

Technical Specifications for PR No: 6000003094

S.No	Brief Description of the Material	Material Code	Qty
I	145KV, 1250A, 31.5KA for 3 sec, Live tank, SF6 Circuit Breaker with spring operated mechanism, suitable for single & three phase auto reclosing with 25mm/KV brown porcelain insulators, with support structure.	CG3500208649	2 Numbers

Technical Specifications for Circuit Breaker (CG3500208649)

S.No	Brief Description of the Material	Requirement	Vendor to Confirm/Specify
1	Applicable standards	IEC 62271-100 Ed.1.0 (2001) latest amendments, IEC-376, IS-5578 & IS-11353, IS-2147, IEC-71 , IEC-694, IS-325, IS-2516, IS-2629, IEC-137, IS-2099, IS-4379, IS-7285, IS-802	
2	Climatic Conditions	Max. ambient air temp. (°C) – 55 Min ambient air temp. (°C) – 5 Average daily ambient air temperature (°C) 35 Maximum Relative humidity (%) 74 Average annual rainfall (mm) 925 Max. wind pressure (Kg/sq.m.) 200 Max. altitude above mean sea level (Metres) 1000 Average No. of thunder storms days/year 40 Average No. of rainy days/year 90 Average No. of months/tropical monsoon condition per year 3 Noise level (db) 45	
3	Auxiliary Supply AC	Power Devices (like drive motors)- 415 V, 3 phase 4 wire, neutral grounded/240V, Single phase 50 Hz, AC supply (Voltage + 10% / - 15%;Frequency +/- 5%) Lighting - 240 V, single phase 50 Hz AC supply.	
4.	Auxiliary Supply DC	DC Alarm, control and protective devices - 220 V DC (-15% to + 10%), ungrounded 2 wire	
5	Rated system voltage (kV rms)	132	

6	Frequency	(50 Hz)(+/-5%)	
7	Maximum System Voltage kV rms	145	
8	Continuous current rating (A) rms	1250	
9	Type	3 pole outdoor SF6	
10	Mounting	Hot dip galvanized lattice steel support structure, bolted type	
11	Number of Poles	3	
12	Type of operation	3 pole gang operated	
13	Phase to phase minimum spacing in the switchyard i.e., inter-pole spacing for breaker (mm).	1700	
14	Required minimum ground clearance from the lowest live terminal if both the terminals are not in the same horizontal plane. (mm)	3790	
15	Line charging at rated voltage at 90 deg. leading power factor (A) rms.	50	
16	Minimum height of the lowest part of the support insulator from ground level (mm).	2550	
17	Operating mechanism	Spring	
18	Auto re-closing duty	Three phase	
19	Rated operating duty cycle min.	O-0.3 sec.-CO-3min-CO	

20	"First pole to clear" factor (type of tripping)	1.5	
21	Max. closing time (ms)	100	
22	Max. total break time (ms)	Less than 3 cycles or 60 ms	
23	1.2/50 microsecond impulse withstand voltage: to earth (kVp)	650	
24	1 minute power frequency withstand voltage (kV rms)	275	
25	Small inductive current (A) rms without switching o/vexceeding 2.0 p.u.	0.5 to 10	
26.	Short circuit current AC component (kA rms)	31.5	
27. a)	Short circuit current % DC Component	Corresponding to minimum opening time as per IEC-56.	
b)	Duration of short circuit in sec.	1 sec.	
28.	Rated short circuit making current capacity (kA)	78.75	
29	Cable charging current (A)	160	
30	Max. acceptable difference in the instants of closing/opening of contacts		
i)	Within a pole (ms)	5	
ii)	Between poles (ms)	10	

31.	Min. creepage distance of support insulator (mm)	3625	
32.	Short time current carrying capability for one second (kA)	31.5	
33.	i) Rating of auxiliary contacts ii) No. of spare auxiliary contacts	10 A at 220 V DC 10 NO & 10 NC	
34.	Breaking capacity of auxiliary contacts with the circuit time constant not less than 20 ms.	2 A DC	
35	Noise level at base and up to 50 meters	75 db (max.)	
36.	Seismic acceleration (horizontal)	0.3 g	
37.	Min. Corona extinction voltage	92 kV (rms)	
38.	No. of closing and tripping coils.	Two trip coils and one close coil with Anti-pumping arrangement.	
39.	Technical requirement	• 132 kV Circuit breakers offered shall be sulphur hexafluoride (SF₆) type only. Any part of the breakers, especially the removable ones, shall be freely interchangeable without the necessity of any modification at site. • 132 kV SF₆ Circuit Breaker shall comprise of three identical single pole units and are not meant for single pole re-closure. The units for these breakers shall be linked together mechanically. • Complete circuit breaker with all the items necessary for successful operation shall be supplied, including but not limited to the following: • Breaker assemblies with bases, support structure for circuit breaker as well as for control cabinet, central control cabinet and foundation bolts for main structure (except concrete foundations), terminals and	

		operating mechanisms are included in the scope of supply. • Instruments, gauges and other devices for SF₆ gas pressure supervision. • All necessary parts to provide a complete and operable circuit breaker installation such as main equipment, terminal, control parts, connectors and other devices, whether specifically called for herein or not. • 132 kV SF₆ Circuit breakers shall be designed for high speed three pole re-closing with operating sequence and timing as specified in clause 19. • The support structure of circuit breaker as well as that of control cabinet shall be hot dip galvanized. All other parts can be grey colour painted as per shade 631 of IS-5. • Circuit breaker shall be suitable for hotline washing. • All breakers shall be supplied with terminal connectors. • The current density adopted for the design of the terminal pads shall in no case exceed the following values. For copper pads - 1.6 A/sq. mm. and others - 1.0 A/sq. mm	
40	CONTACTS	• All making and breaking contacts shall be sealed free from atmospheric effects. Contacts shall be designed to have adequate thermal and current carrying capacity for the duty specified and to have a life expectancy so that frequent replacements due to excessive burning will not be necessary. Provision shall be made for rapid dissipation of heat generated by the arc on opening. • Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear. • If arcing contacts are used they shall be the first to close and the last to open. These shall be easily accessible for inspection and replacement. If there are no separately mounted arcing contacts the main contacts shall be easily accessible for inspection and replacements. Tips of arcing contacts and main contacts shall be silver plated or have tungsten alloy tipping.	

		- Any device provided for voltage grading to damp oscillations or to prevent restrict prior to the complete interruption of the circuit or to limit over-voltages on closing shall have a life expectancy comparable to that of the breaker as a whole. - Breakers shall be so designed that when operated within their specified rating, the temperature of each part will be limited to values consistent with a long life of the material used. The temperature shall not exceed that indicated in IEC-56 under specified ambient conditions. - Contacts shall be kept permanently under pressure of SF₆ gas. The poles shall be partially filled with SF₆ gas at the time of dispatch and only topping upto required pressure shall be permitted at site. The gap between the open contacts shall be such that it can withstand at least the rated phase to ground voltage continuously at zero gauge pressure of SF₆ gas due to its leakage.	
41.	Specific Guarantee for SF6 gas	Specific guarantee that the SF₆ gas will not leak more than 1% per year from the breaker for a minimum period of 10 years from supply or commissioning whichever is later shall be given. If leakage of SF₆ gas occurs beyond this limit within 10 years, the company free of cost shall attend to the defects in the breaker and this shall be done irrespective of the number of leakages during the period of 10 years. The defect shall be rectified within 7 days from the date of intimation (by Fax, Cable, email, Telephone) including travel time of the service personnel. If the Vendor does not attend the defects due to which the gas leak occurs, within 7 days, the cost towards the quantum of gas to be refilled due to the defective system shall be recovered from the vendor.	
42.	Special Guarantee for Interrupter	The bidder should give a special guarantee for interrupter for 5 years from the date of supply or commissioning whichever is later. Free replacement, if fails during five years period. In case Vendor does not confirm to clause 41 & 42 shall be considered non responsive and technical bid will be rejected.	

43	Porcelain Housing	The porcelain housing shall be of single piece construction without any joint or coupling. It shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be uniform brown or dark brown colour with a smooth surface arranged to shed away rain water or condensed water particles (fog), free from blisters, burns and similar other defects.	
44	Additional Requirement	• The circuit breakers shall be single pressure type and single break. The design and construction of the circuit breaker shall be such that there is minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF₆ gas on the internal insulating surface of 132 kV SF₆ circuit breakers. • All gasket surfaces shall be smooth, straight and reinforced, if necessary to minimize distortion and to make a tight seal. Where the operating rod of the operating mechanism connected to the arc chamber (SF₆ media) adequate O-ring seals shall be provided. • In the interrupter assembly there shall be an absorbing product box to eliminate SF₆ decomposition products and moisture. The material used in the construction of the 132 kV SF₆ circuit breaker shall be fully compatible with SF₆ gas. • Each pole of 132 kV SF₆ Circuit Breakers shall form an enclosure filled with SF₆ gas independent of the other two poles. The SF₆ gas density of each pole shall be monitored and regulated by pressure switches. • The SF₆ gas density monitor of 132 kV SF₆ Circuit Breakers shall be adequately temperature compensated. The density monitor shall meet the following requirements: i) It shall be possible to dismantle the density monitor for checking/replacement without draining the SF₆ gas by using suitable interlocked non-return couplings.	

		ii) It shall damp the pressure pulsation while filling the gas in service so that the flickering of the pressure switch contacts does not take place. iii) A pressure indicator shall also be supplied. iv) The alarm and trip setting shall be such that: a) Advance warning can be given for the low pressure below an unacceptable level. b) After alarm, the breaker shall open if the pressure falls below pre-determined value. • Means for pressure relief shall be provided in the gas chamber of circuit breaker to avoid damages or distortion during occurrence of abnormal pressure increase or shock waves generated by internal electrical faults, if required for the Circuit Breakers design. The position of pressure relief devices shall be so arranged as to minimize danger to the operators in the event of gas or vapour escaping under pressure. • Sufficient SF₆ gas for 132 kV SF₆ Circuit Breaker shall be provided to fill all the circuit breakers installed. In addition to this 20% of the total gas requirement shall be supplied in separate cylinders as spare requirement. • Provisions shall be made for attaching an operation analyzer after installation at site to record contact travel, speed and making measurement of operation timings and synchronization of contacts in one pole.	
45	SF ₆ Gas	• The SF₆ gas shall comply with IEC-376, 376A and 376B and be suitable in all respects for use in the switch gear under the worst operating conditions. • The high pressure cylinders in which the SF₆ gas is shipped and stored at site shall comply with requirements of the following standards and regulations: i) IS:4379 Identification of the contents of industrial gas cylinders. ii) IS:7285 Seamless high carbon steel cylinders for	

		permanent and high pressure liquefiable gases. The cylinders shall also meet Indian Boiler Regulations. • Test: SF₆ gas shall be tested for purity, dew point, breakdown voltage, water contents as per IEC-376, 376A and 376B and test certificates shall be furnished to Purchaser indicating all the tests as per IEC376 for each lot of SF₆ gas	
46	Duty Requirements	• The circuit breakers shall be totally re-strike free under all duty conditions and shall be capable of performing specified duties without opening resistors. • The circuit breakers shall meet the duty requirements for any type of fault or fault location, for line charging and dropping when used on an effectively grounded system and perform make and break operations as per stipulated duty cycles satisfactorily. • The circuit breakers shall be capable of: i) Interrupting the steady and transient magnetizing current corresponding to 132 kV class ii) Interrupting line charging current with a temporary over voltage as high as 1.5 p.u. without re-strikes and without use of opening resistors. iii) Clearing short line faults (Kilometric faults) with source impedance behind the bus, equivalent to symmetrical fault current specified. iv) Breaking inductive currents of 0.5 to 10 A without switching over voltage exceeding 2.0 p. u. v) Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition. • The critical current that gives the longest arc duration at lockout pressure of extinguishing medium and the arc duration shall be indicated. • The breakers shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energisation of lines with trapped charges..	

47	Total Break Time	• The "Total Break Time 60 ms shall not be exceeded under any of the following duties: i) Test duties 1,2,3,4,5 (with TRV as per IEC-56). ii) Short line fault L90, L75 (with TRV as per IEC-56). • The Vendor may please note that there is only one specified break time of the breaker which shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage, (70-110%) pneumatic, hydraulic pressure and arc extinguishing medium pressure etc., the proof for the total break time of complete circuit breaker shall be furnished. • The values guaranteed shall be supported with the type test reports.	
48	Operating Mechanism	• The circuit breakers shall be designed for electrical local as well as remote control. In addition there shall be provision for local mechanical control (emergency trip). • The operating mechanism for 132 kV SF₆ Circuit Breakers shall be spring charge type operated by electrical control. The mechanism shall be adequately designed for the specified tripping and re-closing duty. The entire operating mechanism control circuitry, spring charge motor for spring mechanism Circuit Breaker etc., as required, shall be housed in an outdoor type, hot dip galvanized or painted steel enclosure. • The enclosure shall be invariably mounted on a separate concrete plinth of 150 mm height. In case of painted enclosures, the housing shall be painted with shade 631 of IS-5 i.e. epoxy light gray. All interiors and exteriors of the housing shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surface treated by recognized phosphating (i.e. seven tank phosphating sequence). After such preparation of surfaces, two coats of Zinc Oxide primer shall be given by suitable storing and air	

		drying before final painting. The final painted cubicle shall present aesthetically pleasing appearance free from any dent or uneven surface. Painting inside the metallic housing shall be of anti-condensation type and the paint on outside surface shall be suitable for outdoor installation. • All working parts in the mechanism shall be of corrosion resistant material. All bearings which require greasing, shall be equipped with pressure grease fittings. • The design of the operating mechanism shall be such that it shall be practically maintenance free for a minimum period of ten (10) years from the date of installation under all operating conditions. The guaranteed years of maintenance free operation, the number of full load and full rated short circuit current breaking/operation without requiring any maintenance or overhauling shall be clearly stated in the bid. As far as possible the need for lubricating the operating mechanism shall be kept to the minimum and eliminating altogether if possible. • The operating mechanism shall be non-pumping (and trip-free) electrically and mechanically under every method of closing. 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. • A mechanical indicator shall be provided to show open and close positions of the breaker. It shall be located in a position where it will be visible to a man standing on the ground level from a distance of 2 meters with the mechanism housing closed and operation counter shall also be provided in the central control cabinet. • The Vendor shall furnish detailed operation and maintenance manual of the mechanism along with operation manual for the circuit breakers.	
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49	Control	- The close and trip circuits shall be designed to permit use of momentary contact switches and push buttons. - Each breaker shall be provided with two (2) independent tripping circuits and coils each connected to a different set of signals of different DC systems. - The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils. However, provisions shall be made for local electrical control. For this purpose a local/remote selector switch and close and trip push buttons shall be provided in the breaker central control cabinet. - The trip coils shall be suitable for trip circuit supervision. Necessary terminals shall be provided in the central control cabinet of the circuit breaker by the Vendor. - Closing coil shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip shall operate correctly under all operating conditions of the circuit breaker upto the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. - Suitable relay for monitoring of DC supply voltage to the control cabinet shall be provided. The pressure switches used for interlock purposes shall have adequate contact ratings to be directly used in the closing and tripping circuits. In case the contacts are not adequately rated and multiplying relays are used then the interlock for closing/opening operation of breaker shall be with "NO" logic of the relay i.e., if the DC supply to the interlock circuit fails then it is essential that breaker trips in	

		order to protect the switch gear and connected equipment like transformers etc., for any possible faults at that time. Provision for automatic tripping of the breaker shall be made along with the flag indication for non-availability of DC supply. The connection must be such that capacitor provided for this purpose gets charged from the DC source provided by the Board only and the capacitor supply is released for the tripping circuit as soon as DC supply fails. It must be possible to close the breaker only after restoration of DC supply. The entire arrangement of CTD (Capacitor Tripping Device) facility shall be mounted on control cubicle for 132 kV SF₆ Circuit Breaker. • A local manual closing device, which can be easily operated manually by one standing on the ground, shall also be provided for maintenance purposes and direction of motion of handle shall be clearly marked for the spring operating mechanism of Circuit Breaker. • The auxiliary switch of the breaker shall be preferably positively driven by the breaker operating rod and where due to construction features, same is not possible a plug-in device shall be provided to simulate the opening and closing operations of circuit breaker for the purpose of testing control circuits.	
50	Motor compressed Spring Charging Mechanism	• Spring operated mechanism shall be complete with motor, opening spring, closing spring and all other necessary accessories to make the mechanism a complete unit. Breaker operation shall be independent of motor which shall be used solely for the purpose of charging the closing spring. Motor rating shall be such that it requires only 15 seconds or less for fully charging the closing spring. Closing operation shall compress the opening spring and keep ready for tripping. The mechanism shall be provided with means for charging the spring by hand. This operation shall be carried out with the doors of the cubicle closed/opened. During this process no	

		electrical or mechanical operation of the mechanism shall endanger the operator or damage the equipment. A mechanical indicating device shall be provided to indicate the state of the charge of the spring and shall be visible with the door of the cubicle closed. An alarm shall be provided for indicating spring failing to be charged by a pre-set timer after circuit breaker closing. The spring mechanism shall be fitted with a local manual release, preferably by a push button to avoid inadvertent operation. Means shall be provided for discharging the spring when the circuit breaker is in the open position without circuit breaker attempting to close.	
51	SPECIFICATION FOR CONTROL CABINETS	- Control cabinets shall be of the free standing floor mounting out door type. - Control cabinets shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel shall be atleast 3.0 mm. thick. 15 mm. thick neoprene or better type of gaskets shall be provided to ensure degree of protection of atleast IP 55 as per IS:2147. Control cabinets shall be provided with hinged door and padlocking arrangement. The door hinges shall be of union joint type to facilitate easy removal. Door shall be properly braced to prevent wobbling. There shall be provision in the bottom sheet for entrance of cables from below. - The wiring shall be of multi stranded copper with minimum cross section of 2.5 sq.mm. with 1100 V PVC insulation. - Bus bars shall be of tinned copper of adequate cross-section to carry the normal current, without exceeding the permissible temperature rise over an ambient temperature of 50°C outside the cubicle. The buses shall be braced to withstand forces corresponding to short circuit current of 10 kA.	

		• Fractional kW motors shall be suitable for operation on a 240 V, 1-phase, 50 Hz. supply system. • Isolating switches shall be group operated units (3-pole for use on 3-phase supply systems and 2 pole for single phase supply systems). Quick make quick break type, capable of breaking safely and without deterioration, the rated current of the associated circuit. Control cabinet door shall be interlocked with the operating handle of the switch so as to prevent opening of the door when the switch is closed. A device for bypassing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions. • Fuses shall be HRC cartridge link type having prospective current rating of not less than 46 kA (rms). They shall be provided with visible operation indicators to show when they have operated. One fuse pulling handle shall be supplied for every ten fuses or a part thereof. • Push button shall be rated for not less than 6 Amps. 240 V AC or 2 Amps, 220 V DC 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. • 2 pole contactor for single phase motors. Reversing contactor shall be provided with electrical interlocks between forward and reverse contactor. If possible, mechanical interlocks shall also be provided. contactor shall be suitable for uninterrupted duty and shall be of duty category class AC4 as defined in IS:2959. The main contacts of the contactor shall be silver plated and the insulation class for the coils shall be class E or better. The dropout voltage of the contactor shall not exceed 70% of the rated voltage.	
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		filters. Cabinets shall be dust, moisture and vermin proof. The control cabinet shall be of suitable size to accommodate all the equipment to be mounted in the cabinet and they are spaced such that they are easily accessible and convenient to carry out maintenance work. In this regard, during engineering, the size of the cabinet if required to be modified. The supplier shall accept to such modifications as suggested by BHEL.	
52	OPERATING MECHANISM HOUSING:	The operating mechanism housing/control cabinet shall conform to the requirement specified in clause 51.	
53	Interlocks	It is proposed to electrically interlock the circuit breaker with associated air break isolating switches in accordance with switchyard safety interlocking scheme. All accessories required on breaker side for satisfactory operation of the scheme shall be deemed to be included in the scope of supply of this Specification.	
54	SUPPORT STRUCTURE	The Bidder shall include the price of support structure along with the foundation bolts. The support structure shall meet the following requirements. 1) The minimum vertical clearance from any energized metal part to the bottom of the circuit breaker (structure) base, where it rests on the foundation pad, shall be as per clause – 14 in this specification. 2) The minimum vertical distance from the bottom of the lowest porcelain part of the bushings, porcelain enclosures or supporting insulators to the bottom of the circuit breaker base, where it rests on the foundation pad shall be 2.55 meters for all voltages.	
55	FITTINGS AND ACCESSORIES	Following is the major fittings and accessories to be furnished by Bidder in the central control cabinet. a) Central control cabinet in accordance with clause No.51 complete with:	

		i) Cable glands for the following sizes of cables tentatively proposed: Copper Cable Sizes: 2 x 2.5 Sq.mm, 4 x 2.5 Sq.mm, 6 x 2.5 Sq.mm, 10 x 2.5 Sq.mm ii) Local/remote changeover switch. iii) Four digit operation counter. iv) Control switches to cut off control power supply. v) Fuses and links as required. For DC supply, only Fuses shall be provided. vi) The number of terminals provided shall be adequate enough to wire out all contacts and control circuits plus 24 terminals spares. vii) Operation hour meter for motor. viii) Three pin plug with socket. ix) Illuminating lamp with door switch. x) Lock and key for mechanism box. xi) Capacitor tripping device. xii) Thermostatically controlled space heater. xiii) Anti pumping arrangement in the closing circuit. b) Anti-pumping relay. c) Rating and diagram plate in accordance with IEC incorporating year of manufacture.	
56.	SURFACE FINISH	• All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil, as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paint. • All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate 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 paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external paintings shall be as per shade No.631 of IS:5. All ferrous hardware, exposed to atmosphere, shall be hot dip galvanised.	
57	GALVANISING	All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard.	
58	EARTHING	The operating mechanism housing, control cabinets, dead tanks, support structure etc., shall be provided with two separate earthing terminals suitable for bolted connection to 50x8mm Galvanised MS flat .	
59	NAME AND RATING PLATES	Circuit breaker and its operating device shall be provided with a rating plate or plates marked with but not limited to following data: - Manufacturer's or trade mark. - Serial number or type designation making it possible to get all the relevant information from the manufacturer. - Year of manufacture. - Rated voltage. - Rated insulation level. - Rated frequency. - Rated normal current. - Rated short circuit breaking current. - First pole to clear factor. - Rated duration of short circuit. - Rated auxiliary DC supply voltage of closing and opening devices. - Rated out of phase breaking current. - Rated supply voltage of auxiliary circuits. - Rated supply frequency of auxiliary circuits. The coils of operating devices shall have a reference mark permitting the data to be obtained from the manufacturer.	

		The rating plate shall be visible in position of normal service and installation. The rating plate shall be weather proof and corrosion proof.	
60	CONTROLS AND CONTROL EQUIPMENT	a) The compressor control shall be of automatic start/stop type initiated by pressure switches on the main receiver. Supplementary manual control shall also be provided. b) Duplicate incoming supply of 240 V, Single Phase AC supply shall be at switchyard motor control centre. c) All control equipment shall be housed in a totally enclosed sheet steel cabinet conforming to relevant standards. Pressure gauges, other indicating devices and control switches shall be mounted on the control cabinet.	
61	ISOLATING SWITCHES	• The incoming power supply isolating switch operating handle shall be interlocked with the control cabinet door as to prevent opening of door when main switch is closed. Device for bypassing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions.	
62	FUSES	• All fuses shall be of the HRC cartridge type, conforming to IS:2208 and suitable for mounting on plug-in type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit live, without damage of contact with live conductor. Insulated fuses pulling handle shall be supplied with each control cabinet.	
63	TERMINAL CONNECTORS	The terminal connectors suitable for Zebra ACSR conductor 6 Nos. per circuit breaker shall be supplied and shall meet the following requirements. Terminal connectors shall be manufactured and tested as per IS:5561. • All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp	

		edges and corners shall be blurred and rounded off. • No part of a clamp shall be less than 10 mm thick. • All ferrous parts shall be hot dip galvanised conforming to IS:2633. • For bimetallic connectors, copper alloy liner of minimum thickness of 2 mm shall be cast integral with aluminium body. • Flexible connectors shall be made from tinned copper/aluminium sheets. • All current carrying parts shall be designed and manufactured to have minimum contact resistance. • Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS:5561.	
64	MOTORS	• Motors shall be of Universal type of sufficient size and Capacity for satisfactory operation for the application and duty as required for the driven equipment.	
65	Type Tests	All the equipment offered, shall be fully type tested by the bidder as per the relevant standard. The bidder shall furnish one set of the following type test reports for each equipment offered along with bid. The type tests must have been conducted not earlier than ten years from the date of bid opening. The offers received without these Test reports shall be treated as Non-responsive. • Mechanical Endurance Test: The Circuit Breaker shall be of class M1 i.e., mechanically type tested for 2000 operations. • Power frequency voltage withstand tests (wet & dry) • Lightning Impulse withstand test. • Basic short circuit tests, short line fault test duties and out – of phase switching tests. • Short time withstand current and peak withstand current tests. • Line and cable charging current tests. • Temperature rise test. • Seismic withstand test. • Capacitive current switching tests. • RIV (Radio Interference) Voltage Test	

66	ACCEPTANCE AND ROUTINE TESTS	• All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the Supplier in the presence of BHEL's representative. • In addition to the mechanical and electrical tests specified by IEC, the following shall also be performed. • Speed curves for each breaker shall be obtained with the help of a suitable operation analyzer to determine the breaker contact movement during opening, closing, auto-re-closing and trip free operation under normal as well as limiting operating conditions (control voltage etc.). The tests shall show the speed of contacts directly at various stages of operation, travel of contacts, opening time, closing time, shortest time between separation and meeting of contacts at break/make operation etc. The test results shall be proved by the manufacturer at site if demanded by BHEL. • Immediately after finalisation of the programme of type/acceptance/routine testing, the supplier shall give sufficient advance intimation to BHEL to enable him to depute representative for witnessing the tests.	
67	ADDITIONAL TESTS:	• BHEL reserves the right for carrying out any other tests of a reasonable nature at the works of the Supplier/laboratory or at any other recognised laboratory/research institute in addition to the above mentioned type, acceptance and routine tests.	
68	INSPECTION	• The inspection may be carried out by BHEL at any stage of manufacture. The Supplier shall grant free access to the BHEL's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipments under this specification by BHEL 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.	

		• The supplier shall keep BHEL informed in advance, about the manufacturing programme so that arrangement can be made for inspection. • BHEL reserves the right to insist on witnessing the acceptance/routine testing of the bought out items. • No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested. • The supplier shall give 15 days (for local supplies)/ 30 days. (In case of foreign supplies) advance, intimation to enable BHEL to depute his representative for witnessing acceptance and routine tests. All charges in connection with inspection by purchaser's personal such as travel, accommodation and incidentals shall be borne by BHEL.	
69	Training of Personnel	The contractor shall provide necessary facilities for training personnel at their works/principals works relating to design, manufacture, assembly and testing and operation maintenance for six personnel free of cost. However, travel and incidental charges of the personnel will be borne by BHEL	
70	DOCUMENTATION	All drawings shall conform to International Standards Organisation (ISO) 'A' series of drawing sheet/Indian Standards Specification. All dimensions and data shall be in S.I. Units.	

PQ & Other Terms and Conditions

S.No	Description	Vendor Remarks
1.	<u>Prequalification Criteria</u> Vendor shall have successfully supplied 132 KV Circuit Breaker atleast 1 numbers to AP/TS TRANSCO (or) to Industries with AP/TS TRANSCO. Vendor shall submit proof for the same. Along with the above Commissioning/Performance certificate of the equipment from AP/TSTRANSCO/ Industries needs to be Submitted.	
2	Vendor shall offer inspection of the above material to TSTRANSCO officials and BHEL officials. Only after	

	clearance from TSTRANSCO official's material will be accepted.	
3	Third party testing charges are to be included in the offered price by vendor and shall be conducted as per TSTRANSCO standards. (NABL accredited labs only)	
4	4 sets of test reports of each item to be submitted.	