GETCO

GUJARAT ENERGY TRANSMISSION CORPORATION LTD.

SARADAR PATEL VIDYUT BHAVAN,
RACE COURSE, BARODA – 390 007.

TECHNICAL SPECIFICATIONS
OF

400 kV SF6 CIRCUIT BREAKERS
(with PIR and Spring – Spring Mechanism)

GETCO/E/4TS – CB013(PIR)/R6 June 2023

SPECIAL INSTRUCTIONS TO BIDDER

Please read following instructions carefully before submitting your bid.

1. All the drawings, i.e. elevation, side view, plan, cross sectional view etc., in AutoCAD format and manuals in PDF format, for offered item shall be submitted. Also the hard copies as per specification shall be submitted.

2. The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.

3. ~~The bidder shall have to submit all the required type test reports for the offered item. In absence of this, the evaluation shall be carried out accordingly as non-submission of type test reports~~.

4. The bidder must fill up all the point of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in.

5. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.

6. The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by GETCO, in the event of an order, free of cost. The cost of logistics will be borne by GETCO.

7. Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.

8. The bidder shall bring out all the technical deviation/s only at the specified annexure.

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TECHNICAL SPECIFICATIOS FOR 400 kV SF6 CIRCUIT BREAKERS
(WITH PIR AND SPRING-SPRING MECHANISM)

1.1 SCOPE

This specification covers design, manufacture, testing & training to GETCO persons at manufacturer's works, supply and delivery of 400 kV Circuit Breakers with Pre Insertion Resistor (PIR) and all accessories required for satisfactory operation. It also includes the supervision of erection, testing & commissioning at site, for which no separate charges shall be paid. ***In case PIR is not required, it will be indicated in Schedule – A of respective tender, then bidder shall offer breaker without PIR.***

1.2 GENERAL

These requirements include some specific elements of construction and materials, but are not intended to preclude ingenuity of design or improvement. Deviations from this specification are not acceptable and will be rejected. However, if the Bidder proposes any deviations from this specification, they will be considered provided they are necessary, either to improve the quality performance and efficiency or to secure overall economy, without affecting the performance.

Circuit breakers shall be offered complete with all parts that are necessary or useful for their efficient operation. Such parts shall be deemed to be within supplier's scope whether specifically mentioned or not. Circuit breakers in all respects shall incorporate the highest quality of modern engineering, design and workmanship.

1.3 STANDARDS:

The equipment to be supplied under this specification shall conform to the latest issue of standards, rules and codes some of which are mentioned below.

1.	*IEC62271-100*	specification for alternating current circuit breaker
2.	IEC-376	specification and acceptance of new supply of sulfur Hexafluoride.
3.	IS:2147	Degree of protection provided for Enclosures for low voltage switchgear and control gear.
4.	IS:375	Marking and arrangement for switchgear bus-bar, main connections and auxiliary wiring.
5.	IS:325	Specification for 3-0 induction motor.
6.	IS:2516	Specification for circuit breaker.
7.	IS:2099	High voltage porcelain bushing.
9.	IS:2629	Recommended practice for hot dip galvanizing of iron and steel.

The components & accessories to be used in the manufacture of circuit breaker shall conform to relevant Indian Standards/the standard specified under respective clause in this specification.

However, if the offered equipment conforms to standards other than those mentioned above, salient points of comparison between the standards adopted and IEC/IS standards shall be clearly brought out in the proposal.

1.4 CLIMATIC & ISOCERAUNIC CONDITIONS:

The climatic conditions at site under which the equipment shall operate satisfactory are as under:

1.	Altitude above mean sea level (meters)	:	Not exceeding 1000 Meters.
2.	Max. ambient air temperature °C	:	50
3.	Max daily average ambient air temperature °C	:	35°
4.	Relative humidity for design of equipment %	:	95%
5.	Max. yearly weighted average temperature °C	:	30
6.	Minimum temperature of air in shade °C	:	3.5
7.	Climate	:	Moderately hot & humid tropical climate conductive to rust & fungus growth.
8.	Maximum annual rain fall in mm	:	2000
9.	Isoceraunic level	:	30
10.	Maximum wind pressure Kg/Mt²	:	150
11.	Earthquake acceleration (G)	:	0.3 g.

Note: Gujarat State falls under Seismic Zone IV / V

All electrical devices shall be given tropical and fungicidal treatment and shall be capable of satisfactory operation under the severe climatic conditions that would prevail at site as described above.

The equipment offered shall be suitable for continuous operation under the above conditions at the full rated capacity.

The equipment offered shall be suitable for heavily polluted atmosphere as well as suitable for hot line maintenance.

1.5 SYSTEM PARTICULARS

1.	Nominal system voltage	:	400 kV rms.
2.	Highest system voltage	:	420 kV rms.
3.	System frequency	:	50 Hz.
4.	Number of phases	:	Three (3).
5.	Type of earthing	:	Neutral Effectively earthed.

1.6 AUXILIARY POWER SUPPLY

Auxiliary electrical equipment shall be suitable for operation on the following supply system:

1.	Power devices (like drive motors etc.)	440 volts, 3 phase 4wire 50 Hz, neutral grounded AC supply
2.	AC control and protective devices like lighting fixtures, space heaters, HP Motor etc.	240 Volts, 1 Phase, 2wire 50 Hz AC supply with one lead grounded
3.	D.C. alarm control & data protective devices.	Two separate 220 volts two Wires un-grounded DC supply from batteries

The above supply voltages may vary as follows:
All devices shall be suitable for continuous operation over entire range of voltage:

1. A.C. supply : Voltage variation +10% frequency variation +3%
2. D.C. supply : (-)15% to (+) 10% variation.

Each of the foregoing supplies will be made available by the purchaser at one terminal point for each circuit breaker for operation of accessories and auxiliary equipment. Bidder's scope shall include distribution beyond the points of supply including supply of interconnecting cables, terminal blocks, HRC fuses, switches etc.

1.7 TECHNICAL REQUIREMENTS FOR CIRCUIT BREAKER

The circuit breakers shall comply with the following technical requirements :

1)	Type of circuit breaker	:	SF6.
2)	Number of Poles	:	Three (3).
3)	Installation	:	Outdoor. On hot dip galvanized steel structures to be supplied by Bidder.
4)	Rated Voltage	:	420 KV (rms).
5)	Basic Insulation Level	:	
	a) 1.2/50 microsecond lightning impulse withstand voltage	:	
	i) To earth	:	$\pm$ 1425 KV (peak).
	ii) across the open contacts, voltage applied to.	:	
	- One terminal	:	$\pm$ 1425 KV (peak) lightning impulse.
	- Opposite terminal:		240 KV (Peak) P F of opp. polarity.

	b) 250/2500 Microsecond switching impulse withstand voltage		
	i) to earth	:	± 1050 KV (peak)
	ii) across the open contacts, voltage applied to	:	
	- One terminal	:	± 900 KV (Peak) switching impulse
	- Opposite terminal	:	345 KV (Peak) of, PF opp polarity.
	c) Power frequency: With stand Voltage		
	i). to earth	:	520 KV (rms)
	ii) across terminals of open circuit breaker.	:	610 KV (rms.)
6)	Radio interference voltage for frequency between 0.5 MHZ & 2 MHZ both in open and closed position	:	Less than 1000 .micro volts at 266 KV (rms)
7)	Corona extinction voltage	:	320 KV (rms)
8)	Rated frequency	:	50 Hz.
9)	Rated Normal Current:		*3150 A*
10)	Rated line charging current:		400 A (Max. over breaking capacity voltage factor1.5 PU)
11)	Small inductive current breaking capacity	:	Any value from 1 to 10 A (the switching over voltage shall not exceed 2.3PU)
12)	I) Short time current Carrying capability	:	40 KA for 3 second at rated voltage.
	II) Out of phase breaking Current capacity.	:	10 KA (rms.)
13)	First pole to clear factor	:	1.3
14)	Rated transient recovery voltage for terminal faults	:	As per Clause 7 of IEC 56
15)	Rated characteristics for short: line faults		As per Clause-8 of IEC 56
16)	Rated short circuit making current capacity.	:	100 KA peak
17)	Rated operating duty cycle	:	O - 0.3 sec – CO – 3 Min - CO
18)	Rated out of phase making: current		Breaking (25% of the rated fault current) at twice rated voltage under phase opposition condition.
19)	Total break time	:	Maximum 50 ms.
20)	Total closing time	:	Maximum 160 ms.
21)	Auto-reclosing	:	Breakers shall be suitable for 1-Ø and 3- Ø high speed auto re-closing
22)	Temperature rise	:	Final steady state

			temperature of current carrying parts shall not exceed the limits specified in IEC publication 56.2 with a site reference ambient temperature of 50°
23)	Operating Mechanism	:	**Spring-Spring**
24)	Type of operation	:	Individually operated single poles.
25)	Type of tripping	:	Trip free.
26)	Phase to phase spacing in the Switchyard.	:	Not less than 7000mm.
27)	Total creepage distance of Support insulators.	:	Minimum 10500 mm.
28)	Seismic acceleration	:	0.3 g horizontal.
29)	Difference in the instants of closing/opening of contacts at rated voltage and rated pressure of quenching medium.	:	
	i) Within a pole	:	Not exceeding 2.5 ms.
	ii) Between poles	:	Not exceeding 3.3 ms.
30)	Pre-insertion resistance	:	400 Ohms **(Required for line breaker only)**
31)	Air clearances		
	i) Phase to phase	:	7000 mm.
	ii) Phase to ground	:	3500 mm.
32)	***Live part to plinth level clearance in mm***	:	8000 mm.
33)	No. of auxiliary contacts and their rating.	:	12 NO & 12 NC per pole (10 Amp. At 220 VDC)
34)	No. of trip coils	:	Two (2) per pole.
35)	Noise level at base and upto 50 M distance from base of breaker.	:	Maximum 100 dB.

1.8 ADDITIONAL DUTY REQUIREMENTS

The circuit breaker shall be able to interrupt the line charging current with a temporary over voltage as high as 1.5 p.u. without restrikes and without use of opening resistors.

The breaker shall be able to interrupt the fault current without the provision of opening resisters across the contacts.

The breaker shall have capacity of interrupting steady and transient magnetizing current of 400 KV class transformers of 500 MVA capacity.

The breaker shall be suitable for successful operation with power transformers of 315/500 MVA rating, loaded with 25 MVAR reactor provided on tertiary side without the over voltage exceeding 2.3 p.u.

The transformer may be initially operated without switched reactors on the tertiary side. Even after providing the switched reactors on the transformer at later date, the breaker offered shall be able to switched in or cut, with or without all or some of the reactors.

The tenderer shall/quote the value of partial dis-charge level for circuit breaker offered in his tender. ***The value shall be within limit of standards.***

Circuit breaker shall be re-strike free.

Circuit breaker shall be capable of clearing short line faults with the source impedance behind the bus equivalent to the rated fault current.

The critical current which gives the longest arc duration at lockout pressure of extinguishing medium and the duration shall be indicated.

The breaker shall satisfactorily withstand the high stresses imposed on it during fault clearing. Load rejection and re-energisation of lines of 300mm length with trapped charges.

The breakers meant for reactor switching shall be able to switch in and out the 420 KV shunt reactors for any value from 50 MVAR up to 80 MVAR without giving rise to over voltage more than 2.3 p.u. Laboratory tests and/or field test reports in support of this shall be furnished along with the bid.

The total break time as specified in this specification shall not be exceeded under any of the following duties.
The duties 1,2,3,4,5 (with MRV as per IEC-56).
Short line fault L 90, L 75 (with TRV as per IEC-56).

The specified break time shall not exceed under any duty conditions specified such as with the combined variation of the trip coil voltage (70-110%), extinguishing medium pressure etc. While furnishing the proof for the total break time of complete circuit breaker, the bidder may specifically bring out the effect of non-simultaneity between contacts within a pole or between poles and show how it is covered in the guaranteed total break time.

The guaranteed values related to performance of the breaker shall be supported with the type test reports.

1.9 PRE-INSERTION RESISTOR

Each breaker of 420 kV rating to be used for line control shall be provided with a single step pre-insertion resistor of 400 ohms to control the switching over voltages. The pre-insertion time of the resistors shall be 6 to 10 milliseconds.

The resistors put across each break of the pole must be so dimensioned that it has full thermal capability to withstand terminal fault, re-closing against trapped charge and out of phase closing. The resistors must be able to meet the duty cycles given below:

1. Terminal fault : C-1 min – C-C0 – 2 min – C-1 min CO.

2. Re-closing : Duty same as (i) above but
against trapped charge. first, third and fourth closing are to be on de-energised line while second closing is to be made with lines against trapped charge of 1.2 P.U. of opposite polarity.

3. Out of phase : One closing operation under closing phase opposition i.e. with twice the voltage across the terminals.

No allowance shall be made for heat dissipation of resistor during time interval between successive closing operation. The resistors and resistor support shall perform all these duties without deterioration. Calculations and test reports of resistors proving thermal rating for duties specified above shall be furnished in the bid. The calculations shall take care of adverse tolerance on resistance values and time setting.

1.10 OPERATING MECHANISM OF CONTROL

Circuit breakers shall be operated by spring charged mechanism only (for both opening and closing). The mechanism shall be housed in a dust proof and weather proof control cabinet.

The operating mechanism shall be strong, rigid, not subject to rebound and shall be readily accessible for maintenance by standing on ground.

The operating mechanism shall be suitable for high speed re-closing and other duties specified. During re-closing the breaker contacts shall close fully and then open. The machine shall be anti pumping and trip free (as per IEC definition) under every method of closing (Except during manual closing of a breaker for maintenance).

The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices.

A mechanical indicator shall be provided to show open and close position of the breaker. It shall be located in a position where it can be visible by a man standing on ground with the mechanism housing closed. An operation counter shall also be provided in the central control cabinet.

Working parts of the mechanism shall be of corrosion resisting material. Bearing which require greasing shall be equipped with pressure type grease fittings. Breaking pins, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.

The design of the operating mechanism shall be such that it shall be practically maintenance free. The guaranteed years of maintenance free operation, the number of full load and full rated short circuit breaking operation without requiring any maintenance or overhauling, shall be clearly stated in the tender bid. The mechanism will require minimum lubrication.

1.11 CONTROL

The close and trip circuits shall be designed to permit use of momentary control switches and push buttons.

Each breaker pole shall be provided with two independent tripping circuits, valves and coils each connected to a different set of protective relays.

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. The trip circuit supervision relay would be provided by the purchaser. Necessary terminals shall be provided in the central control cabinet of the circuit breaker by the contractor. Trip circuit supervision shall be operative in both close and open condition of the breaker.

Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Shunt trip coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 115% of rated voltage. If additional elements are introduced in the trip coil circuit, their successful operation and reliability for similar applications on outdoor circuit breaker shall be brought out in the tender. In the absence of adequate details, the offer is likely to be rejected.

Suitable monitoring relay of D.C. 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 fail safe logic/scheme i.e. if the DC supply to the interlock circuit fails then operation lockout shall take place.

Following minimum numbers of potential free contacts over and above the breaker scheme shall be provided to meet the requirements of SCADA:

1) Dual DC supply arrangement shall be provided

2) Pressure switch shall be provided with following minimum numbers of potential free contacts for breaker gas monitoring status; over and above provided for breaker scheme. All these contact shall be wired up to central cubicle (Marshalling Kiosk)

(a) SF6 gas pressure normal – 2 NO or 2 NC plus one spare

(b) SF6 gas pressure low – 3NO or 3 NC plus one spare

(c) SF6 gas pressure lockout - 3 NO or 3 NC plus one spare

3) Following minimum numbers of potential free contacts are required to be provided for breaker monitoring in SCADA / control panel; over and above provided for breaker scheme. All these contact shall be wired up to central cubicle (Marshaling Kiosk)

(a) Breaker spring charge – 3 NO or 3 NC plus one spare

(b) CB ready status for Auto reclose -3NO or 3NC plus one spare

(c) Pole Discrepancy Operated - 3NO or 3NC plus one spare

(d) Control supply DC1 & DC2 fail, Motor MCB Trip, CB AC supply fail indication contacts plus, one spare.

(e) Local remote switch – 1 NO or 1 NC plus one spare.

However, to achieve above requirements multiplication relay / contactor may be utilized.

Local manual closing device which can be easily operated by one man standing on the ground shall be provided for maintenance purposes and direction of motion of handle shall be clearly marked. A conveniently located manual tripping lever or button shall also be provided for local tripping of the breaker and simultaneous opening of re-closing circuit. It shall be possible to trip the breaker in the event of auxiliary supply failure.

The auxiliary switch of the breaker shall be preferably positively driven by the breaker operating rod and where due to construction feature the same is not possible a plug in device shall be provided to simulate the opening and closing operation of circuit breaker for the purpose of testing control circuits.

1.12 This clause is intentionally deleted.

1.13 SPRING OPERATED MECHANISM:

Spring operating mechanism shall be complete with motor opening and closing springs, limit switch and all other accessories required for satisfactory operation.

As long as power is available to the motor, continuous sequence of the closing and opening sequence of the closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.

One close-open operation shall be possible after failure of power supply to the motor.

Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring.

Closing action of the circuit breaker shall compress the opening spring ready for tripping.

When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control cabinet.

Provisions shall be made to prevent a closing operation of the breaker when the spring is in partial charged condition. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breakers is already in the closed position.

The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism.

1.14 CONSTRUCTION FEATURES

The circuit breaker shall be of single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breakers.
All gasketed surfaces shall be smooth, straight and reinforced, if necessary, to minimize distortion and to make a tight seal. The operating rod connecting the operating mechanism to the arc chamber shall have adequate seals. Double ‘O’ ring seals and test holes for leakage test of the internal seal shall be provided on each static joint.
Each pole of the circuit breaker shall be provided with its own self-contained gas system. The SF6 gas density of each pole shall be monitored and regulated by individual pressure switches. Provision shall be made for remote indication if possible.
In the interrupter assembly, there shall be an absorbing product box to minimize the effects of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as to be fully compatible with SF6 gas.

The SF6 gas density monitor shall be adequately temperature compensated to control the change in density due to variations in ambient, temperature within the body of the circuit breaker as a whole. The density monitor shall meet the following requirements:

a) It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by using suitable interlocked non-return valve coupling.

b) 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.

Means for pressure relief shall be provided in the gas chamber of circuit breaker to avoid the damages or distortion during the occurrence of abnormal pressure increase or shock waves generated by internal electric fault arcs. The position of vents diaphragms and pressure relief devices shall be so arranged to minimize danger to the operators in the event of gas or vapor escaping under pressure.

Facility shall be provided to reduce the gas pressure within the breaker to a value not exceeding 8 millibars within 4 hours or less. Each circuit breaker shall be capable to withstand this degree of vacuum without distortion or failure of any parts.

Sufficient Sf6 gas shall be provided to fill all the circuit breakers installed. In addition, 30% of total gas requirement shall be supplied in separate cylinders as spare requirement.

Provision shall be made for attaching an operational analyzer after installation of breaker at site to record contact travel, speed, operating time, pre-insertion timing of closing resistors etc. in one pole.

1.15 SULPHER HEXAFLORIDE GAS (SF6 GAS)

The SF6 gas shall comply with IEC 376, 376 a and 376B and shall be suitable in all respects for use in high voltage switchgear under the operating conditions specified.

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.

IS:4379	-	Identification of the contents of Industrial gas cylinders.
IS: 7311	-	Seamless high carbon steel cylinders for permanent and high pressure liquefiable gases

The cylinders shall meet the requirements of Indian Boiler Regulations. *Explosive test certificate for cylinders for SF6 gas shall be submitted.*

Sf6 gas shall be tested for purity, dew point, breakdown voltage, water content as per IEC:376, 376A & 376B and test certificate shall be furnished for each lot of SF6 gas.

1.16 CONTACTS:

Main contacts shall have ample area and contact pressure for carrying the rated current and the short time rated current of the breaker without excessive temperature

rise which may cause pitting or welding. Contacts shall be adjustable to allow for wear, easily replaceable and shall have a minimum of moveable parts and adjustments to accomplish these results. Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear. Contacts shall be so designed that frequent replacement due to excessive burning will not be necessary.

Arcing contacts shall be the first to close and the last to open and shall be easily accessible for inspection and replacement. Tips of arcing and main contacts shall be silver plated or have a tungsten alloy tipping.

If multi-break interrupters are used, they shall be designed and augmented so that a fairly uniform voltage distribution is developed across them. The thermal and voltage withstand of grading elements shall be adequate for the service conditions and duty specified.

Positive mechanical interconnection shall be provided between interrupting contacts, resistor switches (when used), blast valve mechanism, if any, to ensure maximum operating reliability and retention timing.

The gap between the open contacts shall be such that it can withstand at least the rated phase to ground voltage for 8 hours at zero-gauge pressure of SF6 gas due to the leakage.
The breaker should be able to withstand all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. 2 p.u. across the breaker continuously, for validation of which a power frequency dielectric with stand test conducted for a duration of at least 15 minutes is acceptable).
Any device provided for voltage grading to damp oscillations or to prevent re-strike 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.

1.17 BUSHING, SUPPORT INSULATORS AND HOLLOW INSULATORS:

Bushing shall be manufactured and tested in accordance with IS:2099 & IEC:237 while hollow column insulators shall be manufactured and tested in accordance with IS:5284 & IEC:233. The support insulators shall be manufactured and tested as per IS:2544/IEC:168/IEC:273. *The compressive and cantilever strength shall conform to the relevant IS.*

Porcelain used in manufacture of bushings and insulators shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the technical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

Glazing of the porcelain shall be uniform brown or dark brown colour free from blisters, burns and similar other defects Bushings shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.

Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which could cause corrosion or injury to conductors,

insulators or supports by the formation of substance produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.

All iron parts shall be hot-dip galvanized and joints shall be air-tight. Surfaces of the joints shall be turned up porcelain parts by grinding and metal parts by machining. Bushing design shall be such as to ensure a uniform compressive pressure on the joints.

Bushings support insulators/hollow column insulators shall satisfactory withstand the insulation level specified in the I.E.C. specification.

The minimum creepage distance shall be 10,500mm (Total). The pollution level shall be class-III as per IEC 71.

1.18 RESISTORS:

1.18.1 The proposal shall highlight the design features provided to effectively deal with the following without re-strike.

Breaking of inductive currents like transformers on no load.
Charging of long lines open at other end.
Clearing of developing faults.
Opening of phase opposition.

1.18.2 Damping resistors when provided shall be of ceramic type hermetically sealed in porcelain housing.

1.19 OPERATING TIME:

1.19.1 The breaker interrupting, closing and re-closing time shall be stated in the proposal. The interrupting time shall be the sum of (a) the time taken by

contacts to start parting from the moment of trip impulse and (b) the time taken for extinction of the arc thereafter. The interrupting time shall not exceed 50 millisecond. The re-closing times shall be suitable for the high speed re-closing duty as specified.

1.20 SUPPORT STRUCTURES

Support structures along with the foundation bolts required for mounting the breaker shall be within the scope of the bidder and prices for the same shall be quoted inclusive of all the items of structures, hardware and accessories for mounting so as to put circuit breaker in to service.

The design of support structure shall take in to account the following points.

Minimum vertical clearance = 8 meters from any energized part to the bottom of the circuit breaker base where it rest on the foundation pad.

Minimum vertical distance from the bottom of the lowest porcelain part of the bushings, porcelain housing or support insulators to the bottom of the circuit breaker base, where it rests on the foundation pad should not be less than 2.60 meters.

Minimum clearance between the live parts & earth - 3.5 meters

The design of structure shall also take into account the environmental conditions. The structures shall be hot dip galvanized.

Necessary platform for ease of working and maintenance of mechanism, maintaining required clearances for safe working shall also be provided.

1.21 CONTROL CABINET or CUBICLE, TERMINAL or MARSHALING BOX

1.21.1 All types of boxes and cabinets shall generally conform to IS:5039/IS:8623/IEC:439 and meet the requirements stipulated hereunder.

1.21.2 Cabinet box shall be of sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be at least 3.00 mm thick cold rolled/ hot rolled. The cabinet/box shall be properly braced to prevent wobbling. It shall be reinforced sufficiently to provide level surfaces, resistance to vibration and rigidity during transportation and installation.

1.21.3 The enclosure of cabinet/box shall provide a degree of protection of not less than IP 55 and one cabinet/box of each type shall be tested for the same as per IS:2147. The type and thickness of gasket used during type test shall be indicated in GTP

1.21.4 Control cabinet, pedestal mounting junction box, terminal box and marshalling box shall be provided with hinged doors having pad locking arrangement. The maximum distance between two hinges shall be 350mm.

1.21.5 All doors, removable covers and plates shall be gasketed all around with neoprene gaskets of minimum thickness of 6 mm. All gasketed surfaces shall be smooth, straight and reinforced to make a tight seal.

1.21.6 All sheet steel work shall be degreased, pickled, phosphated and then applied with two coats of zinc chromate primer and two coats of finishing powder coated paint. The colour of finishing paint shall be light admiral grey in accordance with shade No.631 of IS:5 for outside & inside surfaces.

1.21.7 All cabinets/boxes shall be designed for the entry of cables from bottom by means of weatherproof and dust-proof connections. Suitable cable gland plate (at least 150 mm above the base of cabinet/box) of HDG having minimum thickness of 3 mm, with necessary cable glands shall be provided. The cable gland plate shall be re-movable type and shall have provision for additional glands for future. The glands shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall be cadmium plated. The cabinet/box shall be designed generously for clearance so as to avoid interference between the wiring entering from below and any terminal block or accessories mounted within the box or cabinet.

1.21.8 60-watt heater(s) along with thermostat of range 0 to 90 ^{0}C shall be provided in the cabinet/box to prevent condensation. The heaters shall be suitable for 240 Volt AC supply. ON/OFF switch and fuse for this shall be provided.

1.22 TERMINAL BLOCKS

1.22.1 All internal wiring to be connected to the external equipment shall terminate on terminal blocks, preferably vertically mounted on the side of cabinet/box.

1.22.2 The terminal blocks shall be made of moulded non-inflammable thermostatic plastic. The material of terminal block moulding shall not deteriorate because of varied anticipated conditions of heat, cold, humidity, dryness etc.

1.22.3. The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking mechanism to prevent cable from escaping from the terminal clamp unless it is done intentionally. The terminal block shall be non-disconnecting stud type ELMEX type CAT-M6 or equivalent.

1.22.4. The connecting part in contact with cable shall be tinned or silver plated.

1.22.5. The terminal blocks shall be of extensible design.

1.22.6. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

1.22.7. The terminal blocks shall be of 1100V grade and shall be rated for maximum continuous current.

1.22.8. The terminal block shall be fully enclosed with removable covers of transparent, non-inflammable, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operation of carrying out the wiring without removing the barriers.

1.22.9. The terminals shall be provided with the marking tags for wiring identification.

1.22.10. Unless otherwise specified, the terminal blocks shall be suitable for connecting the following conductors.

A.	All circuit except CT & PT circuit	:	One No. of 2.5 sq.mm. copper flexible.
B.	All CT circuit	:	Maximum 4 Nos. of 2.5 sq.mm. copper Flexible.
C.	All PT circuit.	:	Minimum 2 Nos. of 2.5 sq.mm. copper Flexible

1.22.11. There shall be a minimum clearance of 250mm between the first row of terminal block and the cable gland plate or side of the box. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

1.22.12. The arrangement shall be such that it is possible to safely connect or disconnect terminals online circuit and replace fuse links when the cabinet is live. Cabinet wiring shall be suitable for 60°c (10°C higher than the maximum ambient temperature).

1.22.13 At least 20% spare terminals shall be provided for future use.

1.23 CABINET INTERNAL WIRING

1.23.1 All wiring shall be carried out with ***minimum 2.5 sqmm,*** stranded tinned 1100 V grade copper wires**.**

1.23.2 All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks.

1.23.3 Wire termination shall be done with solder less crimping type tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on wires and shall not fall off when wire is disconnected from terminal block. Number 6 & 9 shall not be used for ferrule purpose. All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule.

1.23.4. All terminals including spare terminals of auxiliary equipment shall be wired up to terminal blocks. Each equipment shall have its own central control cabinet.

1.23.5. A 240 V, single phase, 50 Hz AC industrial grade plug and a socket shall be provided in the cabinet with ON – OFF switch.

1.23.6. For illumination of control cabinet, 40 W lamp with holder and switch shall be provided.

1.23.7. All control switches shall be of rotary switch type.

1.23.8 ***All the wiring between poles and between pole & control cubicle shall be carried out by bidder, decently placed in perforated hot dip galvanized steel tray of suitable size. The wiring shall be carried out with steel armored, 2.5 sqmm stranded copper cables.***

1.24 INDICATIONS

All Indicating lamps shall be of bright LED type of 22.5 mm dia.
On-Off indication over and above the normal indicating device for breaker position, a separate potential free contact for each position shall be provided for the purpose of remote metering. Mechanical indicators for breaker position shall also be provided such that it can be visible from ground level. *Local electrical ON / OFF and spring charged indication shall be provided*

1.25 PUSH BUTTONS

All push buttons shall be of push to actuate type having 2 NO & 2 NC self reset contacts. They shall be provided with integral escutcheon plates, engraved with their functions. Push button contacts shall be rated for 5-amps at 415 V AC and 1 Amp. Inductive breaking at 250 V DC**.**

1.26 LABELS

All equipment / items mounted shall be provided with individual designated engraved labels. Labels shall be made of non-rusting metal like Aluminum anodized. All the labels shall be properly fixed by Aluminum rivets.

1.27 EARTHING TERMINALS

Control cabinet/housing/box shall be provided with two separate earthing terminals suitable to receive the purchaser's earthing conductor. All instruments/relay case shall be connected to earth by 1100 grade, 4.0 sq. mm. tinned copper wire.

1.28 AUTO-RECLOSING EQUIPMENT

Circuit breakers shall be incorporated with the features of high speed auto re-closing. All relays, controls and interlocks required for auto re-closing scheme shall be included in the offer.
If breaker trips out after first shot re-closing equipment shall lockout and no further closure shall take place.

The duty cycle of the auto re-closing breakers shall be O – t – CO - t' - CO, where the dead time interval 't' shall be adjustable. The bidder shall clearly state the minimum dead time interval (t) that can be used and the range of adjustment for the same. The value of 't' and 't' ' shall be 0.3 sec. & 3.0 min respectively.

Auto-re-closing equipment shall be suitable for operation on the D.C. control Voltage specified in the specification. Control circuitry shall be so arranged that the re-closing sequence shall not come into operation if the breaker is opened by hand.

1.29 INTERLOCKS

The circuit breakers shall be electrically interlocked with purchaser's associated isolators and earth switches. The Bidder shall give recommended interlocking scheme in detail in accordance with switchyard safety interlocking scheme. All accessories required on breaker side for satisfactory operation of the scheme shall be deemed to have been included in bidder's scope of supply.

1.30 AUXILIARY SWITCHES:

Each pole of the circuit breaker shall be provided with twelve (12) normally open and twelve (12) normally closed contacts.

Additional Ten (10) normally open and Ten (10) normally closed contacts shall be provided.

Normal position of auxiliary switches refers to contact position when circuit breaker is open.

The auxiliary switch shall be tested for the following tests:

Electrical endurance test – A minimum of 1000 operations for 2A DC with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop / visual defects/temp. rise test.

Mechanical endurance test – A minimum of 5000 operations with a subsequent checking of contact pressure/visual examination.

Heat run test on contacts.

IR/HV test etc.

1.31 FITTINGS AND ACCESSORIES:

1.31.1 Following is the partial list of some of the major fittings and accessories to be furnished by the bidder in the control cabinet as an integral part of the main equipment. Quantity and exact location of these parts shall be indicated in the proposal & will be finalized during detailed engineering.

1. Cables glands and cable glands plate.
2. Local/remote changeover switch ***(with One No of spare contact for each position)***
3. *SF6 gas* pressure gauges.
4. Control switches to cut off control supply.
5. Operation counter.
6. Heater with thermostat control
7. Fuses, as per requirement
8. Manually operated tripping push button/mechanical lever.
9. Terminal block with spare terminals.
10. Anti-pumping relay / *contactor*.
11. Auxiliary relays required for satisfactory operation
12. Padlocking arrangement with padlock and duplicate key.
13. Earthing terminals.
14. Rating and diagram plate in accordance with IEC incorporating manufacture name & year, order no. & date, purchaser's name, etc.

1.31.2 Miscellaneous Accessories:

1) Arcing horns if required.
2) Corona rings.
3) Lifting lugs/hooks.
4) Hand operated lifting and lowering devices.
5) Galvanized steel supporting structure with foundation bolts and templates.
6) Manually operated device for closing of the breaker under power failure.
7) Terminal connectors.
8) Earthing pads (two)
9) Instruction/caution boards

1.32 PAINTING AND GALVANISING

Interiors and exteriors of tanks, mechanisms, enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease or other adhering foreign matter.
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. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

All the ferrous hardware, exposed to atmosphere, shall be hot dip galvanized.

1.33 TERMINAL CONNECTORS

1.33.1 All circuit breakers shall be provided with ***expansion and rigid*** type terminal connectors suitable to receive 4" IPS (114.3 OD) aluminum pipes. ***Actual quantity and type of connector shall be decided during detailed engineering.*** Clamps shall be designed adequately to take care of any bimetallic effect. The temperature at the clamp shall not exceed 80° C. Corona rings shall be provided at the breaker terminals. The terminal pad shall have protective covers which shall be removed before interconnections. The rating of Terminal Connectors shall be equal or higher than that of the Circuit breakers

1.33.2 Terminal connectors shall be manufactured as per IS/IEC

1.33.3 The drawings of the clamp connectors shall be submitted with the Technical Bid.

1.33.4 Two clamp type grounding terminals each suitable for clamping purchaser's grounding conductor/earthing strip shall be provided on each circuit breaker. Size of the conductor/strip shall be indicated to the successful Bidder.

1.33.5 All casting shall be free from blow holes, surface blisters, cracks cavities. All sharp edges and corners shall be blurred and rounded off

1.33.6 No part of a clamp or connector shall be less than 10mm thick.

1.33.7 Flexible connectors, braids or laminated strips shall be made from tinned copper sheets.

1.33.8 All ferrous parts shall be hot dip galvanized conforming to IS:2633.

1.33.9 All current carrying connectors shall be designed so that hystersis and eddy current losses are negligible.

2.0 ERECTION AND COMMISSIONING

The Bidder shall provide the services of an Erection Engineer who shall assume full responsibility for the supervision of erection, testing and commissioning of the equipment. Skilled & unskilled labour and normal erection tools would be provided by the purchaser. All special tools & instruments required for the erection, testing and commissioning of the circuit breakers shall be provided by the Bidder.

3.0 TESTS

3.1 Type Tests

All the Circuit Breakers offered shall be fully type tested for following, as per *IEC62271-100* & IS 13118 latest editions at the Government approved laboratoryof the eligible country.

The type test reports from NABL approved laboratory shall not be older than 10 (Ten) years and shall be valid as on the last date of submission of bid

3.1.1 Lightning impulse withstand test
3.1.2 Power Frequency voltage dry withstand test after Lightning Impulse test
3.1.3 Switching Impulse voltage withstand test (wet)
3.1.4 Power Frequency voltage dry & wet withstand test after switching Impulse test
3.1.5 Corona inception and extinction voltage test
3.1.6 Temperature Rise and measurement of resistance test
3.1.7 Short Time and peak current withstand test
3.1.8 Short Circuit Test duties
3.1.9 Out of phase closing test
3.1.10 Line charging & switching current test
3.1.11 Capacitor Current switching test
3.1.12 Shunt reactor current switching test
3.1.13 Mechanical Endurance test
3.1.14 Degree of protection for all cubicles
3.1.15 Seismic test
3.1.16 Single phase thermal capability test on PIR (Only for line breakers)
3.1.17 STC withstand test on terminal connector
3.1.18 Temperature Rise & tightness test on terminal connector
3.1.19 Tests on Auxiliary Switches
3.1.20 Test to demonstrate the power frequency withstand capability of breaker in open condition at zero gauge & lockout pressure as per clause no. 1.16.
3.1.21 *Test on hollow insulator of offered make as per IS:62155.*

*The Bidder shall submit **soft copy** of all above type test reports for the offered Circuit breakers along with the offer.*

The Bidder shall furnish ONE set of all above type test reports for the offered Circuit breakers along with the offer. The Type Test report shall not be older than *7 (seven)* years on the date of expiry of offer.

However, the purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative. For this purpose, the Biddermay quote unit rates for carrying out each type test.

IMPORTANT NOTE: *In case of non-submission of some of the type test reports, the bidder shall confirm the submission of same before commencement of supply, without affecting delivery schedule, from NABL accredited laboratory, free of cost. In absence of this confirmation, the offer will be evaluated as non-submission of type test report.*

3.2 ACCEPTANCE AND ROUTINE TESTS

3.2.1 All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of purchaser's representative.

3.2.2 Following additional tests shall also be performed.

1 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 operations under normal as well as limiting operating conditions (control voltage) 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 make-break operation **dynamic contact resistance measurement** etc. This test shall also be performed at site.

2 Temperature Rise test on one of the selected sample from offered lot of Terminal Connectors.

3 Tests on Pre Insertion Resistor.

Immediately after finalization of the programme of acceptance/routine tests at the supplier's works, the supplier shall give notice well in advance to the purchaser for witnessing the tests.
The inspection may be carried out by the purchaser at any stage of manufacturing. The successful Bidder shall allow free access to the purchaser's representative at reasonable time when the work is in progress. The supplier shall keep the purchaser informed, in advance, about the manufacturing program so that arrangement can be made for inspection.

All the components, accessories etc. provided for the breakers shall conform to relevant applicable Standards. The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items.

All the routine test reports for all the breakers and for all the insulators utilized shall be submitted with inspection report

All tests report for acceptance / routine tests shall be submitted in ***spiral bound volume*** and got approved from the purchaser before dispatching the breaker.

4.0 UPRATING OF BREAKING CAPACITY

The Bids shall indicate for suitability of offered breakers for up rating the capacity at site, if required. The details shall be given.

5.0 DRAWINGS AND DATA

As a part of the proposal, the Bidder shall furnish relevant descriptive and illustrative literature and the following drawings for preliminary study. No weight age shall be given to the words "reputed and or equivalent" for the make of any item. Hence should not be indicated.

1 General outlines drawings showing dimensions, net and shipping weights, quantity of SF6 gas etc.
2 Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, dimensions of bushings etc.
3 Typical and recommended schematic diag. for control, supervision and auto-re-closing.
4 General arrangement of the foundations and drawing of support structure.
5 G.A. drawing of control cabinet.
6 Other data/information/details/drawings called for in various clauses of this specification.

The following additional information and data shall be furnished with the bid.

A. Drawing showing contacts in close, arc initiation full arcing arc extinction and open position.
B. The temperature v/s pressure curves for each setting of density monitor along with details of density monitor.
C. Method of checking the healthiness of condensers provided across the breaks at site.
D. The effect of non-simultaneity between contacts within a pole or between poles and also show how it is covered in the guaranteed total break time.
E. Details & type of filters used in interrupter assembly.
F. Characteristics of SF6 gas to be used and test report of the same.
G. Detailed literature and schematic diagrams of switching mechanism for closing resistors showing the duration of insertion. Calculations in respect of thermal rating of resistors for the duties shall also be furnished.
H. Any other information as required by this specification and considered necessary by the bidder to give complete information about the offered equipment.
I. All the documents required shall be submitted over and above as indicated in Section – V of the specification.

After receipt of purchase order the successful Bidder will be required to furnish the following drawings in hard copy as well as in AUTOCAD (DXF format) for approval.

i General outline drawings showing front and side elevations and plan of the equipment, with detailed dimensions.
ii Foundation drawing and floor plans of circuit breaker, structures etc. including weights of various components and impact loadings.
iii Wiring diagrams showing the control schemes of the breaker, including alarm, indicating devices, instruments, space heaters etc.
iv Drawing for locations of control cabinet indicating inlet pipes and cable entry.
v Schematic wiring diagram of the control cabinet.
vi Dimensional drawing of terminal connectors.
vii Schematic Diagram for Gas flow
viii Bill Of Materials with make and rating for all the items
ix Assembly and sub-assembly drawings of the breaker, arcing chamber, contacts, operating mechanism, etc.
x Detailed dimensions and assembly of the auxiliaries.
xi Net and shipping weights quantity of Gas/insulating liquid etc.
xii Drawing for operating mechanism
xii Any other drawing required by purchaser

Drawings, diagrams, instructions and reports shall be identified by descriptive title indicating their application to the equipment offered. All drawings and data shall be annotated in English Language and units shall be in metric system.

Purchaser will review and return one duly approved and stamped copy of drawings to supplier. One set each of such approved drawings shall be submitted to consignee and to end user along with the breaker documents.
Drawings submission and approval should be completed as per terms and conditions of the order.

4 copies of bound manuals covering erection operation and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices shall be furnished. One copy of operation & maintenance instruction should be kept in the kiosks of each breaker before dispatch to destination.

A comprehensive spare parts catalogue listing all component parts with their itemized unit prices shall be furnished with manual.

6.0 INSPECTION:

Equipment shall be subject to inspection by a duly authorized representative of the purchaser. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, is liable for rejection. Bidder shall grant free access to the places of manufacture to purchaser's representatives at all times when the work is in progress.

Inspection by the purchaser or his authorized representative shall not relieve the Bidder of his obligation of furnishing equipment in accordance with the specifications.

7.0 PACKING AND TRANSPORT INSTRUCTIONS:

Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport and be packed in such a manner as to protect it from damage in transit. The Bidder shall be responsible for and make good at his own expense any or all damage due to improper preparation and packing.

Loose material, e.g. Bolts, Nuts etc shall be packed in gunny bags and sealed in polythene bags with proper tagging.

Components containing glass shall be carefully covered with shock absorbing protective material such as 'Thermocol'.

All openings in the equipment shall be tightly covered plugged or capped to prevent dust and foreign material from entering in.

Wherever necessary proper arrangements for attaching slings for lifting shall be provided.

All spare parts shall be packed and treated for long storage at site.

Any material found short inside the intact packing cases shall be supplied by the Vendor/Contractor at no extra cost to the purchaser.

No material shall be dispatched without prior consent of the purchaser.

8.0 SPARES

One set of Closing Coil, One set of Tripping Coil and 30% SF 6 gas shall be provided as spares free of cost with each circuit breaker.

9.0 Mounting Arrangement

The mounting dimensions for structure to be supplied for CB shall be matched with the mounting dimensions mention in attached standard foundation plan of GETCO. Alternatively, bidder can provide necessary steel frame work matching the dimensions of breaker structure on upper side and dimensions of standard foundation plan at bottom side

10.0 *ACTIONS REQUIRED FOR DEFECTS OBSERVED DURING DEFECT LIABILITY PERIOD (Warranty periods)*

The actions required to be taken by OEM/contractor in case of defects observed in AIS type Circuit Breakers of ratings 400KV class during the warranty period (defect liability period) shall be as per following

Sr. no.	***Nature of problem***	***Corrective measures to be taken byOEM/contractor***
1	*Blasting of interrupter/ pole column*	*Replacement of compete CB pole IncludingSF6 gas*
2	*a. Abnormal DCRM and Travel Measurement b. Contact assembly and internal component damage, misalignment not leading to complete failure of interrupter*	*Repair/replacement of affected assembly/component based on repair procedure approved by QA*
3	*Crack in insulator, cementing joint of interrupter , pole column*	*Replacement of affected par*
4	*SF6 gas leakage from sealing andbolted joints. SF6 gas leakage detectable by any Leakage Detection Method*	*Rectification by replacement of gasket, O- ring, sealing, Interrupter or affected part tobe replaced etc If unable to arrest the leakage in 02 attempts, replacement ofinterrupter/column*
5	*SF6 gas purity for new gas (before charging) as per IEC 60376 after charging as per IEC60380*	*Re-conditioning of gas. If does not improve, complete evacuationof CB, replacement filter material and gas*
6	*Pole/ break discrepancy (duringO&M) Limits: Break to Break (Opening/Closing) : max. 2.5 ms Phase to Phase (Opening) : max. 3.33 ms Phaseto Phase (Closing) : max 5 ms*	*Rectification/replacement of affected parts*
7	*Static Contact Resistance: increase >50% from factory/ pre-commissioning value or 75 micro-ohm/ break whichever is lower*	*Rectification/ Replacement of pole*
8	*Drive mechanism assembly failure*	*Rectification/ Replacement of affected part*
9	*Trip/ close coil, density monitor, relays and contactors and components of common MB*	*Replacement of affected part*

11.0 TECHNICAL & GUARANTED PARTICULARS:

The Bidder shall furnish all guaranteed technical particulars as called for in schedule-A of this specification. Bids with any lacking information in this respect may not be considered.

SCHEDULE - A

(THIS SHALL BE INVARIABLY FURNISHED WITH THE TECHNICAL BID)

SCHEDULE OF GAURANTEED TECHNICAL PARTICULARS AND DATA

CIRCUIT BREAKERS

1. General

(a) Name of the Manufacturer :

(b) Country of Manufacture :

(c) Type of Ckt. Breaker :

(d) Manf's. type designation of CB :
Type & Designation of operating mechanism
(as per Mech. Endu. test report)

(e) Standard applicable :

(f) Rated voltage (KV rms) :

(g) Rated current
(i) Under normal condition-A :
(ii) Under site condition – A :

(h) Rated frequency – Hz :

(i) Number of poles :

(j) Whether 3 pole or 1 pole unit :

(k) Whether dead tank or live tank design :

(l) Type of installation :

(m) No. of breaks per pole :

(n) Latching current – KA :

2. Guaranteed Ratings

(a) Rated short circuit breaking currents
(i) Symmetrical component at 420KV – KA :
(ii) DC Component - % :
(iii) Asymmetrical breaking current at 420KV – KA :

(b) Rated making capacity
  (i) At higher rated voltage - KA peak :
  (ii) At lower rated voltage - KA peak :

(c) Max. total break time under any duty condition up to rated breaking current with limiting conditions –(mS)

(d) closing time – ms :

(e) Min. opening time under any limiting condition – ms :

(f) Max. opening time under any condition with limiting voltages and pressure – ms :

(g) Max. close open time under any limiting condition – ms :

(h) First pole to clear factor :

(i) Short time current rating - KA
  (i) 1 Second :
  (ii) 3 Seconds :

(j) Rated operating duty :

(k) Max. breaking capacity under kilometric faults and rated TRV characteristics – KA peak :

(l) Max. breaking capacity under phase opposition – (KA rms) :

(m) (i) Max. line charging breaking current with temporary over voltage upto 1.4 p.u. – KA :
  (ii) Max. cable charging breaking current - KA :
  (iii) Max. single capacitor bank breaking current - KA :

(n) Max. over voltage (p.u.) on

switching off transformer on NO load and corresponding Charging current :

(o) Max. period between closing of first contact and last contact in a pole – ms :

(p) Max. pole discrepancy – ms :

(q) Pre-insertion resistor
- (i) value/pole in ohms with tolerance :
- (ii) Min. and max. duration of insertion per pole – ms :
- (iii) Thermal rating for the C-1M-O-CO-2M-C-1M-O-CO For terminal fault consi-stance max. resistance And time setting :
- (iv) Thermal duty for the same duty as (iii) above for re-closing against trapped charges :

(r) Small fault current breaking capacity – KA peak :

(s) Max. temp. rise for main contacts over an ambient temp. of 50°C :

(t) Rated voltage and pick up range for trip coil – V :

(u) Rated voltage and pick up range for closing coil – V :

(v) Rated capacity (spring force) of operating mechanism :

(w) Rated pressure and limits of pressure of extinguishing medium :

(x) Min. dead time for
- (i) Three phase re-closing–ms:
- (ii) Single phase re-closing–ms:

(y) Data of re-striking voltage :

(i) Amplitude factor :
(ii) Phase factor :
(iii) Natural frequency :
(iv) Rate of rise of re-striking voltage :

(z) Dead time interval for auto recloser
(i) t (sec) :
(ii) t' (sec) :

3. Dielectric withstand capacity of complete breaker

(a) One minute dry & wet freq. Withstand voltage
(i) Between live terminals and ground – KV rms :
(ii) Between terminals with breaker contacts open – KV rms :

(b) 1.2 / 50 micro sec. impulse withstand test voltage
(i) Between live terminals and ground – KV rms :
(ii) Between terminals with breaker contacts open – KV rms :

(c) 250 / 2500 micro sec. switching surge withstand the test voltage
(i) Between live terminals and ground – KV rms :
(ii) Between terminals with breaker contacts open – KV rms :

(d) Corona extinction voltage – KV rms :

(e) Max. radio interference voltage at 266KV rms and at – Microvolt
(i) 0.5 MHz. :
(ii) 1.0 MHz. :
(iii) 1.5 MHz. :
(iv) 2.0 MHz. :

(f) Total creepage distance – mm
(i) To ground :
(ii) Between terminals :

4.0 Spring charged mechanism

(a) No. of close open operations possible after failure of AC supply to motor :

(b) Time required for motor to charge the closing spring – Min. :

(c) Whether indication of spring charged condition provided in central control cabinet :

(d) Rating and type of motor :

5.0 SF6 Gas:

(a) Quantity of SF6 per pole at rated pressure – kg :

(b) Guaranteed max. leakage rate per year :

(c) Rated pressure of SF6 in operating chamber – Kg/SqCm :

(d) Limits of pressure at which breaker operates correctly - Kg/SqCm. :

(e) Standard to which SF6 gas complies :

(f) Qnty. of spare SF6 gas (Min 30%):

(g) Capacity and filling in ratio of containers in which SF6 gas would shipped and the corresponding pressure :

(h) Type and make of SF6 pipe couplings used :

(i) Type and make of mandatory maintenance equipment
  (i) SF6 gas filling and evacuation trolley (portable) :
  (ii) SF6 gas leak detector :

(iii) Any other recommended :

(j) Parameters of SF6 gas for initial fillings and satisfactory operation
- (i) Density :
- (ii) Relative dielectric strength – KV/mm :
- (iii) Acidity – ppm :
- (iv) Water content – ppm :
- (v) Oil content – ppm :
- (vi) Condensation temperature - °C :

(k) Whether details as per Cl. No. 3.1 enclosed :

(l) Dead tank or live tank design :

(m) Type and material of gasket used to ensure gas tight joint for
- (i) Metal to metal joint :
- (ii) Metal to porcelain joint :

(n) Method of housing SF6 gas and equipment
- (i) At circuit breaker :
- (ii) In control cubicle :

(o) Type and make of
- (i) Density meter :
- (ii) Pressure gauge :

(p) Noise level at a distance of - db
- (i) 0 Mtr. :
- (ii) 50 Mtr. :
- (iii) 100 Mtr. :
- (iv) 150 Mtr. :

(q) Noise level at a distance of - db
- (i) 0 Mtr. :
- (ii) 50 Mtr. :
- (iii) 100 Mtr. :
- (iv) 150 Mtr. :

from the base of breaker

(r) Minimum clearance in air
- (i) Between live parts – mm :

(ii) Live parts to earth – mm :
(iii) Live parts to **Plinth level (mm):**

6. Constructional details

(a) Whether arcing contacts provided
(i) Type and material of main contacts and arcing contacts. :
(ii) Minimum thickness of silver plating on arcing contacts :

(b) Whether main contacts are silver plated, state thickness :

(c) Contact pressure on main contacts – Kg/SqCm. :

(d) Contact separation in arcing position – mm :

(e) Contact separation in open position – mm :

(f) Whether pressure relief device for each of the gas chamber of SF6 CB provided :

(g) Rate of contact travel – m/sec. :
(i) Opening :
(ii) Closing :

(h) Whether the making and breaking contacts are hermetically sealed :

(i) Type and capacity of device used to obtain uniform volt. Distribution between breaks :

(j) Over voltage withstand capability of grading components – KV rms
(i) Continuous :
(ii) 10 Min. :
(iii) 1 Min. :
(iv) 5 Sec. :

(k) No. of aux. Contacts per pole provided for owner's use
  (i) NO :
  (ii) NC :
  (iii) Adjustable :

(l) Rated voltage of auxiliary contacts – Volts :

(m) Type of aux. Contacts :

(n) Current capacity – Amps.
  (i) Continuous :
  (ii) DC breaking with 20ms time constant :

(o) Thickness of silver plating on aux. Contacts :

(p) Details of support structures :

  i) Height of support structure :

  ii) Material of support structure :

  iii) Standard to which the design of support structure confirms :

7. Support insulators

(a) Make :

(b) Type :

(c) Weight – Kg. :

(d) Transport dimensions – mm :

(e) Height above floor required to remove porcelain – mm :

(f) Insulation class :

(g) 1 – min. dry power frequency withstand – KV rms :

(h) 1 – min. wet power frequency withstand – KV rms :

(i) Flash over voltage – KV :

(j) Full wave impulse withstand voltage – KVp :

(k) Switching surge withstand voltage – KVp :

(l) Corona discharge voltage – KV :

(m) Creepage distance - mm

(i) Protected :

(ii) Total :

(n) Permissible safe cantilever loading on installed porcelain :

(o) Permissible safe compressive strength of installed porcelain :

8 Details of Control Cubicle

(a) Degree of Protection :

(b) Type and thickness of gasket :

9 Terminal connector

i) Make

ii) Rated Current

iii) STC rating

iv) Type

SCHEDULE – B

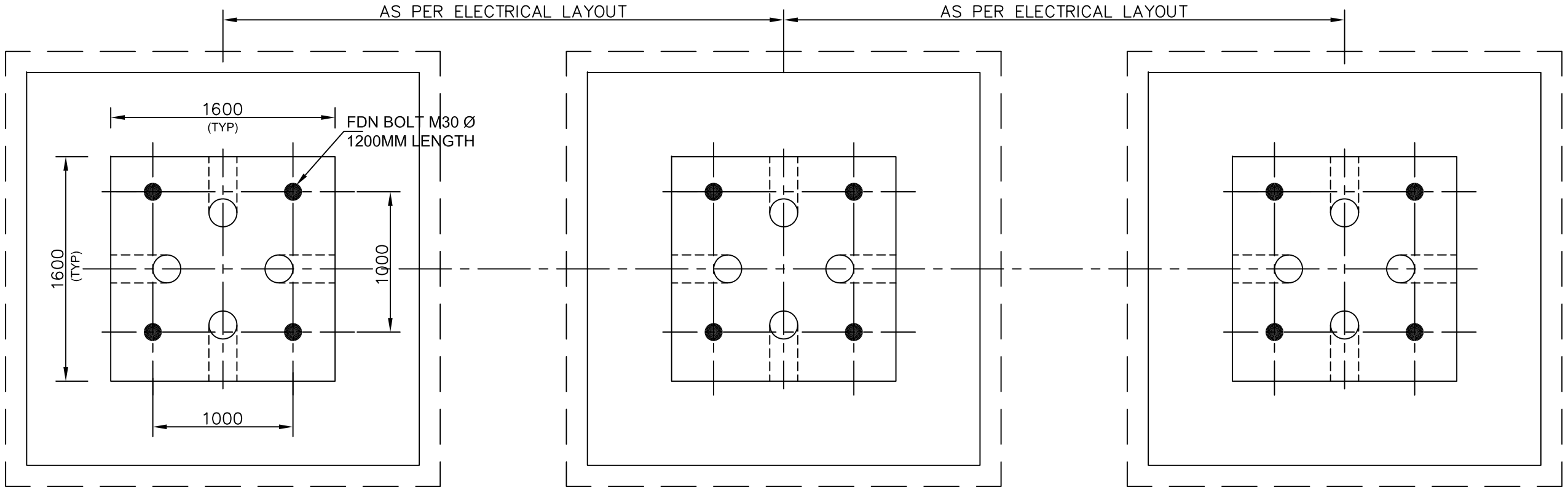
List of documents attached with technical bid:

Bidder shall invariably attach the following documents and clearly marked and duly flagged in technical bid. In absence of these documents offer will be evaluated as a non submission.

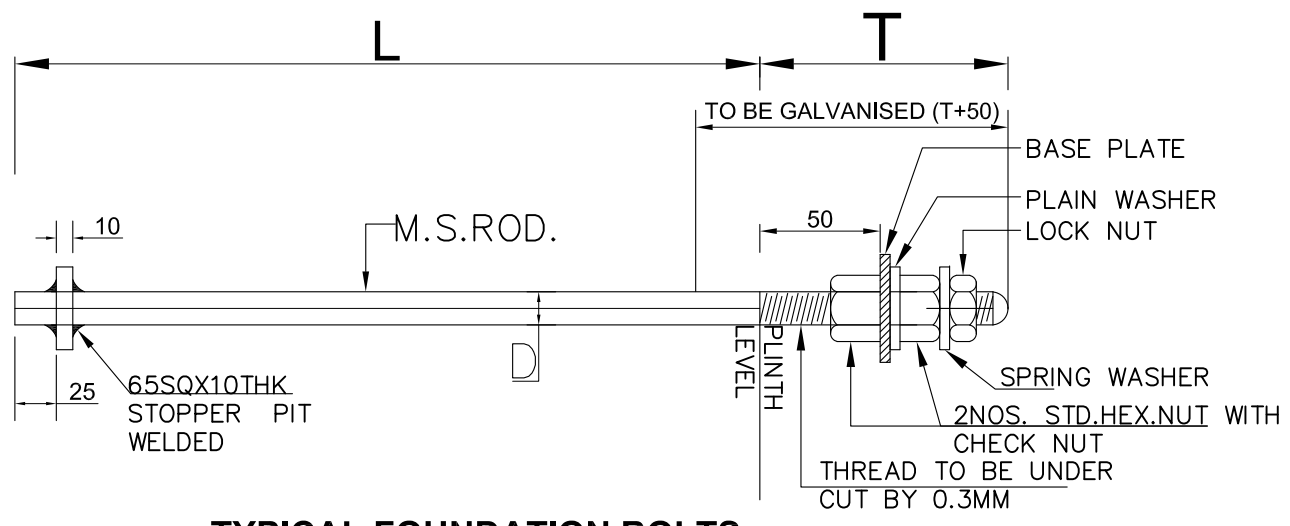
Sr. No.	Particulars of document	Whether attached the with technical bid
1	Drawings in AutoCAD format	
2	Drawings soft copy as indicated in specification	
3	Manual in PDF format	
4	QAP for manufacturing process in SOFT format	
5	QAP for manufacturing process in Hard format	
6	FQP in SOFT format	
7	FQP in Hard copy	
8	Type test Reports in soft copy	
a	for breaker	
b	for clamps & connectors	
9	Confirmation regarding type tests as per clause no. 3.1 page no. 21 – "IMPORTANT NOTE"	
10	Guaranteed Technical Particulars, completely filled in	
11	Any other essential documents	

SIGNATURE OF BIDDER **COMPANY'S ROUND SEAL**

DATE:
PLACE:



STR. TYPE	D= (ø) DIA. OF BOLT (MM)	T (MM)	L (MM)	QTY. OF BOLTS PER STR.
BREAKER	30	150	1050	4X1=4



TYPICAL FOUNDATION BOLTS

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METER.
2. DO NOT SCALE THIS DRAWING ONLY WRITTEN DIMENSION SHALL BE FOLLOWED.
3. THE GRADE OF CONCRETE SHALL BE M20 EXCEPT LEAN CONCRETE.
4. THIS DRAWING IS ONLY FOR SUPPORT STRUCTURE DESIGN OF CIRCUIT BREAKER.
5. FOUNDATION DRAWING SHALL BE ISSUED BY CORPORATE ENGG. FOR ABOVE FOUNDATION BASE DEPENDING UPON TYPE OF SOIL.
6. FOUNDATION BOLTS ARE IN THE SCOPE OF GETCO IN CASE OF DIRECT PROCUREMENT TENDER.
7. FOUNDATION BOLTS ARE IN THE SCOPE OF CONTRACTOR IN CASE OF TURNKEY EPC / DEPOSIT WORK.

FOUNDATION LOAD CONSIDERED	
DESCRIPTION	VALUE
COMPRESSION (INCLUDING VERTICAL LOAD)	8500 Kg.
TENSION / UPLIFT	6500 Kg.
LONGITUDINAL	800 Kg.
TRANSVERSE	800 Kg.

EXECUTION PURPOSE

GUJARAT ENERGY TRANSMISSION CORPN.LTD.
S.P.VIDYUT BHAVAN, RACE COURSE,
VADODARA - 390 007

TYPICAL FOUNDATION PLAN FOR 400KV 'CIRCUIT BREAKER'

SR NO.	REFERENCE	REV:	DESCRIPTION
		R2	MODIFICATION IN GENERAL NOTES
		R1	L(mm) OF BOLT INCREASED FROM 950 TO 1050
		R0	FIRST PREPARATION

DRAWN:	CHECKED:	APPD:	SIZE:
JE(CIVIL)	DE(CIVIL) DE(ENGG) EE(CIVIL)	EE (ENGG) SE (CIVIL) CE (ENGG.)	A3

SCALE:	DATE:	DRG. NO:	SHEET:	REV:
N.T.S.	15.05.2022	GETCO / C / 4S-STD /CB-BASE-19	1 OF 1	R2