of sealing the circuit breaker pole enclosure.			