BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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CUSTOMER	**NTPC LTD.**
CONTRACT NO.	**CS-9587-001R-2-FC-NOA- 7332 dtd 29.08.2023** **CS-9587-001R-2-SC-NOA- 7333 dtd 29.08.2023**
PROJECT	**400kV Switchyard for LARA SUPER THERMAL POWER PROJECT (2X800MW)**

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SECTION 1
TECHNICAL SPECIFICATION OF 400kV CIRCUIT BREAKER

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 400 kV SF6 Circuit Breaker along with steel structure, Inter pole cables, Operating Mechanism, Central Control Cabinet etc. to site.

Refer Section 3 for Project Details. In case of any conflict among various sections of specifications, the order of precedence shall be Section-1, Section-2 & Section-3.

Note: The terms used in this specification namely, "Employer/Purchaser" refers to NTPC, "Contractor" refers to BHEL.

The Equipment is required for the following projects

Name of Customer: **NTPC LTD.**

Name of Projects : **400kV Switchyard for LARA SUPER THERMAL POWER PROJECT (2X800MW)**

1.2 SPECIFIC TECHNICAL REQUIREMENTS

As per Section 2.
For specification of mandatory maintenance equipment refer Cl. 2.13.00 of section-2.
For requirement of controlled switching device please refer Annexure-I of section-2.

1.3 SPECIFIC TECHNICAL REQUIREMENTS

Technical Parameters:

S. NO.	PARAMETER	400kV System
1	Rated voltage (Umax) kV (rms)	420
2	Rated frequency (Hz)	50
3	No. of poles	3
4	Type of circuit breaker	Outdoor SF6 insulated, Single pressure, Live Tank Type, 50Hz
5	Rated continuous current (A) at an ambient temperature of 50 degree C	3150
6	Rated short circuit capacity with percentage of DC component as per IEC62271-100 corresponding to minimum opening time under operating conditions specified.	63kA
7	Symmetrical interrupting capability kA (rms)	63

8	Rated short circuit making current kAp	157.5
9	Short time current carrying capability kA (rms)	63 for one second
10	Out of phase breaking current carrying capability kA (rms)	15.75
11	Rated line charging interrupting current at 90 deg. Leading power factor angle (A rms) with maximum permissible switching overvoltage of 2.3 pu (voltage factor of 1.4)	600
12	First pole to clear factor	1.3
13	Temperature rise over an ambient temperature of 50 degree C	As per IEC: 62271-100
14	Rated break time	As per IEC
15	Total closing time (ms)	Not more than 150
16	Operating mechanism or a combination of these	Pneumatic/spring/hydraulic/or a combination of these
17	Rated operating duty cycle	O - 0.3 sec. - CO - 3min. – CO
18	Reclosing	1ph & 3ph high speed auto reclosing as required .
19	Trip coil and closing coil voltage with variation as specified	220V DC
20	Noise level at base and up to 50 m distance from base of circuit breaker	Maximum 140dB at 50m distance from base of circuit breaker
21	Rating of Auxiliary contacts	10A at 220V DC
22	Breaking capacity of Aux. Contacts	2A DC with circuit time constant not less than 20ms
23	Rated insulation levels	
(i)	Full wave impulse withstand (1.2 /50 µs) between line terminals and ground	±1425 kVp
(ii)	Full wave impulse withstand (1.2 /50 µs) between terminals with circuit breaker open	1425 kVp impulse on one terminal & 240 kVp power frequency voltage of opposite polarity on the other terminal
(iii)	Rated switching impulse withstand voltage (250/2500 µs) Dry & wet between line terminals and ground	+1050 kVp
(iv)	Rated switching impulse withstand voltage (250/2500 µs) Dry &wet Between terminals with circuit breaker open	900 kVp impulse on one terminal & 345 kVp power frequency voltage of opposite polarity on the other terminal
(v)	One minute power frequency dry withstand voltage between line terminals and ground	520 kV rms
(vi)	One minute power frequency dry withstand voltage between terminals with circuit breaker	610 kV rms

	open	
24	Minimum corona extinction voltage with CB in all positions	Not less 320kV rms
25	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz (Micro volts)	1000 µV (at 266kV rms)
26	**Minimum Creepage distance***	
(i)	Phase to ground (25mm/kV)	10500mm
(ii)	Between CB terminals	10500mm
27	Rated small inductive current Breaking capacity	Corresponding to interrupting steady and transient magnetizing current of 50 to 630 MVA transformers with overvoltage less than 2.3 pu
28	Phase to Phase spacing	7000mm
29	System neutral earthing	Effectively earthed
30	Rated terminal load	Adequate to withstand 100kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capacity/or as per IEC (whichever is higher)
31	Auxiliary contacts	Besides requirement of technical specification, the manufacturer/bidder shall wire up 10 NO + 10 NC contacts exclusively for purchaser's use and wired up to common marshalling box
32	No. of terminals in common marshalling box	All contacts & control circuits to be wired out up to common marshalling box + minimum 24 terminals exclusively for purchaser's future use
33	Seismic level	0.5g horizontal for the site location under the Zone-V as per IS-1893 0.3g horizontal for the site location under other than the Zone-V as per IS1893

For other parameters, refer Section-2.

1.4 QUANTITIES

As per Annexure-A of Section-1

1.5 Supervision charges for Erection, Testing and commissioning

Bidder shall quote lump-sum price for supervision of **Erection, Testing and commissioning** of the offered circuit breakers.

All routine tests as per IEC-62271-100 except power frequency voltage dry withstand test on the completely assembled breaker shall be performed on all circuit breakers at ite. Supplier shall perform any additional test based on specialties of CB as per Field QP/ instruction of the equipment manufacturer or Purchaser without extra cost to purchaser. The supplier shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish list of instruments to BHEL/NTPC for approval.

1.6 Spares

All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacement. The spares shall be treated and packed for long term storage in the climatic conditions prevailing at the site. Small items shall be packed in sealed transparent plastic covers with desiccant bags as necessary.

Each spare part shall be clearly marked and labeled on the outside of the packing together with the description when more than one spare part is packed in single case. A general description of the contents shall be shown on outside of the case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

1.7 Sub-Suppliers

Bidder should consider NTPC approved make of components and fitments. In case the offered make is not approved by BHEL/ NTPC, bidder has to provide alternate make components without any commercial/ time of delivery implication to BHEL.

1.8 Technical Qualifying requirements

400kV Circuit Breakers being offered should be from Manufacturer who has manufactured and supplied at least five (5) nos. of three phase circuit breakers suitable for Air Insulated Substation/ Switchyard of 400 kV or above class which should have been in successful operation for minimum two (2) years prior to the date of **Techno- Commercial bid opening i.e., 03.03.2023.**

1.9 Type tests

Equipment offered shall be of type tested design. During detailed engineering, the Bidder shall submit for Owner's approval the reports of all type tests as per the

relevant IEC/IS which should not be more than 10 years old from **date of Techno-Commercial bid opening i.e., 03.03.2023**. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test (s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However, if bidder is not able to submit valid type test report for period mentioned above, or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct the same test(s) under this contract at no additional cost to the owner either at third party lab or in presence of clients/ owners representative and submit the reports for approval.

All acceptance and routine tests shall be carried out. Charges for these shall be deemed to be included in the equipment price.

1.10 Quality Plan

Bidder to follow valid NTPC approved quality plan at contract stage. In case the bidder does not have NTPC approved QP, it will be the bidder's responsibility to get its QP approved from NTPC.

1.11 Special Tools and Tackles

Bidder shall supply all special tools and tackle (other than maintenance tools as if mentioned in BOQ) which are specifically required for Circuit Breakers and are proprietary in nature. Cost of the same shall be deemed inclusive in the offer for main item. List of such special tools and tackle should be clearly listed along with the technical offer. Any special tool which is not listed in the technical spec / bid but required during the erection/commissioning of Circuit Breakers shall also be supplied by the bidder without time / cost implication.

In case, special tools and tackles which is proprietary in nature is not required for Erection/testing/commissioning or for smooth operation of Circuit Breaker, supplier has to submit a certificate mentioning that no special tools and tackles is required for Circuit
Breakers.

1.12 Technical Deviations

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

1.13 Approval of Engineering Drawings and Documents

Date of Submission of first lot of drawings will be counted only from the date of submission of reasonably correct drawings. List of drawings required for technical clearance of manufacturing are as follows:

1. Approved GTP
2. Approved GA.
3. Approved Type Test Reports

S. No.	ITEM DESCRIPTION	UNIT	QTY
1	SUPPLY- CIRCUIT BREAKER : 420KV 63KA FOR 1S 25MM/KV CREEPAGE, 3150A, 3 PHASE CIRCUIT BREAKER WITHOUT PIR, ALONG WITH SUPPORT STRUCTURE, FOUNDATION BOLTS, INTERPOLE CABLES, OPERATING MECHANISM, CONTROL BOXES, AND ALL ACCESSORIES COMPLETE IN ALL RESPECT	NOS	12
2	SUPPLY- CIRCUIT BREAKER : 420KV 63KA FOR 1S 25MM/KV CREEPAGE, 3150A, 3 PHASE CIRCUIT BREAKER WITHOUT PIR, WITH CONTROLLED SWITCHING DEVICE CAPABILITY, ALONG WITH SUPPORT STRUCTURE, FOUNDATION BOLTS, INTERPOLE CABLES, OPERATING MECHANISM, CONTROL BOXES, AND ALL ACCESSORIES COMPLETE IN ALL RESPECT	NOS	6
3	SUPPLY- CIRCUIT BREAKER : Controlled switching Device suitable for complete 400kV Circuit Breaker (Item no. 2) alongwith signal cable and all other accessories as per specification etc.	NOS	6
4	SUPPLY- CIRCUIT BREAKER: SPECIAL CABLES** FOR CB/CSD/RP INTERFACING. MODE OF MEASUREMENT SHALL BE CABLE-TRENCH RUNNING LENGTH FROM CIRCUIT BREAKER TO CSD/REALY PANEL	MTR	1500
5	SUPPLY- CIRCUIT BREAKER : 765KV, FOUNDATION BOLTS FOR CIRCUIT BREAKER, PLATFORM AND LADDER	LOT	1
6	SUPPLY- CIRCUIT BREAKER : SF6 GAS FILLING ADOPTER, INCLUDING COUPLING, REGULATOR, CONNECTING HOSE PIPE UP TO GROUND LEVEL	LOT	1
7	SUPPLY- CIRCUIT BREAKER : Laptop for CSD	NOS	1
8	SUPPLY- CIRCUIT BREAKER : Mandatory maintenance equipment - SF6 Gas filling & evacuation plant (portable) suitable for 400kV Circuit Breaker	NOS	1
9	SUPPLY- CIRCUIT BREAKER : Mandatory maintenance equipment - SF6 gas filtering, drying, storage and recycling plant suitable for both 400kV Circuit Breaker	NOS	1
10	SUPPLY- CIRCUIT BREAKER : Mandatory maintenance equipment - SF6 Gas leak detector	NOS	1
11	SUPPLY- CIRCUIT BREAKER : Mandatory maintenance equipment - Operation analyser along with DCRM kit inlcuding laptop, all software, etc.	NOS	1
12	SPARES- CIRCUIT BREAKER : Relays, power contactors, switch-fuse units, limit switches, Auxiliary switch assembly, push buttons, timers & MCB for electrical control circuit (consisting of one no. each of all types and ratings)	SET	1
13	SPARES- CIRCUIT BREAKER : Set of gaskets, rings & seals	SET	1
14	SPARES- CIRCUIT BREAKER : Molecular filter for Circuit breaker	SET	1
15	SPARES- CIRCUIT BREAKER : Tripping coils with resistors and closing coil with resistor (each type)	NOS	6
16	SPARES- CIRCUIT BREAKER : Density / pressure monitoring system for circuit breaker	SET	1
17	SPARES- CIRCUIT BREAKER : Set of spares for pneumatic/ Spring/ hydraulic operated mechanism(as applicable) as per the main supply of circuit breaker applicable	SET	1
	1) Spare of pneumatic operated mechanism: (1 set for each type of Circuit breaker) a) Complete compressor assembly along with motor, accessories and coupling along with regenerating unit (wherever applicable) – 1 set. b) Micro Filters – 1 No. c) Coupling for compressed air – 1 set d) Pressure switch and valve – 1 no. of each type e) Pressure gauges – 1 Set f) Gaskets – O-rings & seals – 1 Set g) Dowty Seal – 1 set h) Operating drive – 1 set OR 2) Spare of spring-operated mechanism(complete): (1 set for each type of Circuit breaker) a) Spring charging Motor – 1 no b) Limit switch etc. – 1 no. of each type c) Closing dash pot – 1 Set d) Opening dash pot – 1 Set e) Opening catch gear – 1 Set f) Complete spring operating mechanism – 1 Set OR 3) Spare of hydraulic operated mechanism: (1 set for each type of Circuit breaker) a) Hydraulic operating mechanism with drive Motor – 1 no. b) Ferrules and joints – 1 Set c) Hydraulic Filter – 3 Sets d) High Pressure Hose – 1 Set e) N2 accumulator – 2 No. f) Pressure Transducers – 1 No. g) Valves – 1 Set h) Orings, gaskets and seals – 1 Set i) Pressure switches and pressure gauges – 1 Set	LOT	1

18	SPARES- CIRCUIT BREAKER : Fixed and moving arcing contact assemblies including insulating Nozzles etc. for 1 interrupter (each type & rating of Breaker)	SET	2
19	SPARES- CIRCUIT BREAKER : Actuator rings if required	NOS	6
20	SPARES- CIRCUIT BREAKER : Magnetic ventile if required	NOS	3
21	SPARES- CIRCUIT BREAKER : Operation counter	NOS	1
22	SPARES- CIRCUIT BREAKER : SF6 gas (15% of total used quantity in switchyard)	LOT	1
23	SPARES- CIRCUIT BREAKER : Pressure Gauge and coupling	SET	1
24	SPARES- CIRCUIT BREAKER : Pressure switches	SET	1
25	SPARES- CIRCUIT BREAKER : Terminal Pads	SET	2
26	SPARES- CIRCUIT BREAKER : Corona rings	NOS	1
27	SPARES- CIRCUIT BREAKER : Grading capacitor if applicable	NOS	3
28	SPARES- CIRCUIT BREAKER : One complete pole (phase) of circuit breaker including CSD/Closing resistor, grading capacitor(as applicable), pole column, interrupter, Unit operating mechanism, marshalling box excluding supporting structure, terminal connectors and common operating Mechanism (of each type & rating)	NOS	1
29	Supervision of Erection, testing and commissioning of 400 kV Circuit Breakers (item no. 1, 2) (1 lot =1 complete 3-ph CB)	Lot	18
30	Supervision of Erection, testing and commissioning of all supplied CSD's at site including interface with CB. (1 lot =1 complete 3-ph CB)	Lot	6

Note: 1. Set means for complete replacement of one CB (3-ph).

SECTION 2
EQUIPMENT SPECIFICATION OF 400kV CIRCUIT BREAKER

2.00.0 CIRCUIT BREAKER:
2.01.0 GENERAL

Circuit Breakers shall be outdoor type, comprising three identical single pole units, complete in all respects with all fittings and wiring. The circuit breakers and accessories shall conform to IEC- 62271-100 or equivalent Indian Standard.

2.02.0 DUTY REQUIREMENTS:

2.02.01 Circuit breaker shall meet the requirements of Capacitive class : C2, Mechanical Endurance class:M2, Electrical Endurance class:E2 type of duty as per IEC for 400kV and under all duty conditions and shall be capable of performing their duties without opening resistor. The circuit breaker shall meet the duty requirement of any type of fault or fault location and shall be suitable for line charging and dropping when used on 400kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily.

2.02.02 The circuit breaker shall be capable for breaking the steady & transient magnetizing current corresponding to 400/132 kV transformers up to 630 MVA rating. It shall also be capable of breaking line charging currents as per IEC 62271-100 with a voltage factor of 1.4.

2.02.03 The rated transient recovery voltage for terminal fault and short line faults shall be as per IEC:62271-100.

2.02.04 The circuit breakers shall be reasonably quiet in operation. Noise level in excess of 140 dB measured at base of the breaker would be unacceptable. Bidder shall indicate the noise level of breaker at distance of 50 to 150 m from base of the breaker.

2.02.05 The Bidder may note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage, pneumatic/hydraulic pressure and arc extinguishing medium pressure, etc. While furnishing the proof of the total break time of complete circuit breaker, the Bidder may specifically bring out the effect of non-simultaneity between same pole and poles and show how it is covered in the guaranteed total break time.

2.02.06 While furnishing particulars regarding the D.C. component of the circuit breaker, the Bidder shall note that IEC-62271-100 requires that this value should correspond to the guaranteed minimum opening time under any condition of operation.

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

2.02.08 All the duty requirements specified above shall be provided with the support of adequate test reports to be furnished.

2.03.0 CONSTRUCTIONAL FEATURES:

All making and breaking contacts shall be sealed and free from atmospheric effect.
In the event of leakage of extinguishing medium to a value, which cannot withstand the dielectric stresses specified in the open position, the contacts shall preferably self close. Main contacts shall be easily accessible for inspection and replacement. If there are no separately mounted arcing contacts, then the main contacts shall be easily accessible for inspection and replacement. Main contacts shall have ample area and contact pressure for carrying the rated current under all conditions. The interrupter sectional drawing showing the following conditions shall be furnished.

a) Close position b) Arc initiation position c) Full arcing position d) Arc extinction position e) Open position.

2.03.01 All the three poles of the breaker shall be linked together either electrically / pneumatically or electro hydraulically.

2.03.02 Circuit breakers shall be provided with two (2) independent trip coils, suitable for trip circuit supervision. The trip circuit supervision relay would also be provided. Necessary terminals shall be provided in the central control cabinet of the circuit breaker.

2.04.0 SULPHUR HEXAFLOURIDE (SF6) GAS CIRCUIT BREAKER:

2.04.01 Circuit breakers shall be single pressure type. 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 insulated surfaces of the circuit breaker.

2.04.02 In the interrupter assembly, there shall be absorbing product box to eliminate SF6 decomposition products and moisture. The details and operating experience with such filters shall be brought out in additional information schedule.

2.04.03 Each pole shall form an enclosure filled with SF6 gas independent of two other poles. Common monitoring of SF6 gas can be provided for the three poles of circuit breaker having a common drive. The interconnecting pipes in this case shall be such that the SF6 gas from one pole could be removed for maintenance purposes.

2.04.04 Material used in the construction of circuit breakers shall be such as fully compatible with SF6.

2.04.05 The SF6 gas density monitor shall be adequately temperature compensated to model the density changes due to variations in ambient temperature within the body of circuit breaker as a whole. It shall be possible to dismantle the monitor without removal of gas.

2.04.06 Sufficient SF6 gas shall be supplied to fill all the circuit breakers installed plus an additional 20% of the quantity as spare.

2.05.0 OPERATING MECHANISM:

2.05.01 Circuit breaker shall be operated by pneumatic mechanism or electrically spring charged mechanism or electro-hydraulic mechanism or a combination of these. It shall be gang operated in case of 3-phase reclosing operation as applicable.

2.05.02 The operating mechanism shall be anti-pumping and trip free (as per IEC definition) electrically and either mechanically or pneumatically under every method of closing. The mechanism of the breaker shall be such that the position of the breaker is maintained even after the leakage of operating media and/or gas.

2.05.03 The operating 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 operated closing devices. A mechanical indicator shall be provided to show open and close positions of breaker. It shall be located in a position where it will be visible to a man standing on the ground with the mechanism housing door closed. An operation counter shall also be provided.

2.05.04 Closing coil shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip coils 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. If additional elements are introduced in the trip coil circuit their successful operation for similar applications of outdoor breaker shall be clearly brought out in the bid.

2.05.05 Working parts of the mechanism shall be of corrosion resisting material. Bearings requiring grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.

2.05.06 Operating mechanism shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coil. Provision shall also be made for local electrical control. 'Local / remote' selector switch and close & trip push buttons shall be provided in the breaker central control cabinet. Remote located push buttons and indicating lamps shall also be provided.

2.05.07 Operating mechanism and all accessories shall be in local control cabinet. A central control cabinet for the three poles of the breaker shall be provided along with supply of necessary tubing, cables, etc.

2.05.08 Provisions shall be made on breakers for attaching an operation analyser to perform speed tests after installation at site to record contact travel against time and measure opening time.

2.05.09 The Bidder shall furnish curve supported by test data indicating the opening time under close-open operation with combined variation of trip coil and operating media along with the bid.

2.06.0 PNEUMATICALLY OPERATED MECHANISM:

2.06.01 Bidder shall offer unit compressor with each circuit breaker. The unit compressor are to be located outdoor near the breaker(s).

2.06.02 The breaker local air receivers shall comply with the requirement specified, and shall have sufficient capacity for two 'CO' operations of the breaker at the lowest pressure for reclose duty without refilling.

2.06.03 Independently adjustable pressure switches with potential free ungrounded contacts to actuate lockout device shall be provided. This lock out device with provision for remote alarm indication shall be incorporated in the circuit breaker to prevent operation whenever the pressure of the operating medium is below that required for satisfactory operation at the specified rating. The scheme should permit operation of all block and alarm relays as soon as the pressure transient present during the rapid pressure drop has been damped and a reliable pressure measurement can be made. Such facilities shall be provided for following conditions: a) Trip lockout pressure - 2 nos. b) Close lockout pressure - 1 no. c) Extreme low pressure - 1 no. d) Auto reclose lock out pressure - 1 no.

2.06.04 The compressed air mechanism shall be capable of operating the circuit breaker under all duty conditions with the air pressure immediately before operation between 85% and 110% of the rated supply pressures. The make/break time at this supply pressure shall not exceed the specified make/ break time within any value of trip coil supply voltage as specified.

2.07.0 SPRING OPERATED MECHANISM:

2.07.01 Spring operated mechanism shall be complete with motor, opening spring & closing spring
with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit. Opening spring shall be supplied with limit switch for
automatic charging and other necessary accessories.

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

After failure of power supply to the motor, one close-open operation shall be possible with
the energy contained in the operating mechanism.

2.07.03 Breaker operation shall be independent of the motor, which shall be used solely for compressing the closing spring.

2.07.04 Motor ratings shall be such that it requires not more than 30 seconds for fully charging the
closing spring.

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

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

2.07.07 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.

2.08.0 HYDRAULICALLY OPERATED MECHANISM:

2.08.01 Hydraulically operated mechanism shall comprise operating unit with power cylinder, valves, and low pressure reservoir, motor, etc.

2.08.02 The hydraulic oil used shall be fully compatible for the specified temperature range.

2.08.03 The oil pressure controlling the oil pump and pressure in the high pressure reservoir shall have adequate number of spare contacts for continuous monitoring of low pressure, high pressure, etc., in control room. The necessary remote equipment shall also be provided.

2.08.04 The mechanism shall be suitable for at least two close open operations after failure of ac supply to the motor starting at pressure equal to lowest pressure of auto reclose duty.

2.08.05 The hydraulically operated mechanism shall be capable of operating the circuit breaker correctly and performing the duty cycle specified under all conditions with the pressure of hydraulic operated fluid in the operating mechanism at the lowest permissible pressure before make up. The operating time at the lowest pressure for a particular operation shall not exceed the guaranteed operating time within any value of trip coil-supply voltage as specified.

2.08.06 Trip lockout shall be provided to prevent operations of the circuit breaker below the minimum specified hydraulic pressure. Alarm contacts for loss of nitrogen shall be provided and wired suitably upto the central control cabinet.

2.08.07 All hydraulic joints shall have no oil leakage under the site conditions and joints shall be tested at factory against oil leakage at a minimum of 1.5 times maximum working pressure.

2.09.0 FITTINGS AND ACCESSORIES:

2.09.01 Following is partial list of some of the major fittings and accessories to be furnished as integral part of the breakers. Number and exact location of these parts shall be indicated in
the drawing.

2.09.02 Control unit / Central control cabinet complete and provided with the following:
Double compression type cable glands, lugs, ferrules, etc. b) Local/remote changeover switch c) Operation counter d) Fuses, as required e) Anti-pumping relay/contactor f) Rating
and diagram plate in accordance with IEC including year of manufacture, etc. g) Gauges for SF6 gas pressure, pneumatic/hydraulic pressure. h) Gas density monitor with alarm and lockout contacts.

2.09.03 Hollow insulator columns
a) The insulators shall conform to requirements stipulated elsewhere in the specification. All routine tests shall be conducted on the insulators as per relevant IEC.

In addition, the following routine tests shall also be conducted on hollow column insulators:
a) Ultrasonic test
b) Pressure test
c) Bending load test in 4 directions at 50% specified bending load.
d)Bending load test in 4 directions at 100% specified Bending load as a sample test. The tested insulator will not be used in CB.
e) Burst pressure test as a sample test.

2.09.04 SUPPORT STRUCTURES:
The minimum vertical distance from the bottom of the lowest porcelain part of the bushing,
porcelain enclosures or support insulators to the bottom of the equipment structure, where
it rests on the foundation pad shall be 2550 mm. The height of center line of conductor shall be as given elsewhere in the specification.

2.09.05 Terminal connectors shall conform to requirements stipulated elsewhere in the specification.

2.10.0 ADDITIONAL FITTINGS FOR PNEUMATIC CIRCUIT BREAKER:

a) Unit compressed air system.
b) Breaker local air receivers
c) Pressure gauge, spring loaded safety valve and pressure switch with adjustable contacts
d) Pressure switch to initiate an alarm if the pressure in the auxiliary reservoir falls below a preset level for longer than it is normally necessary to refill the reservoir.
e) Stop, non-return and other control valves, piping and all accessories upto breaker mechanism housing.

2.10.01 **UNIT COMPRESSED AIR SYSTEM:**

The unit compressed air system for each breaker shall be provided with compressed air piping, piping accessories, control and non-return valves, filters, coolers of adequate capacity, pressure reducing valves (if any), isolating valves, drain ports, etc.

2.10.02 **Air Compressor:**

a) The air compressor shall be driven by automatically controlled motor. It shall be of air cooled type complete with preferably oil-less cylinder lubrication. The compressors or pumps shall be mounted within the operating mechanism housing or a separate weatherproof and dust-proof housing.

b) The compressor size shall be such that it is capable of performing following operations satisfactorily:
i) Total running time of compressor not exceeding 45 minutes per day, considering 2% leakage and 2 CO-operations
ii) Air charging time not exceeding 20 minutes after one CO operation of the breaker

c) The compressor shall be provided with automatic adjustable unloading device, if necessary, during starting. Each compressor shall be equipped with a time totalizer.

d) The compressors and its accessories shall conform to the type tests and shall be subject to routine tests as per applicable standards.

2.10.03 **Intercooler and After cooler:**

Intercooler between compressor stage and after cooler at discharge of H.P. cylinder shall be included in Contractor's scope. They shall be of air cooled type and shall be designed as per ASME Code of IEMA Standards. The design pressure on the air side of cooler shall be 1.25 times the working pressure. A corrosion allowance of 3mm shall be included for all steel parts.

2.10.04 **Air Receivers:**

a) The capacity of receivers shall be sufficient for two (2) CO operations of the breaker.

b) Air receiver shall be designed in accordance with the latest edition of the ASME Code for

Pressure Vessel - Section VIII of BS:5179. A corrosion allowance of 3.0 mm shall be provided for shell and dished ends. Receivers shall be hot dip galvanized.

c) Accessories such as suitable sized safety valve to relieve full compressor discharge at a set pressure equal to 1.1 times the maximum operating pressure, dial type pressure gauge with isolating and drain valve and test connection shall be provided.

d) Quality of Air: Compressed air used shall be dry and free of dust particles. Arrangement

for conditioning the compressed air shall be provided as an integral part of air compressor system. The quality of air shall be compatible with the parts used in the system. All necessary components required to make it compatible shall be included.

2.10.05 **Controls and Control Equipment:**

a) The compressor control shall be of automatic start stop type initiated by pressure switches on the receiver. Supplementary manual control shall also be provided.

b) All control equipment shall be housed in a totally enclosed cabinet. Pressure gauges and other indicating devices, control switches shall be mounted on the control cabinet.

c) Facility to annunciate failure of power supply to the compressor control shall also be provided.

2.10.06 **Compressed Air Piping, Valves and Fittings:**

a) The flow capacity of all valves shall be at least 20% greater than the compressor capacity.

b) The high pressure system shall be such that after one 0 - 0.3 Sec - CO operation, the breaker shall be capable of performing one CO operation within 3 minutes.

c) All compressed air piping shall be bright annealed, seamless phosphorous Deoxidized Non-Arsenical Copper alloy or stainless steel pipe (C-106 of BS:2871).

d) All joints and connections in the piping system shall be brazed or flared as necessary.

e) Compressed air piping system shall be supplied in clean, sealed and packed condition. Before installation, the pipes shall be again cleaned properly to remove dust, brazing particles, etc.

2.10.07 **Spare Parts and Mandatory Maintenance Equipment:**

The Contractor shall include in O&M manual, the requirement of mandatory spare parts and

maintenance equipment etc.

2.11.0 TESTS:

The circuit breakers along with its operating mechanism shall be type tested for all the type tests.

Type tests for 400KV AIS Circuit Breaker:

a) Dielectric Test
b) Radio Interference Voltage Test
c) Temperature rise Test
d) short time withstand current, peak with stand test, short circuit test duties, short line fault test.
e) Mechanical endurance Test
f) Out of phase making & breaking Test
g) Line charging current breaking Test
h) Coronal Test for 400kV
i) IP: 55test on each type of box
j) Seismic with stand test with structure for 400kV
k) Test for reactor switching duty for 400kV CB (for Bus reactor)

The corona and RIV tests shall confirm to the requirements as per Annexure- A of Section-3 chapter. The seismic withstand test shall conform to requirements as per Annexure -B of Section-3.

2.11.01 **ROUTINE TESTS**

Routine tests as per IEC-62271-100 on the complete breaker/ pole along with its own operating mechanism and pole column shall be performed on all circuit breakers.

SITE TESTS:

All routine tests except power frequency voltage dry withstand test on breaker shall be repeated on the completely assembled breaker at site.

2.12.0 CIRCUIT BREAKER PARAMETERS:

S. No.	Description	
a)	Type of Circuit breaker	Out door SF6 insulated, Single pressure, Live Tank Type, 50Hz
b)	No. of poles	Three(3poles)
c)	Rated operating duty cycle	O - 0.3 sec. - CO - 3min. – CO
d)	Total closing time	Not > than 150ms
e)	Reclosing	1ph & 3ph high speed auto reclosing as required
f)	Trip and closing coil voltage	220V DC
g)	Auxiliary contacts	As required plus 10NO & 10NC contacts per

		breaker as spare
h)	Noise level	Maximum 140dB at 50m distance from base of circuit breaker
i)	Rated terminal load	Adequate to withstand 100kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capacity
j)	Temperature rise over	As per IEC:62271-100
k)	Type of operating mechanism	Pneumatic/spring/hydraulic/or a combination of these
l)	Minimum creepage distance	25mm/kV
m)	Support structure height	Adequate so that lowest part of support insulator of equipment is minimum 2550mm from plinth level.

2.12.01 **400kV Class Circuit Breakers (AIS)**

S. No.	**Description**	
a)	Rated continuous current	Minimum: 3150A/2000A at rated ambient temperature current capacity as per the SLD.
b)	Rated out-of-phase breaking	15.75kA rms
c)	Rated line charging breaking current (voltage factor of 1.4)	600A at 90deg.cen leading power factor with maximum permissible switching overvoltage of 2.3 pu
d)	Rated small inductive current Breaking capacity	Corresponding to interrupting steady and transient magnetizing current of 50 to 630 MVA transformers with overvoltage less than 2.3 pu
e)	First pole to clear factor	1.3
f)	Rated break time	As per IEC
g)	Phase to phase spacing	7000mm
h)	Controlled switching Device (CSD)	The controlled switching requirements of Circuit Breaker as per the SLD. The details of CSD are given at Annexure-I

2.13.0 Mandatory Maintenance Equipments:

1. SF6 Gas Handling Plants:

a) SF6 gas filling and evacuating equipment(Portable), Qty: 1no:

The capacity of this plant shall be such that it shall not take appreciable time for filling or evacuating of the complete 3 pole breaker. The required vacuum for complete evacuation shall be attained with the help of this plant.

b) SF6 gas filtering, drying, storage and recycling plant, Qty: 1no:

i) The plant shall be complete with accessories and fittings so that SF6 gas from the breaker can be directly filled in the plant storage reservoir.
ii) In case purging of the equipment before filling with SF6 gas is desirable, then the required equipment for dry gases etc. shall be furnished as a part of the plant.
iii) For heavy items within the plant, the lifting hooks shall be provided for lifting and moving with the overhead cranes.
iv) The capacity of the plant shall be such as to handle and store 300 kg of SF6 gas.
v) These SF6 gas handling plants shall be complete with all the necessary pipes, couplings flexible tubes and valves for coupling to the equipment.
vi) The design and construction of the plant, valves, couplings, connections shall be such that leakage of SF6 gas shall be minimum. Similarly valves, couplings and pipe work shall be so arranged that accidental loss of gas to the atmosphere shall be minimum.

2. **SF6 Gas leak detector, Qty: 1no:**

The SF6 gas leak detector shall meet the following requirements:

a) The detector shall be free from induced voltage effects.
b) The sensing probe shall be such that it can reach all the points on the breaker where leakage is to be sensed. c) The accuracy of the equipment shall be at least 10 ppm.

3. Operational Analyser (along with DCRM Kit), Qty:1no:

The operational analyser shall meet the following requirements:
a) Operational analyser shall be one complete system, which once installed should record all the parameters, as laid down in subsequent clauses.
b) It shall have facility to record the breaker contact movement during opening, closing, auto reclosing and make-break operation, the speed of contacts at various stages of operation, travel of contacts, opening time, closing time and make break time etc. The analyser shall have provisions for recording at least 12 different functions of the circuit breaker. All necessary transducers (i.e., three nos. for complete 3 phase speed and travel record of breaker), cables, pickups, attachments required for the breaker shall be supplied with the analyser. The cables supplied shall be sufficient for recordings at site on a completely assembled and erected breaker.
c)All the necessary catalogues write up for operation and maintenance of the analyser shall be furnished along with each analyser and peripheral system. The necessary equipments for monitoring various parameters of circuit breaker termed as signature analysing shall be supplied along with all software, laptop computer, devices etc. with the breaker. The same shall be demonstrated at site on a fully assembled breaker.

All above maintenance equipments shall be demonstrated at site during handover.

ANNEXURE-I

Requirement of Controlled Switching Device for 400KV Circuit Breaker

The circuit breaker with controlled switching as indicated in single line diagram shall meet the
following requirement:

1. The Switching controlled Device shall be used to reduce increased over voltages, re ignition between circuit breaker contacts that may be caused by normal switching of high voltage circuit breakers and hence optimize the stresses on circuit breaker while switching the circuit. The switching-controlled device will be called device henceforth.

2. Circuit breaker should be able to be switched while switching controlled device is not in operation e.g., during maintenance work or power supply is not connected, a bypass shall be provided to the device. In these cases, the switching commands will then be forwarded directly to the circuit breaker via this Bypass. The switching time will not be controlled with these switching operations.

3. The controller shall get command to operate the breakers manually or through auto reclose relay at random. The controller shall be able to analyze the current and voltage waves available through the signals from secondaries of CTs & CVTs for the purpose of calculation of optimum moment of the switching the circuit breaker and issue command to
   circuit breaker to operate.

4. The device should have display facility at the front for the settings and measured values,
   alternatively a laptop shall be supplied with each CSD to facilitate display at the front for
   the setting and measured values.

5. The device shall have self-monitoring facility. During the switching operations, current and
   voltage waveforms and other parameters shall be recorded and saved together with calculated values. The control switching device provided shall be networked to an Engineering workstation (EWS) located in the switchyard control room. It shall be possible
   to extract the switching oscillographic records and to do CSD parameterization from this EWS. All necessary software & hardware shall be in bidder's scope.

6. It shall have self-monitoring facilities. Faults which impair the functioning of the device or
   peripheral components, failure of trip voltage or sensors shall be displayed visually and shall give alarm.

7. The device shall be designed to operate correctly and satisfactorily with the excursion of
   auxiliary A/C & DC voltages and frequency as specified elsewhere in the specification.

8. The device shall have time setting resolution of 0.1 ms or better.

9. Test reports for the following type tests shall be submitted:
   a. Dielectric withstand test as per IEC 60255-27.
   b. High voltage Impulse test as per IEC 60255-27.
   c. Slow damped oscillatory wave test as per IEC60255-26
   d. Fast transient test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-4)
   e. Electrostatic Discharge test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-2)
   f. Surge Immunity test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-5)
   g. Power frequency magnetic field test as per IEC 60255-26 (class 5 installation as per base standard IEC 61000-4-8)
   h. Radiated radio frequency electromagnetic field test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-3)
   i. Conducted disturbance induced by radio frequency field as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-6)
   j. Power frequency immunity test on binary input as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-16)

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT DETAILS

	Particular	Details
a)	Customer	NTPC Ltd.
b)	Engineer/Consultant/ Inspector	NTPC Ltd.
c)	Project Title	LARA SUPER THERMAL POWER PROJECT (2x800 MW) : 400kV Switchyard at NTPC LARA STAGE-II
d)	Project Location	Place: Village Lara, bounded by villages Lara, Chhapora & Lohakhan on the western side of Odisha State boundary District: Raigarh State: Chhattisgarh
e)	Latitude & Longitude	**400kV S/s at LARA STAGE-II:** North: 21°45'25" East: 83°27'26"
f)	Nearest Railway Station	Raigarh Railway Station (on South East Central Railway, Howrah-Bilaspur Broad Gauge)
g)	Distance of project location from the Railway station	30 Km (approx.)
h)	Nearest Major Town	Raigarh city
i)	Distance of the town from the project site	30 Km.
j)	Nearest commercial airport	Raipur
k)	Distance of airport from the project site	50 Km
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000 meters

d)	Pollution Severity	Heavily polluted
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3) 1987
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	44 m/ sec
g)	Category of terrain	Cat –2
h)	Risk Coefficient "K1"	1.07

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV
1	i) Highest system voltage	420 kV rms
	ii) Rated / Nominal system voltage	400kV rns
2	Lightning Impulse voltage (ph to earth & between phases)	±1425kVp
	Across Isolating distance	1425(+240) KVp
3	Switching impulse voltage (ph to earth)	±1050kVp
	Across Isolating distance	900(+345) KVp
4	Power frequency withstand for 1 min (rms) to earth & between phases	520 & 610kV rms as per IEC
5	Max. fault level (1 sec.)	63 kA
6	Rated dynamic with stand current	157.5 kAP
7	PD Level	<5 pico-coulomb
8	Rated frequency	50Hz
9	Rated Ambient Temperature	50.deg.Cen
10	System earthing	Effectively earthed
11	Min.creepage (25mm/kV)	10500mm
12	Seismic acceleration	0.3g
13	Max. radio interference for freq. between 0.5 MHz and 2.0 MHz at 266 kV rms	1000 microvolt
14	Corona extinction voltage	Not less 320kV rms

3.1.2 **AUXILIARY POWER:**

Sl. No.	**Nominal Connection Voltage**	**Variations in Voltage**	**Frequency**	**Phase**	**Neutral**
1	415V,	±10%	50 (+3% -5%)	3Phase , 4 Wire	Solidly Earthed
2	240V	±10%	50 (+3% -5%)	1 phase	Solidly Earthed
3	220V	(+) 10% to (-) 15%.	-	DC	-

Combined variation of voltage and frequency shall be + 10%. Design fault level of 415V system shall be restricted to 50kA rms for 1 second.

The operational limits for variation of DC voltage are (+) 10% to (-) 15%.

3.1.3 The various minimum heights of the switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level	2nd Level	3rd Level	Peak
400kV	8000mm	16000mm	23000mm	8500mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

The minimum height of 400kV gantry for AIS shall be 16m+8.5 (peak). However intermediate gantry height for O/H connection to GT side shall be min 22m+8.5m (peak).

3.1.4 The minimum clearances for 400kV & 220 kV switchyards shall be as given below:

	400kV
Phase to earth clearance	3500 mm
Phase to phase clearance	4000 mm
Section clearance	6500 mm

3.2 INSTRUCTION TO BIDDERS:

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the bidders may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section-Lighting System.

Equipment furnished shall be complete in every respect with all mountings, fittings, erection hardware (on plinth/equipment structure) fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall

be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), NTPC safety codes, and other local rules and regulations.

In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

a) Indian Electricity Act
b) Indian Electricity Rules
c) Indian Explosives Act
d) Indian Factories Act and State Factories Act
e) Indian Boiler Regulations (IBR)
f) Regulations of the Central Pollution Control Board, India
g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India
h) Pollution Control Regulations of Department of Environment, Government of India
i) State Pollution Control Board.
(j) Rules for Electrical installation by Tariff Advisory Committee (TAC).
(k) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996
(l) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998
(m) Explosive Rules, 1983
(n) Petroleum Act, 1984
(o) Petroleum Rules, 1976,
(p) Gas Cylinder Rules, 1981
(q) Static and Mobile Pressure Vessels (Unified) Rules, 1981
(r) Workmen's Compensation Act, 1923
(s) Workmen's Compensation Rules, 1924
(t) NTPC Safety Rules for Construction and Erection
(u) NTPC Safety Policy
(v) Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise in the specifications, the latest editions (as applicable as on the date of bid opening 03.03.2023), of the codes and standards given below shall also apply:

a) Bureau of Indian standards (BIS)
b) Japanese Industrial Standards (JIS)
c) American National Standards Institute (ANSI)
d) American Society of Testing and Materials (ASTM)
e) American Society of Mechanical Engineers (ASME)
f) American Petroleum Institute (API)
g) Standards of the Hydraulic Institute, U.S.A.
h) International Organization for Standardization (ISO)
i) Tubular Exchanger Manufacturer's Association (TEMA)
j) American Welding Society (AWS)
k) National Electrical Manufacturers Association (NEMA)
l) National Fire Protection Association (NFPA)
m) International Electro-Technical Commission (IEC)/ European Norm (EN)
n) Expansion Joint Manufacturers Association (EJMA)
o) Heat Exchange Institute (HEI)
p) IEEE standard
q) JEC standard

Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and
deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

As regards highly standardized equipments such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.

In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

In case of any change in codes, standards & regulations between the date of bid opening (03.03.2023) and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (not applicable for this project) short circuit etc for the equipment.

The equipment shall also comply with the following:

a) All equipments shall be suitable for hot line washing.
b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.
d) All equipment shall be supplied with necessary inter-pole cabling, and its cost shall be included in the cost of equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

All drawings submitted by the supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

After the approval of the drawings, further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the purchaser will cover only general conformance of the data to the specification and documents, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect plan layout. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the purchaser shall not be considered by the contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent

of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

3.5.2 Approval Procedure

The following procedure for submission and review/approval of the drawings, data-reports, information, etc. shall be followed by Contractor:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".

b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.

c. All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance.

d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Contractor shall resubmit the drawings approved under Category II, III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.).

g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

h. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

i. Contractor shall not make any changes in the portion of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**

j. Approval of drawings will not in any way relieve the Contractor of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

3.5.3 Erection Drawings.

a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc. The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.

b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.5.4 Instruction Manual

a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least sixty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, operation and maintenance procedures, etc. separately for each component/equipment along with log record format. These instruction manuals shall be submitted in five (5) copies for approval.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall being corporate and the updated final instruction manuals shall be submitted.

c. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall have sufficient details to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment, including erection, testing, commissioning, operation, maintenance dismantling and repair. Each manual shall also include a complete set of approved drawings together with performance/rating curves of the equipment and test certificates, wherever applicable. The contract shall not be considered completed for

purpose of taking over until such instructions and drawings have been supplied to the Employer.

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets.

e. The manuals shall include the following
a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

f. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.

g. A collection of the manufacturer's standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.5.5 ERECTION MANUALS

The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of a particular equipment/system. The erection manual should contain the following as a minimum:

a) Erection strategy.
b) Sequence of erection.
c) Erection instructions.
d) Critical checks and permissible deviation/tolerances.
e) List of tools, tackles, heavy equipments like cranes, dozers, etc.
f) Bill of Materials
g) Procedure for erection and General Safety procedures to followed during erection/installation.
h) Procedure for initial checking after erection.
i) Procedure for testing and acceptance norms.
j) Procedure / Check list for pre-commissioning activities.
k) Procedure / Check list for commissioning of the system.
l) Safety precautions to be followed in electrical supply distribution during erection

3.5.6 OPERATION & MAINTENANCE MANUALS

a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.

b) The arrangement and contents of O & M manuals shall be as follows:

1) Chapter 1 - Plant Description: To contain the following sections specific to the equipment/system supplied

(a) Description of operating principle of equipment / system with schematic drawing / layouts.

(b) Functional description of associated accessories / controls. Control interlock protection write up.

(c) Integrated operation of the equipment alongwith the intended system. (This to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers).

(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.

(e) Design data against which the plant performance will be compared.

(f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets.

(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).

(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).

2) Chapter 2.0 - Plant Operation: To contain the following sections specific to the equipment supplied

(a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.

(b) Limiting values of all protection settings.

(c) Various settings of annunciation/interlocks provided.

(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.

(e) Do's and Don'ts related to operation of the equipment.

(f) Safety precautions to be taken during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.

(g) Parameters to be monitored with normal value and limiting values.

(h) Equipment isolating procedures.

(i) Trouble shooting with causes and remedial measures.

(j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.

(k) Routine Operational Checks, Recommended Logs and Records

(l) Change over schedule if more than one auxiliary for the same purpose is given.

(m) Preservation procedure on long shut down.

(n) System/plant commissioning procedure.

3) Chapter 3.0 - Plant Maintenance- To contain the following sections specific to the equipment supplied.

(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population.

(b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment.

(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.
(d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.
(e) Preventive Maintenance schedules linked with running hours/calendar period along with checks to be carried out.
(f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.
(g) Long term maintenance schedules
(h) Consumables list along with the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.
(i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement.
(j) Tolerance for fitment of various components.
(k) Details of sub vendors with their part no. in case of bought out items.
(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.
(m) List of mandatory and recommended spare list along with manufacturing drawings material specification & quality plan for fast moving consumable spares.
(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.
(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.

After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in table below. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer. If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in table below:

S. No.	Description of Drgs/Docs	No. of Prints	No. of CD ROMs/DVDs/Portable Hard Disk
1	Erection Manual	4 Sets	2
2	Operation & Maintenance manual i) First Submission	1 Sets	1
	ii) Final Submission	4 Sets	2

3.5.7 Final Submission of drawings and documents:

The Contractor shall furnish the following after approval of all drawings /documents and test reports:

a. List of drawings bearing the Employer's and Contractor's drawing number.

b. Three (3) bound sets along with 2 portable hard disk of all drawing.
c. All documents/designs in two (3) copies as noted above.
d. Contractor shall also furnish three (3) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.
e. The Contractor shall also furnish four (4) copies of instruction/ operations & maintenance manuals (after approval) for all the equipments.

3.5.8 TEST REPORTS

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval six (6) bound copies & 2 set of soft copies in portable hard disk of all type and routine test reports shall be submitted to Employer.

3.6 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as “similar” to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.
The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.7 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity' heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On –off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

Degree of Protection

The enclosure of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a. Installed outdoor: IP- 55
b. Installed indoor in air conditioned area: IP-31
c. Installed in covered area: IP-52
d. Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP-41.
e. For LT Switchgear (AC & DC distribution Boards): IP-52 (Indoor), IP-54 (outdoor)

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

PRESERVATIVE SHOP COATING

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.

Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.

Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.

3.8 RATING PLATES, NAME PLATES AND LABELS

3.8.1 Each equipment shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer’s name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.

3.8.2 Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.

3.8.3 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.8.4 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.8.5 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.8.6 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.

3.8.7 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

3.9 GALVANISING:

3.9.1 The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.

3.9.2 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor's cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness of zinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS:2633.

3.9.3 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area. The threads having extra deposit of zinc shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.10 PAINTING

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical
equipment shall be as follows:
Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

3.11 QUALITY ASSURANCE PROGRAMME

3.11.1 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his subcontractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS- 14001.

A quality assurance programme of the contractor shall generally cover the following:

i. His organisation structure for the management and implementation of the proposed quality assurance programme
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System

v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed as Annexure-I.

3.12 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.12.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.

3.12.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

3.12.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities starting from receipt of materials/equipment at site.

3.12.4 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference

documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.

3.12.5 These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.

3.12.6 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of MDCC.

3.12.7 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

3.12.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer.

3.12.9 All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.

3.12.10 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.

3.12.11 Test results or qualification tests and specimen testing shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.

3.12.12 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipments/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.

3.12.13 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

3.12.14 No welding shall be carried out on cast iron components for repair.

3.12.15 Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

3.12.16 All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 50mm shall be ultrasonically tested.

The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the subcontractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor’s proposal shall include vendor’s facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified subcontractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

3.12.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor’s purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor’s quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

3.12.18 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor’s or their sub vendor’s quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

3.12.19 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractors and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

3.12.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

3.12.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

3.12.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.13 Environmental Stress Screening

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1. The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.

In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

Burn In Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.

The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.

3.14 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identified in respective quality plan with tick (√) mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However, CD-ROM may be issued not later than three weeks.

3.14.1 Typical contents of Quality Assurance Document are as below: -

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

iv) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
v) Heat Treatment Certificate/Record (Time- temperature Chart)
vi) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).
vii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
viii) Certificate of Conformance (COC) whoever applicable.
ix) MDCC

3.14.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

3.14.3 Before dispatch/ commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory. The Inspector shall stamp the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing finalizing the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
i) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.15 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer after the delivery date for the corresponding equipment. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.
For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery similarly as stated above.

3.16 INSPECTION, TESTING & INSPECTION CERTIFICATE

3.16.1 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

3.16.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

3.16.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

3.16.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

3.16.5 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

3.16.6 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

3.16.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.

3.16.8 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

3.16.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.

3.17 PACKAGING & TRANSPORTATION

Items shall be packed & dispatched separately to site i.e. to 400kV S/s at LARA SUPER THERMAL POWER PROJECT STAGE-II.

3.17.1 Packing, Marking and shipping

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Bidder shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.

Bidder shall ensure to affix RFID tags/Trackers on the item & punch the same before dispatch with RFID reader/BLE beacon & enter details of item associating with RFID tag no./Tracker no. For low value items QR code-based solution shall also be acceptable. Exact selection of type of tagging based on type & size of equipment/consignment/package will be decided during detail engineering.

Bidder to provide RFID tags/Trackers/QR code for all items being supplied to the Contractor under the contract of this project.

a) Each item identifiable with KKS / PGMA-DU / other identification scheme of the bidder/OEM/OES shall have a RFID/QR.
b) Even if the BOQ is identified in tonnage/ cumulative of multiple items, unique identification shall be provided for each item as mentioned above (Eg – GIS Duct, Gis bay module, Panels etc., however each sub item shall have its own RFID/equivalent). c) For items which are

interchangeable and dispatched together (eg Foundation bolts in a box / Identical beams in a single consignment), the entire consignment can be tagged with a single RFID if the software system has the capability to track partial
consumption (eg 100 bolts consumed from a package of 1000 bolts) from a consignment.

3.17.2 Insurance

a) The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.

b) Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise shall not constitute groups for claims for extension in time or for extra payment.

3.18 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.18.1 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetallic liner.

3.18.2 The material of clamps and connectors shall be Galvanised mild steel for connecting to shield wire.

3.18.3 Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

3.18.4 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

3.18.5 They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

3.18.6 Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

3.18.7 Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last at least till erection time.

3.19 SPACERS

3.19.1 Spacers shall conform to IS: 10162. They shall be of non-magnetic material except nuts and bolts, which shall be of hot dip galvanised mild steel.

3.19.2 Spacers shall generally meet the requirements of clamps and connectors as specified above. Its design shall take care of fixing and removing during installation and maintenance.

3.19.3 In addition to the type tests as per IS: 10162, clamp slip test should have been conducted. In this test the sample shall be installed on test span of twin/quad bundle string at a tension of 44.2kN (4500 kg). One of the clamps when subjected to a longitudinal pull of 2.5kN (250 kg) parallel to the axis of conductor shall not slip, i.e. permanent displacement between conductor and clamp after test shall not exceed 1.0 mm. This test should have been performed on all other clamps of the sample.

3.20 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS, AND DISC INSULATORS

3.20.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS: / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.20.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

3.20.3 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.20.4 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

3.20.5 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.20.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.20.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued, porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.20.8 In accordance with the requirement stipulated elsewhere, bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests and acceptance test/sample test in accordance with relevant standards.

3.21 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT.

3.21.1 All types of control cabinets, junction boxes, marshalling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.

3.21.2 **Mechanism Box/ Control Cabinet/ Kiosks:** A sheet steel (at least 2.5 mm thick), dust and vermin proof M.Box/CCC/CMB shall be provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber.

Painting of boxes shall be as follows,

- External surface : Chemical resistant epoxy zinc phosphate primer, MIO (Micaceious iron oxide) as intermediate paint followed by polyurethane finish paint **(RAL 5012 Blue)**
- Internal surface : Chemical resistant epoxy zinc phosphate primer followed by chemical & heat resistant **epoxy enamel white paint**.

3.21.3 **Junction Boxes:** The junction boxes shall be made of minimum 2 mm thick sheet steel. Gland plates shall be removable type and made of 3 mm thick sheet steel. The boxes shall be provided with detachable cover or hinged door with captive screws. Top of the box shall be arranged to slope towards the rear of the box. The box shall be **hot dip galvanised** and shall be provided with suitable neoprene gaskets to achieve requisite degree of protection. Adequate spacing shall be provided to terminate the external cables. The boxes shall be suitable for mounting on various types of steel structures. The terminal blocks provided shall be of 650 V grade, rated for 10 A for control cables. Suitable numbering for terminal blocks shall be done. In case of junction box for power cable, the box shall be rated for maximum current carrying capacity. Terminal blocks shall be of one piece, Klippon RSF-1 or ELMEX CSLT-1 type with insulating barriers.

3.21.4 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

3.21.5 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.

3.21.6 The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.

3.21.7 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.21.8 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.21.9 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.22 TERMINAL BLOCKS

3.22.1 They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

3.22.2 The terminal blocks shall be of 850 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.22.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

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

3.22.5 Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:
All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. Aluminium conductor
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor.

3.22.6 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.

3.23 Wiring

3.23.1 All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:
a) All circuits except CT circuits 2.5 sq.mm
b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).

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

3.23.3 Wire terminations shall be made with solderless crimping type of 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 the wires shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

3.23.4 All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

3.23.5 All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.

3.24 CABLE GLANDS AND LUGS

3.24.1 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and off tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.

3.24.2 The cable glands shall be tested as per BS:6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

3.24.3 Cables lugs for power cables shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.25 CONDUITS, PIPES AND ACCESSORIES

3.25.1 The bidder shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes, etc. including all necessary sundry materials, such as tees, elbows, check nuts, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.

3.25.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. The outer surface of the conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanised. All rigid conduits/ pipes shall be of a reputed make.

3.25.3 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

3.26 MOTORS

3.26.1 The voltage level for motors shall be as follows:

a) Up to 0.2 KW:	Single phase 240V AC / 3 phase 415V AC
b) Above 0.2 KW and up to 200 KW:	3 phase, 415V AC
c) Above 200 KW and up to 1500 KW:	3 phase, 3.3 kV AC
d) Above 1500 KW:	11 kV Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards.

The bidder may adopt 415V/3.3 KV for the drives rated in the range of 160-210 KW.

The voltage rating of the drives indicated above is for basic guideline.

3.26.2 All motors shall conform to IEC-60034-5 / IS Standard and with principal dimensions in accordance with IEC 60072-1 (1991), IEC 60072-2 (1990) and IEC 60072-3 (1994).

3.26.3 All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.

3.26.4 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

3.26.5 **Degree of Protection**

Degree of protection for various enclosures as per IEC60034-05 shall be as follows:

Indoor motors -	IP 55
Outdoor motors -	IP 55 (additional canopy to be provided)
Cable box-indoor area -	IP 55
Cable Box-Outdoor area -	IP 55

3.26.6 **Type:**

AC Motors:
a) Squirrel cage induction motor suitable for direct-on-line starting.
b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30.
c) Crane duty motors shall be squirrel cage Induction motor as per the requirement.
d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034- 18-41 and IEC: 60034-18-42 as applicable.

DC Motors Shunt wound

3.27 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.
b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination
c) Heat run test on contacts
d) IR/HV test, etc.

3.28 LAMPS AND SOCKETS

3.28.1 Lamps:

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

3.28.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.28.3 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

3.29 SWITCHES & FUSES:

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch-fuse units. Selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal Protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

All control switches shall be of rotary type. Toggle/piano switches shall not be accepted.

3.30 TYPE, ROUTINE & ACCEPTANCE TESTS:

All equipments to be supplied shall be of type tested design. During contract stage, bidder shall submit for Owner's approval the reports of all the type tests listed in this specification and carried out within last ten years from the date of techno-commercial bid opening **03.03.2023**. These reports should be for the test conducted on the

equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have be witnessed by a client.

However, if contractor is not able to submit report of the type tests conducted within ten years from the date **03.03.2013** or in the case of type test reports are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

3.31 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

a) The corona (for 400kV only) and RIV tests shall confirm to the requirements as per Annexure A.
b) The seismic withstand test for 400kV shall conform to requirements as per Annexure B.

3.32 Enclosures:

1. ANNEXURE- A - CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST
2. ANNEXURE- B - SEISMIC WITHSTAND TEST
3. ANNEXURE- I – MQP (NTPC format)
4. ANNEXURE- II – QUALITY ASSURANCE FOR SWITCHYARD

Annexure – A

CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST (for 400kV AIS only):

The corona and RIV tests shall confirm to the requirements as per Annexure- A to this chapter. The seismic withstand test shall conform to requirements as per Annexure -B to this section.

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST (For 400 kV AIS only)

1.0 General:

Unless otherwise stipulated, all equipment together with its associated connectors where applicable shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and measurement of radio interference voltage (RIV).

2.0 Test Methods for RIV:

2.1 RIV tests shall be made according to measuring circuit as per International Special – committee on Radio Interference (CISPR) Publication 16 -1 (1993) Part – I. The measuring circuit shall preferably be tuned to frequency with 10 % of 0.5 MHz but other frequencies in the range of 0.5 MHZ to 2 MHz may be used, the measuring frequency being recorded. The result shall be in microvolts. Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107 – 1964 except otherwise noted herein. In measurement of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

2.2 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, 115% and 130% for the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 420 KV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.0 Test Methods for visible Corona:

The purpose of this test is to determine the corona extinction voltage of the apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 130 % of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 130 %, the voltage level shall be raised till inception of corona or rated voltage whichever is lower. The voltage will then be decreased slowly until all visible corona disappears. The test procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which the visible corona (negative or positive polarity) disappears.

Annexure – B

SEISMIC WITHSTAND TEST (for 400 kV AIS only)

a.) The seismic withstand test on the complete equipment (except BPI) shall be carried out along with supporting structure.

b.) The supplier shall arrange to transport the structure from his purchaser's premises / owner's sites for purpose of seismic withstand test only.

c.) The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the terminal pad of the equipment and at any other point as agreed by the owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the purchaser.

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	**MANUFACTURING QUALITY PLAN**		PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : SUB-SYSTEM:	QP NO.: REV.NO.: DATE: PAGE: …. OF….	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER C**:** MAIN SUPPLIER, **N**: NTPC **P:** PERFORM **W**: WITNESS AND **V:** VERIFICATION. AS APPROPRIATE, **CHP:** NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"		DOC. NO.: REV…… CAT…..		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1 **1/1** **ENGG. DIV./QA&I**

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW)			

ANNEXURE-II

ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP / SQP/*RFQP/SFQP*)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		To be filled in by NTPC
PROJECT NAME		*REVIEW & ENDORSEMENT BY NTPC* **PROJECT SPECIFIC QP NUMBER ALLOTTED**
CONTRACT NO.:		**QP NO.:**
MAIN SUPPLIER		
MANUFACTURER WORKS & ADDRESS	M/S	**REV. NO.: DATE:**
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.		** The RQP/SQP/RFQP/SFQP once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
APPROVED QP NO.: RQP/SQP/RFQP/SFQP	0000-999-QV - - REV. NO.: DATED**: **	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		*(TICK APPLICABLE)*
***I. That the item/ component is identical to that considered for QP approval.* OR.**		**The QP is endorsed for this project without any change**
***II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP.* OR**		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		**The QP is endorsed for this project with changes as indicated.**
		DISTRIBUTION OF ENDORSEMENT OF **A) RQP/SQP:** *1. MAIN SUPPLIER (WITH A COPY OF QP)* *2. MANUFACTURER* *3. RIO* *4. CQA-SPL* *5. CQA-O/C* **B) RFQP/SFQP:** *1. MAIN SUPPLIER (with a copy of QP)* *2. MANUFACTURER* *3. NTPC FQA (with a copy of QP)* *4. NTPC Erection (with a copy of QP)* *5. CQA-SPL* *6. CQA-O/C*
SIGN.: (Main Supplier) DATE	***SIGN.: (Manufacturer) DATE:***	**NTPC (Reviewed /Approved by/ Date & Seal)**

SECTION - 4
GUARANTEED TECHNICAL PARTICULARS FOR CIRCUIT BREAKERS

(To be furnished during detailed engineering)

- NTPC datasheet for Circuit Breaker (5 pages)
- NTPC datasheet for Bushing/Hollow Insulators (1 page)

CLAUSE NO.	Bidder's Name ……..	

DB:12A

EHV CIRCUIT BREAKERS

(Bidder to fill up separately for each type of breaker)

1.	General		
	a)	Name & country of the Manufacturer	.....
	b)	Type of Circuit breaker	.....
	c)	Manufacturer's type designation	.....
	d)	Standards Applicable	.....
	e)	Rated Voltage (KV)	.....
	f)	Rated Current	.....
		i) Under normal condition (Amps)	.....
		ii) Under site conditions (Amps)	.....
	g)	Rated frequency (Hz)	.....
	h)	Number of poles	.....
	i)	Whether 3 poles or single pole unit	.....
	j)	Whether dead tank or live tank design	.....
	k)	No. of breaks per pole	.....
2.	Guaranteed Ratings		.....
	a)	Rated short circuit breaking current	.....
		i) Symmetrical component at highest system voltage (kA)	.....
		ii) DC Component (%)	.....
		iii) Asymmetrical breaking current at highest system voltage (kA)	.....

CLAUSE NO.	Bidder's Name ……..	एनटीपीसी NTPC

b) Rated Making capacity .....

i) at higher rated voltage (kA peak) .....

ii) at lower rated voltage (kA peak) .....

c) Maximum break time for any current upto rated breaking current (ms) .....

i) For Test duties 2,3 & 4 at rated values .....

ii) For other duties at limiting conditions of voltage and pressure .....

d) Closing times (ms) .....

e) Minimum opening time under

any condition with limiting voltage and pressure (ms) .....

f) Maximum opening time under any condition with limiting voltage and pressure (ms) .....

g) First pole to clear factor .....

h) Short time current rating (kA) .....

i) 1 Second .....

ii) 3 Second .....

i) Rated operating duty .....

j) Maximum line charging breaking current with temporaty over voltage up to 1.4 p.u. (kA) .....

k) Maximum arc duration and corresponding current under lockout pressure. .....

l) Pre-insertion resistor (if applicable) .....

i) Value / pole (Ohms)/with tolerance .....

ii) Minimum and maximum duration of insertion per pole (ms) .....

iii) Thermal rating for the C-1m-0-CO-2m-C-1m-O-CO for terminal fault considering maximum resistance and time setting .....

iv) Thermal rating for the same duty as (iii) above for reclosing against trapped charges .....

3. Dielectric with-stand of Complete Breaker .....

a) One minute dry & wet power frequency withstand voltage .....

i) Between live terminal and ground (kV rms) .....

ii) Between terminals with breaker contacts open (kV rms) .....

b) 1.2/50 micro second impulse withstand test voltage .....

i) Between live terminal and ground (kV peak) .....

ii) Between terminals with breaker contacts open (kV peak) .....

c) 250/2500 micro second impulse switching surge withstand test voltage .....

i) Between live terminal and ground (kV peak) .....

ii) Between terminals with breaker contacts open (kV peak) .....

CLAUSE NO.	Bidder's Name ……..	
	d) Total creepage distance	.....
	i) To ground (mm)	.....
	ii) Between terminals (mm)	.....
4.	Operating Mechanism	.....
	a) Type of operating mechanism for	.....
	i) Closing	.....
	ii) Opening	.....
5.	Quenching Media	
	a) Quantity of SF6 per pole at rated pressure (Kg)	.....
	b) Guaranteed maximum leakage rate per year	.....
	c) Rated pressure of SF6 in operating chamber (Kg/cm^2)	.....
	d) Limit of pressure at which breaker operates correctly (Kg/cm^2)	.....
6.	Constructional Details	.
	a) Type and capacity of device used to obtain uniform voltage distribution between breaks	.....
	b) Number of auxiliary contacts per pole provided	.....
	i) NO	.....
	ii) NC	.....
	iii) Adjustable	.....

CLAUSE NO.	Bidder's Name ……..	
7.	Detailed Literature	.....
	(Whether the following are enclosed)	
	a) Type test reports	Yes/No
	b) OGA drawing of breaker	Yes/No

CLAUSE NO.	Bidder's Name ……..	एनटीपीसी NTPC

DB:12H

EHV INSULATORS FOR CHAPTER E1 TO 6&12

A. BUSHING / HOLLOW INSULATORS

(Bidder shall furnish these data for each equipment separately i.e
. for circuit Breakers, Instrument Transformer, Surge Arrestors, etc.)

1.	Manufacturer's Name	.....
2.	Country of Manufacturer	.....
3.	Type	.....
4.	Applicable Standards	.....
5.	i) Height	.....
	ii) Diameter (Top)	.....
	iii) Diameter (Bottom)	.....
6.	Creepage distance	.....
	a) Total (mm)	.....
7.	Rated Voltage	.....
8.	Power frequency withstand voltage for 1 min. (kv rms)	.....
	i) Dry	.....
	ii) Wet	.....
9.	1.2/50 micro sec. impulse withstand voltage (kVp)	.....
10.	250/2500 Micro sec. switching impulse withstand voltage (kVp)	.....
	i) Dry	.....
	ii) Wet	.....
11.	Weight (Kg)	.....
12.	Cantilever Strength (Kg)	.....
13.	OGA drawing enclosed	Yes/No

SECTION - 5
QUALITY PLAN

Supplier shall follow valid approved Quality Plan of NTPC.

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BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

BHEL Document No. **TB-423-316-TS-001**	Rev. 00		Prepared by	Checked by	Approved by
		Name	**MSP**	**SKS**	**SKS**
Type of Document **Technical Specification**		Sign	-sd-	-sd-	-sd-
Title **400kV CIRCUIT BREAKERS**		Date	01.04.24	01.04.24	01.04.24
		Group	TBEM		
		W.O. No	WO24A02871		

CUSTOMER	**NTPC LTD.**
CONTRACT NO.	**CS-9587-001R-2-FC-NOA- 7332 dtd 29.08.2023** **CS-9587-001R-2-SC-NOA- 7333 dtd 29.08.2023**
PROJECT	**400kV Switchyard for LARA SUPER THERMAL POWER PROJECT (2X800MW)**

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution						
	To					
	Copies					

	technical specification and applicable IS / IEC			
6	**TYPE TESTS REQUIREMENTS**			
6.1	All equipment being supplied shall conform to type tests as per Cl. 1.9 of Section-1 of technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections	Confirmed	YES/NO	
6.2	In case the test reports are not found technically valid during contract stage by BHEL/Customer, the bidder shall repeat these test(s) at no extra cost to the purchaser and no delivery implication. **Technical valid** - Any error or incompleteness (any/all additional type tests not carried out) or discrepancy in the test reports vis-à-vis offered equipment due to any design / manufacturing changes (including substitution of components) or non-compliance with the requirement stipulated in the Technical Specification.	Confirmed	YES/NO	

Report ID: GEM/GARPTS/05032024/9DAFAROOPU43
Report Name: 420kV and 245kV Circuit Breaker
Generated By: Durga Prasad , Department of Heavy Industry , Ministry of Heavy Industries and Public Enterprises

Generated On: 05/03/2024
Valid till: 04/04/2024

GeM Availability Report and Past Transaction Summary

GeM Availability Report and past transaction summary report is generated based on the specifications searched by the Buyer. The specification may be modified appropriately for searching relevant categories on GeM. Buyer may navigate to GeM category page by clicking on the category link to view category specifications and products/services available in the category.

Order Count and Order Value displayed is on a cumulative basis since GeM inception.

1. Search String: 420kV and 245kV Circuit Breaker

Search type: Product

1. There are categories available on GeM matching your requirements (as listed here). You can create a bid on GeM with a product closest matching your required specifications and add additional parameters in specifications through Corrigendum using RMS functionality.
2. If you feel that category TP needs updating you can submit category updating request also through RMS.
3. If you do not want to use any of the above option and want to proceed for procurement outside GeM, please suggest the specifications of the required product for creation of new category on GeM for future procurement.

Search Result: Category available/suggested on GeM but marked as "not matching requirements" by the buyer with undertaking as under:

It is certified that I have thoroughly checked all probable categories suggested by GeM and I am satisfied that the product required is not covered / does not fall in any of the suggested categories and can not be procured under any of these categories even after inclusion of List of Values(LOV) wherever possible in category specifications of suggested categories. It is also certified that the technical specification requirement are such that these can not be covered even by adding specification parameters using ATC in any of the GeM suggested categories. This is a one-time requirement hence new category creation is not proposed / or requirement is recurring but request for new category creation will be submitted separately post generation of GeMARPTS.

Category Name	Catalog Count	Order Count			Order Value (in Lakhs)		
		Direct Purchase	Reverse Auction	Bid	Direct Purchase	Reverse Auction	Bid
Air Circuit Breaker	43	30	1	22	108	1	74
Molded Case Circuit Breakers (MCCB) as per IS / IEC 60947	7,334	23,986	242	2,629	12,161	262	2,186
Circuit Breaker Analyzer	14	0	0	0	0	0	0
books	83,422	1,14,602	116	1,451	8,700	52	900
SF6 Circuit Breaker, 245 kV	5	0	0	0	0	0	0
MCB - Miniature Circuit - Breakers for A.C. Operation as per IS / IEC 60898 (Part 1)	3,139	10,260	274	2,692	1,708	159	936
SF6 Circuit Breaker, 145 kV	5	1	2	2	0	38	69

Category Name	Catalog Count	Order Count			Order Value (in Lakhs)		
		Direct Purchase	Reverse Auction	Bid	Direct Purchase	Reverse Auction	Bid
Vacuum Circuit Breaker 3.3 KV	6	0	0	0	0	0	0
Earth Leakage Circuit Breaker (ELCB)	55	526	1	25	47	0	21
RCCB - Residual Current Operated Circuit - Breakers as per IS 12640	2,272	2,225	30	640	1,032	29	637