BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-417-316-101	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	Vyom	JK	SKS
TITLE 110kV CIRCUIT BREAKER				SIGN			
				DATE	11.02.22	11.02.22	11.02.22
				GROUP	TBEM	W.O. No	

CUSTOMER	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
PROJECT	110KV Switchyard for Renovation, Modernization and Uprating (RMU) OF Kodayar Power House-I from 1X60MW TO 1X70MW.

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SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES.

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to project sites and supervision of erection, testing & commissioning of 110KV Circuit Breaker complete in all respect for efficient & trouble free operation mentioned under this specification.

The specification comprises of following sections

Section-1	Scope, project specific technical requirements & bill of quantities.
Section-2	Standard Technical Specification for Circuit Breaker
Section-3	Project details & general technical Specifications for all the equipments under the project.
Section-4	Annexures

In case of any discrepancies between the requirements mentioned under different Sections, order of precedence shall be as follows:
section-1 shall precede section-2, section-2 shall precede section-3

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer, however bidder shall furnish list of conflicts/ ambiguities/ deviations (if any) in *Schedule of Technical Deviations*. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed. In case the deviations mentioned in the *Schedule of Technical Deviations* are not technically acceptable, the offer of the bidder will be liable to rejection.

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

The Circuit Breakers are required for the following Project

Customer: Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)

Project: 110KV Switchyard for Renovation, Modernization & Uprating (RMU) of Kodayar Power House-1 from 1 X 60MW to 1 X 70MW

2.0 SPECIFIC TECHNICAL REQUIREMENTS

2.1 All equipments shall perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

2.2 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, (wherever applicable) short circuit etc for the equipment.

2.3 The equipment shall also comply to the following:

a) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".

b) All piping, if any between equipment control cabinet/operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

2.4 Minimum Number of auxiliary contacts on each Circuit Breaker - Besides requirement of technical specification, the manufacturer shall wire up 10 NO + 10 NC contacts of each phase/ pole exclusively for purchaser's use and shall be wired up to common marshalling box of CB.

2.5 All contacts & control circuits to be wired out upto common control cabinet plus **24 spare terminals** exclusively for Owner's use.

2.6 All cables within & between circuit breaker poles and its marshalling box and up to the controlled switching device shall be in bidder's scope of supply. Bidder to provide detailed "**Bill of Quantity"** during detailed engineering stage.

2.7 Cabling & termination schedule for the same shall be provided by successful bidder along with AS BUILT drawing during contract stage.

2.8 TB's for (for incoming AC Power Cables) shall be suitable for size (minimum) **4Cx16** Sqmm Al.

2.9 Following accessories are clarified as bidder's scope of supply

- **Structure** for Equipment support, Ladder & Platform etc.
- **Foundation bolts** for Circuit Breaker, CB Ladder, CB Platform, common control cubical.
- **Cable tray** arrangement to be mounted on Breaker structure
- Breaker **Terminal Pad**

2.10 Terminal connectors are not in bidder's scope of supply (BHEL supplied items)

2.11 Bidder to submit detailed "guaranteed and technical particulars" and "detailed drawings" for Circuit Breakers during contract stage for approval. Bidder may need to visit to BHEL / TANGEDCO corporate engineering office for drawing / document approval if standard approval is not available.

3.0 BILL OF QUANTITIES:

S.No.	DESCRIPTION	UNIT	QTY
A.	**Main Quantity**		
A.1	110kV, 1250A, 40kA for 3s, 3-Phase Circuit Breaker along with support structure, interpole cables, operating mechanism, Marshalling box, control boxes and all accessories complete in all respect	Nos.	3
A.2	Foundation/fixing bolts for 110kV, 3-Phase SF6 Circuit Breaker structure, platform, ladder (if applicable)	Set	3
A.3	SF6 gas filling adopter, including coupling, regulator, connecting hose pipe.	Set	1
B	**SERVICES**		
B.1	Supervision of Erection, Testing & Commissioning of supplied 110kV, 3-Phase Circuit breakers at site.	Lot	3

Note:

3.1 Total contract value may vary upto ±20% at contract stage.

3.2 Prices for all applicable accessories of Circuit Breakers shall be included in the equipment prices.

3.3 Respective dates for the commencement of erection, testing and commissioning activities of Circuit Breakers shall be communicated to manufacturers from time to time as per the readiness of respective sites.

4.0 TECHNICAL QUALIFYING REQUIREMENTS:

Please refer the following Annexure_**TQR**

5.0 SUPERVISION OF ERECTION COMMISSIONING AND TESTING:

Supervision of Erection, testing and commissioning of all the supplied Circuit Breakers are in the bidder's scope. Bidder shall quote lump-sum price for supervision of installation, testing and commissioning of all offered breakers. Supplier's testing engineer shall bring SF6 gas leak detector, SF6 gas filling adopter, timing kit and Transducer for operational analyser (as per requirement).

Required unskilled man power / Labor, tools (other than special tools and tackles which shall be in bidder's scope) shall be provided by BHEL.
The measurement at site shall be carried out as per TANGEDCO Standard Pre-commissioning procedures as indicated in Section-2 Technical Specification. The commissioning report shall be prepared and signed by the manufacturer's representative.

Following Instruments shall be made available by BHEL to testing engineer

a) DCRM (Operational analyser) Kit
b) 5kV Insulation tester
c) 1kV Insulation tester
d) Single phase variac
e) Dew Point meter
f) Capacitance and Tan Delta Kit
g) Contact Resistance measurement kit
h) Multimeter

Any **other instrument(s), if required for Testing/commissioning of Circuit Breaker shall be arranged by bidder**. Cost of the same shall be deemed inclusive in the offer.

The respective dates of commencement of erection, testing and commissioning activities by BHEL will be intimated to the equipment supplier from time to time, so that arrangements for supervising the activity can be made accordingly by the manufacturer.

6.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for approval. The type test reports submitted shall be of tests conducted within last 10 years prior to the date of technical bid opening of this tender. The bidder should have conducted type test on identical or similar equipment/ components to those offered. If these tests have been conducted more than 10 years' prior from the date of technical bid opening or type test reports are found to be technically unacceptable to BHEL/TANGEDCO, the type test shall be conducted without cost and delivery implication to BHEL. Type test report shall be reviewed for approval in detailed engineering stage only.

7.0 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.

8.0 QUALITY PLAN

Bidder to follow valid TANGEDCO approved Quality Plan as per TANGEDCO procedure. In case the bidder doesn't have TANGEDCO approved Quality Plan, it will be the bidder's responsibility to get its Quality Plan approved directly from the ultimate customer M/s TANGEDCO Corporation of India Limited.

9.0 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.

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TECHNICAL QUALIFYING REQUIREMENT

Bidder should be manufacturer of the offered Circuit Breaker. Bidder needs to meets the following technical requirements for 110KV Circuit Breaker as stipulated here under:

The manufacturer(s) whose 110KV Circuit Breaker (s) are offered, must have, manufactured, type tested (as per IEC/IS or equivalent standard) and supplied 110kV or higher voltage class Circuit Breaker as on the original date of technical bid opening of this tender.

GENERAL POINTS (NOTES)

- Consideration of offer shall be subject to customer approval of bidders, as applicable.

PREPARED BY	REVIEWED BY	APPROVED BY
11/02/2022	11/02/2022	11/02/22.

STANDARD TECHNICAL SPECIFICATION FOR CIRCUIT BREAKER

(1) GENERAL

1.1 The circuit breakers and accessories shall conform to IEC: 62271 - 100, IEC: 60694 and other relevant IEC / IS standards except to the extent explicitly modified in the specification and shall also be in accordance with requirements specified herein.

1. IS - 13118 Specification for circuit breakers.
2. IS - 2629 Recommended practice for Hot Dip galvanized Iron and Steel.
3. IS - 4379 Identification of the contents of industrial gas cylinders.
4. IS - 7311 Seamless high carbon steel cylinders for permanent and high pressure liquefied gases.
5. IS - 2147 Degree of protection provided for enclosures for low voltage switchgear and control gear.
6. IS - 2099 High voltage porcelain bushings. (IEC 2331)
7. IS - 802Code of practice for use of structural steel in overhead (Part-1) trans. Line towers.
8. IS - 375Marking and arrangements for switchgear bus bar, main connections and auxiliary wirings.
9. IEC - 62271-100 Specification for alternating current circuit breakers. (replacing IEC-60056, 1987)
10. IEC - 325 Specification for three phase induction motors.
11. IEC - 376 Specification and acceptance of new supply of Sulphur 376A, 376B Hexafluoride.
12. IEC - 60 High voltage test techniques.
13. IEC - 71 Insulation co-ordination. (Part 1 & 2)
14. IEC - 270 Partial discharge measurement
15 IS5561 - Electric Power Connectors
16 IS 9135 - Guide for testing of Circuit Breakers with respect of out of phase switching.
17. IS:10601- Dimensions of terminals of high voltage switchgear and control gear.

18 IS:12729 - General requirements for switchgear and control gears for voltages exceeding 1000V

19. IS:13516 - Methods of synthetic testing of high voltage AC circuit breakers.

20. IS:14658 - High voltage AC circuit breakers - Guide for short circuit and Switching test procedures for metal closed and dead tank circuit breaker.

21. IS:14674 - High voltage alternating circuit breakers - Guide for seismic qualifications of high voltage AC breaker.

22 IS:8828 - Miniature air break circuit breaker for AC circuits for voltages not exceeding 1000V

23 IS:13947 - Contactors for voltages not exceeding 1000V dc or 1200V dc

24 IS:2544 - Porcelain post insulators for systems with nominal voltages greater than 1000V

25 IS:694 - PVC cables upto 1000V.

26 IS:2148 - Cable glands

27 IS:8337 - Cable lugs.

1.2 The 110 KV circuit breakers offered would be of Sulphur hexafluoride (SF6) type only with spring - spring operating mechanism and of class C1-M1 as per IEC.

1.3 The circuit breaker shall be complete with terminal connectors, operating mechanism (spring type), control cabinets, inter pole cable, cable accessories like glands, terminal blocks, marking ferrules, lugs, pressure gauges, density monitors (with graduated scale) for SF6 gas control part connectors, galvanized support structure for CB, their foundation bolts and all other circuit breaker accessories required for carrying out all the functions the CB is required to perform.

1.4 All necessary parts to provide a complete and operable circuit breaker including installation such as main equipment, terminals, control parts, connectors and other devices whether specifically called for herein or not shall be provided.

1.5 The support structure of circuit breaker as well as that of control cabinet shall be hot dip galvanized. All other parts shall be painted as per shade 697 of IS - 5.

1.6 The circuit breakers shall be designed for use in the geographic and metrological conditions.

1.7 The SF6 Breakers shall conform to the latest revisions and amendments thereof. Besides the above, the standard minimum safety clearances stipulated in IE Rules 1956 shall also be complied with.

(2) DUTY REQUIREMENTS

2.1 The circuit breakers shall be restrike free as per IEC under all duty conditions and shall be capable of performing their duties without opening resistors.

2.2 The circuit breakers shall meet the duty requirements for any type of fault of fault location also for line switching when used on a 110 KV effectively grounded system and perform make and break operations as per the stipulated duty cycles satisfactorily.

2.3 The breaker shall be capable of interrupting the steady state and transient magnetizing current corresponding to Auto transformers.

2.4 The circuit breaker shall also be capable of:

i) Interrupting line/cable charging current as per IEC without any restrike and without use of opening resistors.

ii) Clearing short line fault (Kilometric faults) with source impedance behind the bus equivalent to symmetrical fault current specified.

iii) Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition.

2.5 The breakers shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energization of lines with trapped charges.

(3) TOTAL BREAK TIME

3.1 The total break time as specified under this chapter shall not be exceeded under any of the following duties:

i) Test duties 1,2,3,4,5 (TRV as per IEC: 62271-100)
ii) Short line fault L75, L90 (--- do---)

3.2 The bidder may please 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 (70-110%). While furnishing the proof of the total break time of complete circuit breaker, the Bidders may specifically bring out the effect of non- simultaneity between contacts within a pole or between poles and show how it is covered in the guaranteed total break time.

3.3 The values guaranteed shall be supported with the type test reports.

(4) CONSTRUCTIONAL FEATURES

The features and constructional details of circuit breakers shall be in accordance with requirements stated hereunder.

4.1 Contacts

The gap between the open contacts shall be such that it can withstand at-least the rated phase to ground voltage for 8 hours at zero gauge pressure of SF6 gas due to the leakage. The breaker should be able to withstand all dielectric stresses imposed on it in open condition to lock out pressure continuously (i.e. 2 p.u. across the breaker continuously).

4.2 If multi break interrupters are used, these shall be so designed and augmented that a uniform voltage distribution is developed across them. Calculations/test report in support of the same shall be furnished. The

thermal and voltage withstand of the grading elements shall be adequate for the service conditions and duty specified.

4.3 The SF6 Circuit Breaker shall meet the following additional requirements:

a) The circuit breaker shall be single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surface of the circuit breaker.

b) All gasketed surfaces shall be smooth, straight and reinforced, if necessary, to minimize distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 1% per year. In case the leakage under the specified conditions is found to be greater than 1% after one year of commissioning of circuit breaker, the manufacturer will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during first year operation after commissioning.

c) In the interrupter assembly there shall be an absorbing product box to minimize the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products.

d) Each pole shall form an enclosure filled with SF6 gas independent of two other poles and the SF6 gas density of each pole is monitored.

e) The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the following requirements:

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

f) Each circuit breaker shall be capable of withstanding a vacuum of minimum 8 millibars without distortion or failure of any parts.

g) Sufficient SF6 gas including that will be required for gas analysis during testing shall be provided to fill all the circuit breakers installed. In addition, spare gas shall be supplied in separate unused cylinders.

h) Suitable SF6 gas filling adopter one number each for each voltage rating (110KV) shall be supplied along with breaker.

(i) One number portable / Hand held SF6 gas leakage detector shall be supplied for the entire lot of breakers.

j)Portable SF6 filling unit with Vacuum pump.

4.4 Provisions shall be made for attaching an operational analyzer after installation of circuit breakers at site to record contact level, speed and making measurement of operating timings, Pre-insertion timings of closing resisters if used, synchronization of contacts in one pole.

(5) SULPHUR HEXAFLUORIDE GAS (SF6 GAS)

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

5.2 The high pressure cylinders in which the SF6 gas is shipped and stored at site shall comply with requirements of the relevant standards and regulations.

5.3 Test: SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water content as per IEC 376, 376A and 376B and test certificates shall be furnished indicating all the tests as per IEC 376 for each lot of SF6 gas. Gas bottles should be tested for leakage during receipt at site.

5.4 SF6 gas Cylinder.

(6) INSULATORS

6.1 The porcelain of the insulators shall conform to the requirements

6.2 The mechanical characteristics of insulators shall match with the requirements specified under this chapter.

6.3 Test: All insulators shall conform to IEC- 61624 (for pressurized hollow column insulators) and IEC-233 (for others). All routine and sample tests

shall be conducted on the hollow insulators as per these standards with requirements and procedures modified as under:

i) Pressure test as a routine test.

ii) Bending load test as a routine test.

iii) Bending load test as a sample test on each lot.

iv) Burst pressure test as a sample test on each lot.

v) In addition to the above ultrasonic test shall be carried out as additional routine test

6.2 The Hollow porcelain for pressurized columns/chambers should be in one integral piece in green and fired stage.

(7) OPERATING MECHANISM AND CONTROL

7.1 General requirements:

7.1.1 Circuit breaker shall be operated by spring charged mechanism for all rating of breakers. This is mandatory requirement. The mechanism shall be housed in a weather proof and dust proof control cabinet.

7.1.2 The operating mechanism shall be strong rigid, not subject to rebound and shall be readily accessible for maintenance for a man standing in ground.

7.1.3 The mechanism shall be anti pumping and trip free (as per IEC definition) under every method of closing.

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

7.1.5 A mechanical indicator shall be provided to show open and close position of the breaker. It shall be located in a position of the breaker where it will be visible to a man standing on the ground level with the mechanism housing closed. An operation counter shall also be provided in the central cabinet. A plat form for manual operation / Spring charging and for routine check must be provided for breakers of all voltage class.

For Manual spring charging operation through operating handle.

it is desired that mechanism box may be mounted at adequate height and gear ratio shall be so chosen that one man standing at ground level is able to manually charge the spring without much effort. The operating handle for charging the spring shall be inserted from side of mechanism box and not from bottom. The spring charging facility shall have ease of operation and the movement of handle shall be in vertical plane only. The Bidder should enclose G.A. Drawings with the above provision.

7.1.6 Working parts of the mechanism shall to corrosion resisting material, bearings which require 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 breakers.

7.1.7 The bidder shall furnish detailed operation and maintenance manual of the mechanism along with the operation manual for the circuit breaker. The instruction manuals shall contain exploded diagrams with complete storage handling, erection, and commissioning, troubleshooting, servicing and overhauling instructions.

7.1 CONTROL:

7.2.1 The close and trip circuit shall be designed to permit use of momentary contact switches and push buttons.

7.2.2 Each breaker pole shall be provided with two (2) independent tripping circuits, pressures switches and coils each connected to a different set of protective relays.

7.2.3 The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils. However provisions shall be made for local electrical control. For this purpose a local/remote selector switch and close and trip control switch/push buttons shall be provided in the Breaker central control cabinet.

7.2.4 The trip coils be suitable for trip circuit supervision during both open and close position of breaker. The trip circuit supervision relay would be provided on relay panels.

7.2.5 Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip coil and associated circuit shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. However, even at 50% of rated voltage the breaker shall be able to operate. If additional elements are introduced in the trip coil circuits, their successful operation and reliability for similar applications on outdoor circuit breakers shall be clearly brought out in the additional information schedules.

7.2.6 Density meter contact and pressure switch contact shall be suitable for direct use as permissive in closing and tripping circuits. Separate contacts have to be used for each of tripping and closing circuits. If contacts are not suitably rated and multiplying relays are used then fail safe logic/schemes are to be employed. DC supplies for all auxiliary circuits shall be monitored and provision shall be made for remote annunciations and operation lockout in case of DC failures. Density monitors are to be so mounted that the contacts do not change on vibration during operation of circuit Breaker.

7.2.7 The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.

(8) SPRING OPERATED MECHANISM

8.1 The Spring operated mechanism shall be complete with motor. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also be provided.

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

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

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

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

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

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

8.8 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.

(9) SUPPORT STRUCTURE

9.1 The structure design shall be such that during operation of circuit breaker vibrations are reduced to minimum.

9.2 The contractor shall provide suitable platform with steps on both sides of the circuit breaker for easy accessibility for monitoring the density/pressure of gas and for local operation.

(10) TERMINAL CONNECTOR PAD

The circuit breaker terminal pads shall be made up of high quality electrolytic copper or aluminum. The terminal pad shall have protective covers which shall be removed before interconnections. The terminal connectors of 110 KV breakers shall be suitable for 3" Aluminium tube of expansion type.

(11) INTERPOLE CABLING

11.1 All cables to be used by contractor shall be as per IS-1554 (1100 Volts Grade). All cables within & between circuit breaker poles shall be supplied by the CB manufacturer.

11.2 Only multi stranded conductor shall be used. Minimum size of the conductor shall be 2.5 sq.mm (Copper).

11.2 The cables shall be with oxygen index Min. 29 and temp index as 250°C as per relevant standards.

(12) INTERPOLE CABLING

The operating mechanism housing/control cabinet shall conform to the requirement specified below.

Operating mechanism and all accessories shall be enclosed in a weather-proof cabinet of sheet steel construction, the thickness of which shall not be less than 3mm.

Hinged doors giving access to the mechanism and panel wiring at the front and rear shall be provided. The enclosure shall conform to the degree of protection IP-55.

Suitable space heaters shall be mounted in the housing to prevent condensation. Heaters shall be controlled by differential thermostat so that the cubicle temperature is always, maintained approximately 10 deg C above the outside air temperature. ON/OFF switch and fuse shall be provided for the heaters. Heaters shall be

suitable for 240 V AC single phase supply. The heater leads shall be covered with porcelain material up to sufficient length to avoid melting of insulation of the leads.

Adequate number of cable glands shall also be provided along with control cabinet. The number of terminals provided shall be adequate enough to wire out all contacts and control circuits with 10% extra terminals.

(13) INTERLOCKS ALARMS AND INDICATIONS

13.1 Potential free contacts shall be provided, duly wired upto to the operating mechanism housing/control cabinet for the following alarms and indications.

ALARMS :

(a) Low pressure of SF6 gas.
(b) Auto reclosing lock out for low pressure of gas
(c) General lock-out for SF6 gas.
(d) Pole discrepancy
(e) Auxiliary AC/DC failure.

INDICATIONS :

(a) Breaker on off (Both Electrical/Mechanical)
(b) Spring charged (Both Electrical/Mechanical)
(c) Mechanical operation counter.

13.2 It is proposed to electrically interlock the circuit breaker with TANGEDCO's associated air break isolating switches in accordance with switchyard safety inter-locking scheme. All spare contacts in Auxiliary switch will be brought out. Sufficient spare terminal preferably minimum 60 terminals in a separate terminal block may be provided in the central control cubicle for wiring 10 NO + 10 NC spare contact from each pole. All accessories

required on breaker side for satisfactory operation of the scheme shall be deemed to be included in the scope of supply of this specification.

13.3 The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate Earthing terminals suitable for bolted connection to mild steel flat to be provided.

(14) FITTINGS AND ACCESSORIES

14.1 Following is a partial list of some of the major fittings and accessories to be furnished by the contractor in the central control cabinet. Number and exact location of these parts shall be indicated in the bid:

i) Cable glands (double compression type). Lugs ferrules etc

ii) Local/ remote change over switch.

iii) Operation counter.

iv) Pressure gauges.

v) Control switches to cut off control power supply

vi) Fuses as required.

vii) The number of terminals provided shall be adequate enough to wire out all contacts and control circuits plus 24 terminals spare for future use.

viii) Antipumping relay.

ix) Pole discrepancy relay.

x) D.C Supervision relays.

xi) Rating and diagram plate in accordance with IEC incorporating year of manufacture.

xii) one number Adopter for each voltage rating (110 KV) for SF6 Gas filling (Breaker to filling hose)

(15) ADDITIONAL DATA TO BE FURNISHED ALONGWITH THE OFFER

a) Drawing showing contacts in close arc initiation full arcing, arc extinction and open position.

b) The temperature v/s pressure curves for each setting of density monitor along with details of density monitor.

c) Method of checking the healththiness of voltage distribution devices (condensers) provided across the breakers at site.

d) Data on capabilities of circuit breakers in terms of time ad number of operations at duties ranging from 100% fault currents to load currents of the lowest possible value without requiring any maintenance or checks.

e) The effect of non-simultaneity between poles and also show how it is covered in the guaranteed total time.

f) Sectional view of non-return coupling is used for SF6 pipes.

g) Details & type of filters used in interrupter assembly and also the operating experience with such filters.

h) Details of SF6 gas.

i) The test methods used in controlling the quality of gas in the circuit breakers particularly purity & moisture content.

ii) Proposed tests to assess the conditions of the SF6 within a circuit breaker after period of service particularly with regard to moisture contents of the gas.

(16) TEST

16.1 The circuit breaker along with its operating mechanism shall conform to IEC: 62271 -100.

16.2 The test reports of the type test and following additional type tests shall also be submitted for purchaser's review:

i) Corona extinction voltage test.

ii) Out of phase closing test as per IEC: 62271-100

iii) Line charging breaking current for providing parameters as per clause no: 17.9 of this chapter.

iv) Test to demonstrate the power frequency withstand capability of breaker in open condition at Zero Gauge pressure (Ref. Clause 4.1.1) and lockout pressure.

v) Seismic withstand test (As per annexure B of chapter GTR) in unpressurised condition.

vi) Verification of the degree of protection.

vii) Low & high temperature test (if applicable)

viii) Humidity test (if applicable)

ix) Static Terminal load test.

x) Critical current test (if applicable)

xi) Switching of shunt Reactors.

16.2 The test reports of the type test and following additional type tests shall also be submitted for purchaser's review:

16.3 Routine Tests:

Routine tests as per IEC: 62271-100 /latest IS shall be performed on all circuit breakers. In addition to the mechanical and electrical tests specified by IEC- the following tests shall also be performed.

1) Speed curves for each breaker shall be obtained with the help of a suitable operation analyzer to determine the breaker contact movement during opening, closing, auto reclosing and trip free operation under normal as well as limiting operating conditions (control voltage, pneumatic/hydraulic pressure etc.). The tests shall show the speed of contacts directly at various stages of operation etc. This shall also be performed at site for which the necessary operation analyzer along with necessary transducers, cables, console, etc. Where included in scope of supply shall be furnished and utilized. In case of substations where operation analyzer is existing the bidder shall utilize the same. However necessary adopter and transducers etc., if required shall have to be supplied by the bidder.

2) Measurement of Dynamic Contact resistance measurement for arcing & main contacts, signature of Dynamic contact resistance measurements shall be taken as reference for comparing the same during operation and maintenance in order to ascertain the healthiness of contacts.

16.4 SITE TESTS:

All routine tests except power frequency voltage dry with stand test on main circuit breakers shall be repeated on the completely assembled breaker at site.

(17) TESTING AND COMMISSIONING

17.1 An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P/Instructions of the equipment Supplier or purchaser without any extra cost to the employer. The contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the employer for approval.

a) Insulation resistance of each pole.
b) Check adjustments, if any suggested by manufacturer.
c) Breaker closing and opening time.
d) Slow and power closing operation and opening.
e) Trip free and anti-pumping operation
f) Minimum pick-up voltage of coils.
g) Dynamic Contact resistance measurement.
h) Functional checking of compressed air plant and all accessories.
i) Functional checking of control circuits interlocks trapping through protective relays and auto reclose operation.
j) Insulation resistance of closing and tripping coils
k) Resistance of closing and trapping coils
l) SF6 Gas leakage check
m) Dew point Measurement
n) Calibration of pressure switches and gas density monitor.
o) Checking of mechanical “CLOSE “interlock, wherever applicable

(17) TECHNICAL PARAMETERS:

Sl.No.	ITEM	REQUIREMENTS
1	Rated voltage (KV rms) (nominal/max)	110 KV
2	Highest System Voltage	123KV
3	Frequency (Hz).	50
4	Neutral grounding	Solidly earthed
5	Continuous current rating	1250 A
6	Type KV	Outdoor SF6
7	Mounting	Hot dip galvanized/Epoxy painted steel support structure
8	Number of Poles	3
9	Type of operation	Gang operated poles
10	Height of concrete plinth	300 mm
11	Minimum height of the lowest part of the support insulator from ground level (mm)	2550 mm
12	Clearances (a) Centre to Centre distance between poles (b) Line to Ground	 1700 mm 4572 mm
13	Operation mechanism	Spring - Spring (Motor operated spring charged)
14	Auto reclosing duty	Single and three phase
15	Rated operating duty cycle	O-0.3 Sec.-CO-3Min-CO as per IEC - 62271-100
16	First pole to clear factor	1.3
17	Type of tripping	Trip free
18	Maximum closing time (ms)	150 ms
19	Maximum total break time (ms) At rated breaking capacity	Less than 60 ms
20	1.2/50 microsecond impulse withstand voltage (dry) (KVp) (i) To earth (KVp) (ii) Across open contacts with impulse on one terminal and power frequency voltage on opposite terminal (KVp/KV rms)	 550 550

Sl.No.	ITEM	REQUIREMENTS
21	1 minute power frequency withstand voltage (KV rms) (wet)	230
22	Rated breaking current capacity : (i) Line charging at rated voltage at 90 degrees leading power factor	50 A
23	Short circuit current : AC component (KA) DC component	40 Corresponding to minimum Opening time as per IEC - 62271-100
24	Rated short circuit making current capacity (KA)	78.75
25	Permissible limit of temperature rise	As per IS applicable
26	Max. acceptable difference in the instants of closing/opening of contacts : (i) Within a pole (ms) (ii) Between poles (ms)	5 10
27	Min. creepage distance of support insulator (mm)	3400
28	Short time current carrying capability for three seconds (KA)	40
29	Rating of auxiliary contacts	10 A at 220V DC
30	Breaking capacity of auxiliary contacts	5 A DC with the circuit time constant less than 20ms at the rated voltage.
31	Noise level at base and upto 50metres	140 dB (max.)
32	Seismic acceleration	0.3g
33	Capacitance Current switching Line Charging Cable Charging Capacitor Banks	Conforming to Class C1 as per IEC 62271-100
34	Mechanical Endurance Test	Conforming to class M1 as per IEC 62271-100

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PROJECT INFORMATION AND GENERAL TECHNICAL REQUIREMENTS

The provisions under this section are intended to supplement general requirements for the materials, equipment's and services covered under other sections.

[1] PROJECT INFORMATION

1.1 Project Title: Renovation, Modernization & Uprating of Kodayar Power Power House - I from 1x60MW to 1x70MW in Tirunveli Generation Circle in the Kanyakumari District, Tamil Nadu, India .

Owner: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

Transport facilities : Road/Rail

1.2 Meteorological Data

(i) Maximum ambient temperature : 50ºC
(ii) Minimum ambient temperature : 20ºC
(iii) Maximum daily average ambient air temperature : 45º C
(iv) Maximum yearly average ambient air temperature : 32º C
(v) Maximum Humidity (%) : 100%
(vi) Average thunder storm days per annum : 50
(vii) Average rainy days per annum : 90
(viii) Average annual rainfall (mm) : 1000 mm
(ix) Maximum wind pressure : 150 Kgf/Sqmm
(x) Altitude above MSL : Below 1000M

However for design purpose, ambient temperature should be considered as 50ºC and relative humidity as 100%.

[2] ELECTRICAL DATA

2.1 MAIN ELECTRICAL PARAMETRS/ CLEARANCES :

Sl.	Technical Parameter	Unit	-
1	Type of Switchyard		AIS
2	Nominal voltage class, rms	kV	110
3	Maximum System voltage, rms	kV	123
4	Current Rating	A	1250A
5	Number of phases	Nos	03
6	Symmetrical Short time withstand current	kA/Sec	40 kA for 3 sec.
7	One minute power frequency withstand voltage	kV	230
8	Peak impulse test withstand voltage	kV	550
9	Creepage distance	mm/kV	25
9.1	Phase to Phase	mm	1100
9.2	Phase to Earth	mm	1100
9.3	Phase To Phase Spacing	mm	2800
9.4	Minimum Section Clearances	mm	4000
10	Design ambient Temperature	°C	50

2.2 STANDARD VOLTAGE LEVELS:

S.No.	Description	Voltage level
1.	Evacuation and Transmission 110 kV	3 phase, 3 wire 50 Hz, effectively earthed
2.	Station supply	415 V, 3 phase, 4 wire, 50 Hz, effectively earthed.
3.	A.C. Drive motors	415 V, 3 phase, 4 wire effectively earthed

S.No.	Description	Voltage level
4.	Metering 110 V	110 V, AC PT. voltage
5	Control & protection gear	AC 2 wire from UPS
6.	Panel lighting and space heaters	230V, 1 phase, 2 wires, 50 Hz, A.C. with point earthed.

2.3 BASIC INSULATION LEVELS

Sl.No	Nominal voltage kV	BIL kV (peak)
1.	110 kV	550
2.	11 kV	75
3.	400 V	1.1

[3] GENERAL REQUIREMENT

3.1 ALL THE EQUIPMENTS / MATERIALS TO BE SUPPLIED SHOULD BE INACCORDANCE WITH RELEVANT LATEST / AMENDED IS/IEC, WHETHER IT HASBEEN SPECIFICALLY MENTIONED IN THE SPECIFICATION OR NOT.

3.2 Life of the Electro-mechanical generating equipment i.e., turbine, generator, transformers, auxiliaries etc. shall not be less than thirty five (35) years.

3.3 All EQUIPMENTS and type of clamps, fittings hardware, insulators, bus bar. These designs/ drawing shall be got approved by the purchaser before commencing the manufacture/ construction/ erection and are to be as per latest IS/ IEC.

3.4 GENERAL:

The bidder shall be fully responsible for providing all equipment, materials system and services specified or otherwise which are required to complete

the construction and successful commissioning of the substation in all respects.

Any other items not specifically mentioned in the specification but which are required for erection of materials/equipment under the scope of work, testing and commissioning are deemed to be included in the scope of the specification unless specifically excluded.

All items shall be supplied as per schedule and as specified in the relevant Indian standard of latest revision. The Technical specification of the main materials/equipment is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

The bidders are requested to procure the equipment's/materials/component only from reputed /qualified manufacturer as per Technical requirement stipulated in Section-1 of Technical specifications. Approval of make of item shall be taken up by vendor from M/s TANGEDCO himself.

3.5 COMPLETENESS

Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

All equipment furnished by the Bidder shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

3.6 All the equipment, technological structures, pipes, valves, fittings, etc shall be subjected to inspection and testing as per accepted national or international standards and practices. All the components shall be subjected to inspection and testing as per standard practices of the manufacturer prior to offering them for inspection by the Purchaser /his authorized representative.

3.7 Suitable working platforms, walkways, ladders lifting tackles and tools required for the above shall be provided.

3.8 The fabrication and assembly areas shall be kept clean and free from contamination. During assembly of major components, a polythene covering shall be maintained in position to prevent ingress of dirt, grease, etc from overhead cranes or other equipment.

3.9 All equipment shall be visually inspected in the presence of an inspector immediately before closure. A system of physical identification and accountability shall be used to account for all tools, test equipment, shipping blanks and other items used during assembly to obviate the possibility of their being left inside vessels or equipment.

3.10 CODES & STANDARDS

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:

1. Bureau of Indian Standards (BIS)
2. Indian electricity act
3. Indian electricity rules

4. Indian Explosives Act
5. Indian Factories Act and State Factories Act
6. Indian Boiler Regulations (IBR)
7. Regulations of the Central Pollution Control Board, India
8. Regulations of the Ministry of Environment & Forest (MoEF), Government of India
9. Pollution Control Regulations of Department of Environment, Government of India
10. State Pollution Control Board.
11. Rules for Electrical installation by Tariff Advisory Committee (TAC).
12. Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

1. Japanese Industrial Standards (JIS)
2. American National Standards Institute (ANSI)
3. American Society of Testing and Materials (ASTM)
4. American Society of Mechanical Engineers (ASME)
5. American Petroleum Institute (API)
6. Standards of the Hydraulic Institute, U.S.A.
7. International Organization for Standardization (ISO)
8. Tubular Exchanger Manufacturer's Association (TEMA)
9. American Welding Society (AWS)
10. National Electrical Manufacturers Association (NEMA)
11. National Fire Protection Association (NFPA)
12. International Electro-Technical Commission (IEC)
13. Expansion Joint Manufacturers Association (EJMA)
14. Heat Exchange Institute (HEI)

Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Owner's approval, for which the Bidder shall furnish, along with the offer, 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.

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

3.11 LANGUAGE

a. The tender shall be submitted in English language only.

b. In all the technical correspondences English shall be used. Warning & safety notice around the plant shall be in English and Tamil.

c. Plant labels & rating plates and all permanent & temporary notices around the plant shall be in English.

d. Instruction manuals & training programme shall be in English. The visual display unit outputs given by the computer driven data acquisition system shall be in English only.

e. If the offer and all documents are not submitted in English, the tender is liable for rejection. Further, in case the tenderer submits documents in any language other than English along with the translation of the same, such translated documents in English shall be submitted duly authenticating that the translation is true and correct to their knowledge and belief in all such pages by the bidder/ all the consortium partners duly affixing their signatures and seals. In case of foreign bidders, this shall be in addition to the attestation by the Consulate of India

functioning in the respective countries. In case such proper authentication for translated documents is not observed, the tender is liable for rejection.

f. All documents, instructions, catalogues, brochures pamphlets, design data, norms and calculations, drawings, operation, maintenance and safety manuals, reports, labels, on deliveries and any other data shall be in English Language.

g. All correspondence between TANGEDCO and the Contractor shall be in English language.

h. However, all signboards required to indicate "Danger" and/or security at site and otherwise statutory required shall be in English, Tamil & Hindi languages.

3.12 TECHNICAL AND ENGINEERING SERVICES

Technical Services to be provided by the Contractor shall generally include the following amongst others:

a) Material testing, if necessary.

b) Basic design/drawings and layout engineering

c) Detail design/drawings and engineering

d) Drawings/data for carrying out Plant Engineering and detail design including design modification & model testing/ CFD analysis/drawings of civil, structural and services, wherever necessary.

e) Technical services relating to planning, procurement, manufacturing inspection, expediting, packing, shipping, storing, etc.

f) Project management services and complete feedback data and information to TANGEDCO/Purchaser for the same, for the Contractor’s scope of supply and services.

g) Training of TANGEDCO/Purchaser's personnel.

h) Consultancy services, if any, obtained by the Contractor from elsewhere

i) Technical consultation/liaison/guidance relating to detail design a plant engineering by his Sub-Contractors.

j) Supplier's co-ordination relating to site work and other engineering work.

k) Total supervision of dismantling, repair, civil engineering work & erection including specialised erection services.

l) Start-up trial runs, and- commissioning services.

m) Demonstration of performance guarantee tests with the commissioning engineers/specialists.

n) Quality control and adherence to the time schedule control of site work and other Indian works. Time bound project co-ordination relating to customs clearance, transportation, insurance, claim settlement, inspection, construction planning and scheduling dismantling repair & erection planning field construction engineering, cold tests, start up, trial run, commissioning and performance guarantee tests. The contractor shall bring and associate his own and /or his sub-contractor's specialists for the performance of the above mentioned functions.

o) Clearance of installations from the statutory and other concerned authorities on behalf of TANGEDCO/Purchaser, The Contractor shall also assist in preparing application forms, providing necessary drawings, documents test certificates etc including necessary co-ordination with statutory and other concerned authorities.

The Contractor shall be responsible for supply of all the drawings and technical documents & information in respect of the plant &equipment, commissioning spares and also for recommended spares for operation and maintenance. The Contractor shall deliver the drawings, technical documents and information to TANGEDCO and his authorised agency.

3.13 APPROVAL BY TANGEDCO

a. Drawings and documents as per this contract shall be subject to the review and reference of TANGEDCO. Documents and drawings as mentioned in this contract shall be subject to the approval of TANGEDCO.

b. All changes from the approved drawings/documents shall be subject to the prior approval of TANGEDCO.

c. All Sub-Contractors and sub-suppliers for raw materials testing, design and engineering, manufacture, supplies, construction and erection work and any other work/services covered under the Contract shall be subject to the written approval of TANGEDCO.

d. While the Contractor shall make/execute/perform supplies, work and services in terms of the Contract, TANGEDCO shall have the right to check and approve design, type, quality, quantity, materials and workmanship of any or all items of supplies, work and services where considered necessary by TANGEDCO to ensure that supplies, work and services made/executed/ performed by the Contractor are in accordance with the provisions of this Contract.

e. The Chief Project Manager of Contractor who shall be in overall charge of the Project and Site Manager at site shall be appointed in consultation with TANGEDCO.

f. Detailed assignment schedules of foreign Experts/ Specialist for rendering technical services shall be submitted by the Contractor for the approval of TANGEDCO within six months from the effective date off contract. The biodata of key personnel shall be submitted within two months of the effective date of contract and for others six months before their deputation.

g. To enable TANGEDCO to accord approval and to review documents and drawings, the Contractor shall submit back-up data/drawings/basic calculations/assumptions as may be required by TANGEDCO.

h. Where approval of TANGEDCO is required or implied but is not specifically provided for elsewhere in this Contract, such approval shall also come within the purview of this schedule.

i. Approval by TANGEDCO in terms of this schedule shall not relieve the Contractor of any of his obligations under the Contract. TANGEDCO shall approve or refuse approval within 30 (thirty) days from the date of receipt of request with supporting documents.

j. The approval requested by the Contractor shall not be withheld unreasonably by TANGEDCO. All requests for approval shall be accompanied by fully supporting documents, otherwise it shall not be considered as a request.

[4] INSPECTION AND TESTING

4.1 INSPECTION

4.1.1 GENERAL

a) Manufacturing progress review, inspection & testing of equipment covered under the technical specification shall be carried out by the Purchaser at the manufacturers' works/premises prior to dispatch to ensure that their quality & workmanship are in conformity with the contract specifications and approved drawings.

b) These instructions are in addition to provisions laid down in other tender documents of the Purchaser.

4.1.2 INSPECTION & TESTING STAGES AND FINALISATION OF QUALITY ASSURANCE PLAN (QAP)

a) Within 12 weeks of the award of contract the Contractor shall furnish the quality assurance plan as per proforma given to successful tenderer for electrical equipment. separately with suggestive stages and hold points for undertaking inspection and testing by the Purchaser/TANGEDCO. Total list of plant & equipment of the order shall be submitted to the Purchaser/TANGEDCO prior to submission of QAP

b) After receipt, scrutiny and rendering into acceptable mode of above documents, a mutually agreed programme of inspection & testing of equipment shall be finalized with the Contractor by the Purchaser/ TANGEDCO.

c) Inspection & testing of plant & equipment shall be undertaken by the Purchaser / TANGEDCO after finalization & approval of QAP.

4.1.3 RESPONSIBILITY FOR INSPECTION

a) Any inspection by the Purchaser does not replace the responsibility of quality assurance and quality control functions, as expected of the Contractor to be performed by him for supply of plant & equipment as part of the contractual obligations. As such, any approval which the Inspecting Engineer of the Purchaser may have given in respect of plant and equipment and other particulars and the work or workmanship involved in the contract (whether with or without test carried out) shall not bind the Purchaser to accept the plant and

equipment, should it on further test at site be found not to comply with the requirements of the contract.

b) The Contractor is to meet the inspection & testing requirements for the equipment coming under statutory regulations e.g. weights & measures, safety, IE rules, etc. and submit certificates and documents from appropriate authority to Inspecting Engineer for the same.

4.1.3 EXTENT OF INSPECTION

a) The extent of inspection by the Purchaser shall vary from equipment to equipment as per design requirements.

b) However, indicative extent of inspection for electrical equipment is furnished below.

c) Extent of inspection to be carried out shall be finalized with the Contractor after award of the contract on the basis of scope of supply, technical specification and approved GA drawings. However, in case of similar bulk manufactured items, methods of sampling for inspection of different lots shall be governed by relevant Indian or international standards.

d) In case of critical components, the Purchaser reserves the right to undertake 100% inspection.

e) .Categories of Equipment :

1. Bought out items.&
2. Final Inspection & testing

f) Extent of Inspection : (as applicable from equipment to equipment)

i) BOUGHT-OUT ITEMS

Following standard bought-out items shall be accepted on the basis of manufacturers' test certificates:

- LV current transformers
- Standard AC motors
- AC /DC DBs
- Push button station in manufacturer's' standard enclosure
- LT power, control & instrumentation cables and cable termination / jointing kits

- Starters in manufacturer's standard enclosure
- Light fittings
- Field instruments
- Conduits
- Cable trays

ii) FINAL INSPECTION & TESTING:

- Verification of test certificates
- Visual & Workmanship
- Dimensional
- Witnessing of routine tests as per relevant standards. Manufacturers' test certificates for type test to be submitted for verification.
- Witnessing of proto-type tests, as applicable.

4.1.5 TESTS, TEST CERTIFICATES AND DOCUMENTS

a) For each of the items being manufactured, following test certificates and documents (as applicable for each of the equipment) in requisite copies shall be prepared and submitted to the Inspecting Engineer for scrutiny & records.

i) Materials identification & physical and chemical test certificates for all materials except IS:2062 -1992 and FG 150 IS:210-1978 materials used in manufacture of the equipment.

ii) Welding procedures and welder's qualification test certificates, wherever applicable.

iii) Routine/type/calibration/acceptance/special test certificates for electrical items.

iv) Surface preparation and painting certificates.

v) Certificates from competent authority for the items coming under statutory regulations.

b) The Contractor shall be required to produce the specimen and test pieces on which tests were carried-out by his sub-contractors and if called for, samples and specimen shall become the Purchaser's property.

c) Where facilities for testing do not exist in the Contractor/sub-contractor's laboratories or in case of any dispute, samples and test pieces shall be drawn by the contractor/sub-contractor in presence of Inspecting Engineer and sealed

samples shall be sent to any approved laboratories for necessary tests at Contractor/sub-contractor's cost.

d) The Purchaser/TANGEDCO shall have the right to be present and witness all tests being carried out by the Contractor/sub-contractor at their own laboratory or approved laboratories. Also, the Purchaser/TANGEDCO shall reserve the right to call for confirmatory test on samples, at his discretion.

e) Should the result of tests not come within the margin specified, the tests shall, if required, be repeated at Contractor's cost without any liability to the Purchaser

4.1.6 METHOD OF GIVING INSPECTION CALLS

Inspection calls shall be given by the Contractor. All calls shall accompany four sets of relevant test certificates and inspection report of the Contractor/ sub-contractor after satisfactory completion of internal inspection and tests by them as per approved QAP.

4.2 TESTING

4.2.1 GENERAL

a) Test of all equipment shall be conducted as per latest IS. Tests shall also confirm to International Standards IEC/VDE/DIN/BS.

b) All routine tests shall be carried out at manufacturer's works in presence of purchaser or his representative.

c) The tenderer shall submit type test certificates for similar equipment supplied by him elsewhere. In case type test certificates for similar equipment is not available, the same shall be conducted in presence of purchaser or his representative if purchaser so desires, without any financial implications to purchaser. Heat run test based on type test certificate of similar transformer is acceptable.

d) The site tests and acceptance tests to be performed by contractor are detailed below.

e) The contractor shall be responsible for satisfactorily working of complete integrated system and guaranteed performance.

4.2.2 SITE TESTS AND CHECKS

a) All the equipments shall be tested at site to know their condition and to prove suitability for required performance.

b) The test indicated in following pages shall be conducted after installation. All tools, accessories and required instruments shall have to be arranged by contractor. Any other test which is considered necessary by the manufacturer of the equipment, contractor or mentioned in commissioning manual has to be conducted at site.

c) In addition to tests on individual equipment some tests/ checks are to be conducted / observed from overall system point of view. Such checks are highlighted under 'Miscellaneous tests' but these shall not be limited to as indicated and shall be finalized in consultation with TANGEDCO before charging of the system.

d) The contractor shall be responsible for satisfactory working of complete integrated system and guaranteed performance.

e) All checks and tests shall be conducted in the presence of TANGEDCO's representative and test results shall be submitted in six copies to TANGEDCO and one copy to Electrical Inspector. Test results shall be filled in proper proforma.

f) After clearance from Electrical Inspector system/ equipment shall be charged in step by step method.

g) Based on the test results clear cut observation shall be indicated by testing engineer with regard to suitability for charging of the equipment or reasons for not charging, are to be brought by the contractor.

4.2.3 SITE TESTS

The tests to be carried out on the equipment at pre-commissioning stage shall include following but not limited to the following:

a) TRANSFORMER

1. IR test on each winding to ground and between windings.
2. Turns ratio test on each tap.

3. Polarity and vector group test.
4. Measurement of winding resistance.
5. IR, wiring and operational tests on all control devices in control cabinet, oil level indicator, winding and oil temp. indicators, cooling fan etc.
6. Checking of Earthing with respect to transformer tank (flexible from top cover to tank) other parts, neutrals and tank to electrodes of LAs (for LAs located near to transformer).
7. Testing of buchholz relay for alarm and trip conditions.
8. For bushing CTs, tests applicable shall be as for current transformers.
9. Setting of oil/winding temperature indicators, level gauge and checking of alarm/trip circuits.
10. Check insulators for cracks.
11. Checking for oil leakage and arresting of leakages (if there)
12. Checking of operation of all valves.
13. Checking for open position of all the valves (except drain and filter valves).
14. Filtration of oil by using line filter, vacuum pump, and heater set.
15. BDV test on oil samples from top and bottom.
16. Checking of oil for acidity, water content, tan delta etc. as per IS 335.
17. Measurement of magnetizing current and no load loss.
18. Measurement of PI value.
19. Checking of silica gel breather.
20. Checking of noise level at no load and at full load.
21. Checking of air circulation conditions for indoor transformers.
22. Conducting magnetic balance test
23. Checking of other points given in manufacturer's commissioning manual.
24. Back charging of the transformer and checking of voltages at different tap positions.
25. Tan delta Test and SFRA test at site

b) CURRENT TRANSFORMER

1. IR test on each winding, winding to earth and between windings.
2. Checking of winding ratios by primary injection set.
3. Polarity check on each winding.

4. Continuity check for all windings.
5. Check for connections to correct taps.
6. Measurement of knee point voltage and secondary winding resistance for the CTs used for differential protection.
7. Checking of continuity and IR values for cables from CT to Marshalling box.
8. Checking tightness of Earthing connections.
9. Check output after loading of the main circuit.
10. Tan Delta Test.

c) POTENTIAL TRANSFORMER

1. IR test of primary winding by HV megger between windings and earth
2. IR test of secondary winding by LV megger between windings and winding to Earth.
3. Checking of voltage ratio.
4. Verification of terminal markings and polarity.
5. Checking of continuity and IR values for cables from PT to Marshalling Box.
6. Checking tightness of Earthing connections.
7. Checking of insulator for cracks.
8. Check output on charging of the system with connected meters/relays.
9. Tan Delta Test.

d) ISOLATOR / DISCONNECTING SWITCHES

1. IR test by HV Meggar on main poles.
2. IR test on control circuits.
3. Measurement of Contact resistance for all three phases.
4. Functional checking for electrical and manual operation.
5. Checking of interlocking with earth switch and as per write up and checking of earth switch operation.
6. Checking of operation of earth switch.
7. Setting and checking of auto trip operation of motor on complete close / open position of isolator.
8. Testing of overload relay of motor.

9. Checking for remote operation.

10. Checking of operation on minimum and maximum specified voltages (local as well as remote).

11. Checking tightness of Earthing connections.

12. Checking of insulators for cracks.

e) LIGHTNING ARRESTOR

1. Continuity check (for metal oxide type only).
2. Check for connection to ground.
3. Check insulators for cracks.
4. Check reading of leakage current.
5. HT and IR test of each element.

f) INSULATORS

1. Checking of tightness of connection.
2. Check for minor damage / cracks after cleaning.
3. Verification of number of disks as per drawing.
4. Check for Creepage distance on one type of each set.
5. Check heating at termination point during shutdown.

g) NGT

1. Measurement of resistance
2. IR test by HV megger between terminal and earth.
3. Checking of earth connection for terminal and for body
4. Check for isolator operation and continuity of aux. contacts (if applicable)
5. Check for temp. rise of enclosure and current flow in the resistances.

h) LT SWITCHGEAR

1. IR test
2. HV test with 1.1 kV Meggar
3. Functional test for all feeders
4. Testing of all meters

5. Checking and calibration of overload relays and protective relays as per supplier's commissioning manuals.

6. Check operation of contactors from local and remote points
7. Checking of interlocking between incomers/bus coupler and other feeders.
8. Test to prove interchangeability of similar parts

i) PDB / DCDB

1. IR test before and after HT test
2. HV test by 1.1 kV megger
3. Checking for functions of components for each module
4. Checking for interchangeability of similar components
5. Checking of tightness of earth connection.
6. Testing and calibration of all indicating meters
7. Check output of each feeder after energization.

j) AC MOTORS

1. IR test of stator and rotor windings.
2. Check tightness of cable connection
3. Winding resistance measurement of stator and rotor.
4. Check tightness of earth connections.
5. Check space heaters and carryout heating of winding (if required)
6. Check direction of rotation in decoupled condition during kick start
7. Measure no load current for all phases.
8. Measurement of temperature of body during no load and load conditions.
9. Check for tripping of motor from local/remote switches and from electrical/ technological protection including differential protection.
10. Checking of vibration.
11. Checking of noise level.
12. During load running, measurement of stator and bearing temperatures (if applicable) for every half an hour interval till saturation comes.
13. Checking tightness of foundation bolts.
14. Check continuity of temp. detectors.
15. For actuator drives following shall be checked/tested :
    - Visual and dimensional.
    - IR and operation of limit switches.
    - Winding resistance.

k) UNINTERRUPTED POWER SUPPLY

1. Visual check.
2. IR value by megger.
3. Current limit test.
4. Ripple test.
5. Supply variation.
6. Functional test.
7. Capacity test with respect to time.

l) CABLES & CABLES SUPPORTING STRUCTURES

1. Checking of continuity/phasing and IR values for all the cables before and after HV test.
2. HV test and measurement of leakage current after termination of cable kits (for HT cables).
3. Checking of earth continuity for armor and fourth core (if applicable).
4. Check for mechanical protection of cables.
5. Check for identification (tag number system) distance placement of cable marker, cable joint etc. as per the cable layout drawing.
6. Check Earthing of cable structures.
7. Check clearances from ventilation duct and light fittings for cable structures.
8. Check proper fixing of cable structures.

m) INDOOR LIGHTING

1. Check dressing of cable.
2. Measurement of lux level at various places.
3. Check accessibility for replacement of lamps.
4. Checking for black spots or poor visibility near operating and indicating equipments.
5. Check for mechanical protection of cables.
6. Checking for adequacy of emergency DC light.
7. Checking for starting system of periphery lighting.
8. Check for auto switching of battery supply on failure of AC.
9. Checking of Earthing of light panel, socket boards, light fittings.

10. Checking of type of fittings with respect to specification at various locations.
11. Check adequacy of support of fittings.
12. Check water tightness of outdoor located panels.

n) EARTHING

1. Check tightness of all earth connections
2. Check earthling of all metallic equipments, cable trays, Busbar supporting structures, yard fencing steel structures of yard, rails, gates, building column (if steel) all elect. equipments, gas/oil/water pipe lines etc. as per the drawing / specification
3. Measurement of earth resistance for each electrode.
4. Measurement of total earth resistance.
5. Measurement of earth loop resistance for E/F path of biggest LT drive.

o) CONTROL, RELAY & METERING PANELS

1. IR value test by megger
2. Checking of control cable connection.
3. Operational test of all components mounted on control panel.
4. Testing and calibration of indicating meters
5. Testing of all relays including auxiliary relays for their pick up- drop values, operation at all taps (current, voltage and time) etc. as per the manufacturer's commissioning manuals with the help of relay testing kits.
6. Setting of relays as per approved setting table and checking its operation for one below and one upper settings, in the scheme.
7. Measurement of current and voltage in relay operating coils by secondary injection in CT and PT circuit at switchboard.
8. Measurement of current and voltage in relay and meter circuits during loading of the primary circuit/system
9. Testing of all schemes for their functions as per approved drawings
10. Checking stability of differential protection schemes
11. Checking inter changeability of similar equipments
12. Verification of accessibility of all operating points including resetting knob of relays

13. Check operation of each annunciation facias, operation of bell/hooter etc. and sequence of the system
14. Check operation of relays at minimum/maximum control voltage as per the specification
15. Integrated testing of protective relays for operation of master trip relays and tripping of breakers from Operation of master trip relay
16. Check dressing of cables, sealing of openings in gland plate and for provision of double compression glands
17. Check earthling connection of panels, fixing of panels and openings from side and bottom.
18. Checking and adjustment in tri-vector meters as per the manufacturer's instructions.

p) MISCELLANEOUS

1. Checking of continuity of the system
2. Checking of phase sequence from overhead line to consumer end
3. Checking safe accessibility of all operating points
4. Check availability of emergency lighting
5. Check availability of control/aux. supply
6. Ensure availability of first aid box, firefighting equipments, earth discharge rods, rubber mats, rubber glove
7. Check working of ventilation system for battery room - transformer room etc.
8. Check proper covering of cable channels.
9. Placement of shock treatment chart, danger boards, provision of boards indicating 'Man on Work, Do not switch ON', 'Do not switch OFF', 'Earthed', etc.
10. Check proper dressing of cables, mechanical protection of cables, placement of cable markers
11. Check sealing of all cable openings including conduit opening with fire resistance material
12. Check sealing of all openings at bottom of elect. panels.

[5] PAINTING

5.1 GENERAL

a) The primers & finishing paints will conform to latest Indian Standard or equivalent international standards. There shall be of approved quality and shade.

b) General precautions for painting such as preparation of surfaces, application of paints, inspection and testing etc. will be as per relevant clause of IS:1477 (Part I & II) and shall be followed, wherever possible.

c) General compatibility between primer and finishing paints recommended by the paint manufacturer, supplying these paints shall be followed.

d) General compatibility between successive coats must be ensured.

e) Unless otherwise specified, the general color scheme for finishing coats for different types of equipment and pipelines as per requirement of the Purchaser are to be followed. The color schemes, however, may be changed, if necessary, by the Purchaser at any stage before the start of the painting of the equipment.

5.2 PAINTING INSTRUCTIONS

a) In general, unless otherwise specified, all plant and equipment & pipelines will be given one coat of antirust primer, lacquers, etc. at the supplier's works after completing surface preparation to remove grease, rust, scales and other foreign materials. The second coat of antirust primer will be applied immediately after erection after completing requisite surface preparation) followed by two coats of finishing paint of approved quality & shade.

b) Technological structures, crane girders & other structures shall be given one coat of primer during manufacturer & one coat of primer after erection followed by two coats of finishing paint.

c) For equipment where original colour as per supplier's practice is desired, both primer & finishing coats will be applied at supplier's works before dispatch of equipment.

d) Structures embedded in concrete shall have no shop painting applied. The portion of the column that is to be embedded in concrete shall be given a coat of Portland cement slurry after thoroughly cleaning the surfaces from mill scale, grease & oil immediately after fabrication.

e) The portion of the structures embedded underground shall be given two coats of red leadg raphite primer at shop and finished with two coats of bituminous black paint of approved quality.

f) Machined/plained surfaces shall be coated with while lead and tallow before dispatch or before being put into open air & covered with gunny cloth.

g) Surfaces to be site welded shall have no shop paint applied within 100mm of welding zone. After site welding normal painting application will be followed.

h) Areas which become in-accessible after assembly shall be painted before assembly.

i) Cables & other electrical accessories shall have adequate antirust protection.

j) Chequered plates shall be given primer coats only.

k) The phosphate coated surface shall have one coat of baking based and two coats of finished paint of amino alkyd resin stone enamel.

l) External surface of pipe fittings shall be thoroughly cleaned by wire brushing and given two coats of red oxide zinc chromate primer at supplier's works & two coats of final synthetic enamel paint after erection.

m) The equipment which are to be dispatched in knocked down condition and require assembling at site, shall be given two coats of rust and corrosion preventive primer and one coat of synthetic enamel paint of approved quality and shade. After assembly at site, such equipment shall be given one final coat of synthetic enamel paint.

n) The equipment which can be sent as a single block unit duly shop assembled, shall be given full application of paint i.e. two primer coats of rust and corrosion preventive primer and two finish coats of paint of approved quality and shade as per relevant Indian Standards/equivalent international standards.

o) All painting shall be carried out by brushing or roller application with prior permission of the Purchaser.

p) All metal parts not accessible for painting shall be made of rust and corrosion resisting materials. Interiors of equipment will be suitably quoted with anti-rust compounds.

q) The fasteners shall not be painted. These will be dispatched with application of anti-rust compound.

r) Any special painting requirement indicated on the Contractor's drawings by the Purchaser during approval stage shall be binding.

5.2 SURFACE PREPARATION AND ENVIRONMENTAL CONDITIONS

a) All surfaces to be painted shall be thoroughly cleaned of dirt, grease, rust & mill scale.

Removal of rust & scale shall be by hand brushing, power driven wire brushes or by sand blasting, as the surface condition/service condition warrants.

b) The paint shall be applied on the metallic cleaned surface after it is perfectly dry but not later than 3 hours after cleaning of the surfaces. Reasonable time gap should be allowed between any two consecutive coats of primer or finishing coats.

c) Surfaces coming in contact with acid & acidic fumes alkalis, soda, detergents etc shall be cleaned thoroughly to get complete metallic surface as per IS;1477 Part I & II or BS 4232-1967. After sand blasting the surface shall be cleaned with cotton rags, soaked in benzene, to remove fine rust, grease, etc. No sand blasted surface shall be exposed to weather for more than 3 hours.

d) The choice of primer & finishing paint will depend on the environmental condition to which the plant & equipment & pipelines are exposed to.

e) Paints are to be applied on dry surface only under agreeable weather conditions. Painting in damp & foggy weather conditions will not be permitted.

f) For a selected primer the method of surface treatment best suited for that primer & suggestion of paint manufacturer shall be obtained and followed.

g) Zinc rich primer paints which have been exposed for a long time before the finishing coat is applied shall be washed down thoroughly to remove soluble zinc salt deposit.

h) The recommendation of paint manufacturer shall be forwarded to the Purchaser for approval.

5.2 PRIMER PAINT

a) In general, two coats of primer paints conforming to relevant Indian Standard or equivalent international standards shall be applied on all unmachined surfaces, except noted otherwise.

b) Where equipment is to be finish painted for dispatch, both coats will be applied before finishing coats at supplier's works.

c) Where equipment warrants finishing coat after erection, one coat will be applied just after manufacture at supplier's works and the second coat just after erection at site after surface cleaning.

d) Equipment on which primer coat has been damaged due to prolonged exposition at site, final erection or transport, shall be given two coats of primer at site before applying finishing coats. Before applying paint the surface will be thoroughly cleaned by sand paper.

e) The primer applied should be compatible in quality and colour schemes with the subsequent finishing coats.

f) Unless stated otherwise, the following primer paints shall be used depending upon the exposition and environmental condition to which the plant & equipment, structures & pipelines are exposed to :

- Aluminium zinc oxide - conforming to IS;2931
- Red oxide zinc chromate - conforming to IS;2074
- Heat resistant aluminum - conforming to IS:161 primer paint
- Air drying chemical resistant paint
- Epoxy resin paint (cold cured) -
- Poly urethene paint
- Chlorinated rubber based conforming to DEF-1402, Ministry of Defense

5.3 PRIMER PAINT

a) Two coats of finishing paint compatible with the primer and conforming to relevant Indian

Standard or equivalent international standards shall be applied on all un-machined surfaces

unless mentioned otherwise.

b) Unless noted otherwise, the following finishing paints will be applied on plant & equipment,

structure & pipelines depending upon the exposition and environmental conditions to which the plant & equipment, structures & pipelines are on subjected to:

- Synthetic enamel conforming to IS; 2932 exterior type
- Epoxy based finishing paint -
- Heat resistant silicon based Aluminium paint IS:161

c) The finishing paint shall be of approved colour. The undercoat shall have different tinge to distinguish from the finishing paint.

d) The surfaces of the equipment on which finishing coats of paint has been damaged due to prolonged exposition at Contractor's work, erection site, during transport, storage or final erection shall be thoroughly cleaned & touched up with the same paint as applied previously.

5.3 THICKNESS OF COAT OF PAINT

a) A single coat of paint when dry should have a thickness of 25 to 30 microns (0.025 to 0.030 mm) or 1 mil to 1.25 mils.

b) Total thickness of 4 coats (2 primer coats + 2 finishing coats) should have thickness of 100 to 125 microns (0.100 to 0.125 mm) or 4 to 5 mils.

c) In case of bituminous aluminum gilsonite based paint 3 coats are to be applied. The total thickness of 3 coats will be not less than 100 microns (0.100 mm) or 4 mils.

d) Immediately following the award of the Contract, the Contractor shall submit the names of the proposed paint supplier and applicator together with a quality assurance program for approval. All paints for one section shall be provided by one manufacturer and preferably shall be manufactured in one country to ensure compatibility.

[6] GENERAL REQUIREMENT

6.1 GENERAL

a) Name of coordinators with address, telephone/FAX numbers for all sub-contractors, pertaining to electrical job.

b) List of equipment/tools and manpower proposed to be arranged for installation erection and site handling of the equipment.

c) Name of site in-charge with office/ organization and date of opening of site office.

d) Quality control manuals

e) Detailed list of drawings and documents containing information on current state of the project.

f) Monthly progress report furnishing status of

- Planning
- Manufacture
- Transport
- Erection
- Testing & commissioning

6.2 FOR APPROVAL

A. CALCULATIONS

1. Relay settings with calculations and graph for justification of all relay settings (current, voltage and time).
2. Calculation to justify generator CT/PT parameters like VA burden, knee point voltage etc. for all cores.
3. Calculations for Required battery capacities of the UPS system.
4. Calculations for voltage drop and short time rating of cables to prove adequacy of sizes.
5. Calculation for Neutral grounding transformer and secondary resistance.
6. Calculation of lux levels of Control Room, Machine hall and other floors
7. Calculations for short time withstand of transformers.

8. Calculations for design of supporting structures for outdoor switchyard regarding wind pressure, short circuit forces etc.

B. OTHERS

1. Single line diagram indicating transformers, breaker, CT/PT, all relays, meters, LA, cable sizes, details of CT/PT ratio, VA burden, Vk value, type and make of all relays, their range, nominal and short time ratings of bus bars, etc. for all equipment.
2. Front view and GA diagrams for all panels.
3. Control and schematics drawings for local/remote control/protection for each equipment and drives.
4. Drive list.
5. Synchronization schemes.
6. Auto change over arrangement.
7. Logic diagrams for start/stop of various mechanism/drives.
8. Lighting layout for Control Room and other areas. Type of fittings, wiring arrangement, switching of fittings and single line diagram from board to fittings.
9. Details of protection logic (class A,B&C tripping) indicating list of electrical and mechanical protection leading to tripping of turbine generator, field breaker, etc.
10. Equipment Earthing layout drawing
11. Electrical equipment layout for all electrical premises.
12. Cable structure layouts with size of structures for gallery and cable channels of different places
13. Sequence of inspection plan and despatch of materials to site.
14. List of drawings, numbering system, size, proposed date of submission (To be submitted just after LOI).
15. Installation drawings of all equipment with

- Layout of equipment
- Layout of Cabling
- Illumination drawings
- Earthing Layout.

6.3 FOR INFORMATION

1. Details of painting for all equipment
2. Bus wire arrangement for control/signal/annunciation and heater supplies of control panels and switch boards.
3. Cable schedule indicating type of cables, from to via. route, total length, size of each cable and a final summary sheet indicating total requirement of all types of cables (for control and power both).
4. Core wise control cable termination details indicating ferrule no./terminal block no. for each cable/each equipment.

5 Internal wiring diagrams for all panels.

6. VI characteristics and RCT values of CTs used in differential protection.
7. Cable layout drawings.
8. Technical particulars of all LT motors and recommended protection.
9. Catalogues for each type of equipment, relays, meters etc.
10. Installation and commissioning manuals for each equipment, relay etc.
11. Operation and maintenance manuals indicating trouble shooting procedure for all equipment.
12. Type test certificates for all the major equipment.
13. Details of test results conducted at works for all equipment in bound Volume
14. Details of test results conducted at site for all equipment in bound Volume
15. Spare part list number and ordering procedure for all recommended spares.
16. Details of transport arrangement and maximum size of transportable section (weight and overall dimensions).
17. Details of agency proposed to be fixed for doing erection commissioning job.
18. Panel wise bill of material indicating type make and brief technical particulars of all items/ accessories mounted on the panels.
19. Overall GA of all the panels/equipment
20. Fixing details of all the panels/equipment, supporting structures, etc.
21. Heat loss for each equipment.

22. Static and dynamic loading of each equipment
23 Floor cutouts and wall opening details for cables bus duct, air conditioning ducts, light conduits, exhaust fans etc.
24. Details and location of various inserts base plates, bolts etc. required to be provided for support of cable structure, bus duct electrical panel, etc.
25. Conduit layout drawing indicating type, size, length and locations of conduits required to be placed in RCC wall/floor, brick wall.
26. Technical data sheet for each type of motors and characteristic curves for protection settings.
27. As built drawings incorporating site changes along with soft copies in CD.

ANNEXURE-A

COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the 'schedule of deviations'.

3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

ANNEXURE – B

SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Section / Page No.	Clause No.	Deviation	Reason / Justification

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Tenderer's Stamp & Signature

1	**Technical Qualifying Requirement**		
1.1	The bidder to furnish relevant documents for meeting the qualifying requirement. Performance certificates shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/No
1.2	The bidder's scope includes supply and services such as Supervision of installation, Testing and commissioning.	Confirmed	Yes/No
2	**Un-priced BOQ**		
2.1	Confirm that all items have been quoted separately. (If any item has not been quoted, the same shall be specifically brought out with technical reasons thereof) Record the same in schedule of technical deviations.	Confirmed	Yes/No
3	**Technical**		
3.1	Minimum Number of auxiliary contacts on each Circuit Breaker - Besides requirement of technical specification, the manufacturer shall wire up 10 NO + 10 NC contacts of each phase/ pole exclusively for purchaser's use and shall be wired up to common marshalling box of 110kV CB.	Confirmed	Yes/No
3.2	TB's for (for incoming AC Power Cables) shall be suitable for size 4Cx16 Sqmm Al (minimum).	Confirmed	Yes/No
3.3	Catalogues, indicative OGA of the offered equipment is attached.	Enclosed with bid	Yes/No
4	**Technical Deviations**		
4.1	Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned elsewhere in the bid will not be considered.	Confirmed	Yes/No
5	**GTP**		
5.1	All equipment being supplied shall conform to Gurantee Technical Particulars as per technical specification and applicable IS / IEC	Confirmed	Yes/No
6	**TYPE TESTS REQUIREMENTS**		
6.1	All equipment being supplied shall conform to type tests as per 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-a-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

Date:

Bidder's Stamp & Signature

Contact Details:

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

1.	For any **technical clarification**, please contact Mr. Vyom Kumar, Dy. Manager (TBEM). Contact No. 0120-06748597; e-mail: vyom@bhel.in
2.	For any **commercial clarification**, please contact Mr. Sandeep, Dy. Manager (TBMM). Contact No. 0120-6748540; e-mail: kumar.sandeep@bhel.in
3.	**Terms of Payment:**

(Supply & Services)

As per GTC of GeM (Payment due date shall be as per GEM)

Supply Payment:

a) 95% of payment from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows:
   - LR / GR duly endorsed by BHEL Site Official.
   - Material Receipt Certificate issued by BHEL Site Official.
   - GST Compliant Tax Invoice
   - Packing List (Case-wise)
   - Copy of Transit Insurance Certificate from underwriters.
   - Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management
   - Guarantee Certificate
   - Copy of Performance Bank Guarantee (PBG)
   - Certificate of acceptance of Type Test Reports issued by BHEL Engineering Management wherever specifically mentioned in the Purchase Order

b) 5% of payment days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows:
   - Certificate of successful completion of Supervision of Erection, Testing & Commissioning at Site if it is in the scope of the supplier or Certificate of successful completion of Testing & Commissioning at Site if it is in the scope of the supplier.
   - Certificate of completion of final documentation as per Purchase Order / Technical Specification issued by BHEL Engineering Management

Note: In-case commissioning is delayed beyond reason not attributable to supplier. Supplier may claim the balance 05% of supply portion after 12 months from the date of last delivery upon submission of BG with equivalent amount and the certificate endorsed by BHEL Site In-Charge citing the details that the "delay in commissioning is not attributable to supplier".

Vendor has to submit the duly signed check-list along with Bill.

Payment terms for supervision of ETC: 100% payment along with applicable GST from the date of receipt of complete GST compliant Tax invoice along with certificate of successful completion of Testing & Commissioning at Site issued by BHEL Site Official / Construction Management in 3 sets (Original + 2 copies).

Note: Service charges like Supervision should not exceed 2% of the total contract value.

4.	**Terms of Delivery:**

As per GeM. However, unloading at site is in the scope of BHEL. Bidders to quote price accordingly.

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

5.	**Delivery Time:**
33 Weeks (231 days) from the date of PO by BHEL as per Activity schedule (Annexure-A). Early Delivery is acceptable. **Note:** In case, BHEL's delivery requirement is not met by vendor(s), then a chance may be given to all such vendors to review their quoted delivery schedule in line with BHEL's delivery requirement. However, if vendor fails to meet the requisite delivery plan, then BHEL reserves the right not to consider the offer of such vendor(s).	
6.	**Prices:**
The quoted prices shall be on **Firm basis including packing and forwarding charges**. Price to be quoted as inclusive of GST. i.e. Ex-Works + F&I + GST.	
7.	**Liquidated Damage of delayed Delivery:**
As per GeM terms and conditions.	
8.	**Item & BOQ:**
BOQ: As per Clause No. 3 of Section-1 of Technical specification.	
9.	**Technical Specification:**
Technical specification no**. TB-417-316-101 Rev-00.** No permissible Technical Deviation has been envisaged. Bidders to quote as per Technical Specification.	
10.	**Pre-Qualification Requirement:**
As specified in Technical Specifications	
11.	**MQP (Manufacturing Quality Plan):**
MQP format is indicative only, however inspection shall be carried out as per approved Quality Plan. Supplier has to submit Quality Plan to BHEL for Customer approval.	
12.	**Inspection:**
Inspection shall be carried out as per customer as per approved Quality Plan.	
13.	**Destination / Delivery Location**:
Stores Officer Kodayar Sub Store Kodayar Lower Camp, Kanyakumari District, Pin Code: 629102, GSTIN 33AADCT4784E1ZC	
14.	**Bill to Address:**
Bharat Heavy Electricals Limited-TBG, 10th Floor, Plot No.C-20/1A/1, Joy Tower, Sector-62, Noida-201301, U.P. **GSTN**-09AAACB4146P2ZC	

15.	**Guarantee Clause (Defect Liability Period):**
The equipment / material supplied and services rendered (if applicable) shall be guaranteed to be free from all defects and faults in design & engineering, material, workmanship & manufacture and in full conformity with the Purchase Order / Contract, Technical Specifications & approved drawings / data sheets, if any, "Twenty-Four (24) months from the date of taking over of the Facilities (10.01.2024) or twelve (18) months from the date of last delivery (or any part thereof), whichever is later".	
16.	**Performance Bank Guarantee:**
Performance BG to be kept valid till the completion of guarantee period i.e. **Twenty-Four (24) months from the date of taking over of the Facilities (10.01.2024) or twelve (18) months from the date of last delivery (or any part thereof), whichever is later"**.	

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

"Bidder agrees to submit performance security required for execution of the contract within the time period mentioned. In case of delay in submission of performance security, enhanced performance security which would include interest (SBI rate + 6%) for the delayed period, shall be submitted by the bidder. Further, if performance security is not submitted till such time the first bill becomes due, the amount of performance security due shall be recovered as per terms and conditions defined in NIT / Contract, from the bills along with due interest."	
17.	Bidders to ensure that Third party / customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document / certificate issuing authority such as name & designation of Issuing Authority and its organization contact number and e-mail Id etc. In case the same found not available, Purchaser has right to reject such document from evaluation.
18.	**Acceptance of Offer:**
Bidder's offer will be technically acceptable subject to final acceptance of vendor by ultimate customer as approved supplier. Price Bid will be opened only for those bidders in respect of which vendor approval is received from TANGEDCO Kodyar. Necessary credentials/documents to be submitted for approval by Customer as per format.	
19.	**Deviations:**
a) Technical Deviation: No Technical Deviation is envisaged. b) Commercial Deviation: No Commercial Deviation is envisaged.	
20.	All other terms & conditions shall be as per GTC of GeM

Signature & Seal of supplier

Date

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

ACTIVITY SCHEDULE FOR MAIN ITEMS

Annexure-A

SL. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS
1.	Submission of documents necessary for getting manufacturing clearance Drawings, data sheets (In scope of vendor)	04
2.	Review and Approval of documents and issue of manufacturing clearance (In scope of BHEL)	06
3.	Manufacturing Time (In scope of vendor)	20
4.	Inspection (In scope of BHEL)	01
5.	Issue of MICC (In scope of BHEL)	01
6.	Dispatch (In scope of vendor)	01
7.	Supervision activity considered from the date of PO/Contract (33 Weeks for supply + 07 Weeks for site readiness + 12 Weeks for services)	52 Weeks

Note – 1 - Supplier to ensure every revised submission incorporating comments within 2 weeks from the date of comments by BHEL.

1. Inspection call to be issued 2 weeks in advance.
2. Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier.
3. Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.

Signature & Seal of Supplier
Date

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

Annexure-V

Item/Package Name :	**Supply & Supervision of ETC for Isolators**
Enquiry No.:	
Project:	**TSGENCO Kodyar**
Type of project	**Hydro**
Percentage of Local Content	***(Bidder to enter the applicable % of local content)***

Format of Self certification regarding Local Content in line with PPP-MII order, 2017 & its revision dated 04.06.2020.

Date:……

I _____S/o, D/o, W/o, _____Resident of _____ hereby solemnly affirm and declare as under:

That I will agree to abide by the terms and conditions of the Public Procurement (Preference to Make in India) Order, 2017 (*hereinafter PPP-MII order*) of Government of India issued vide Notification No: P-45021/2/2017-BE-II dated 15/06/2017, its revision dated 04/06/2020 and any subsequent modifications/Amendments**,** if any**.**

That the information furnished hereinafter is correct to the best of my knowledge and belief and I undertake to produce relevant records before the procuring entity/BHEL or any other Government authority for the purpose of assessing the local content of goods/services/works supplied by me for …… *(Enter the name of the Equipment/Item for Project)*.

That the local content for all inputs which constitute the said goods/services/works has been verified by me and I am responsible for the correctness of the claims made therein.

That the goods/services/works supplied by me for …… (Enter the name of the Equipment/Item for Project) contains…….% (mention the Local content in %age) Local Content.

That the value addition for the purpose of meeting the 'Minimum Local Content 'has been made by me at …… (*Enter the details of the location(s) at which value addition is made)*.

That in the event of the local content of the goods/services/works mentioned herein is found to be incorrect and not meeting the prescribed supplier class categorization criteria as per said order, based on the assessment of procuring agency (ies)/BHEL/Government Authorities for the purpose of assessing the local content, action shall be taken against me in line with the PPP-MII order and provisions of the Integrity pact/ Bidding Documents.

I agree to maintain the following information in the Company's record for a period of 8 years and shall make this available for verification to any statutory authority.

i. Name and details of the Local Supplier
(Registered Office, Manufacturing unit location, nature of legal entity)
ii. Date on which this certificate is issued

Annexure-V

iii. Goods/services/works for which the certificate is produced

iv. Procuring entity to whom the certificate is furnished

v. Percentage of local content claimed and whether it meets the Minimum Local Content prescribed

vi. Name and contact details of the unit of the Local Supplier (s)

vii. Sale Price of the product

viii. Ex-Factory Price of the product

ix. Freight, insurance and handling

x. Total Bill of Material

xi List and total cost value of input used to manufacture the Goods/to provide services/in construction of works

xii. List and total cost of input which are domestically sourced. Value addition certificates from suppliers, if the input is not in-house to be attached

xiii. List and cost of inputs which are imported, directly or indirectly

For and on behalf of…… (Name of firm/entity)

Authorized signatory (To be duly authorized by the Board of Directors)
<Insert Name, Designation and Contact No.>

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

SCHEDULE OF COMMERCIAL DEVIATION

The following are the deviations/ variations exception from the General Terms and Conditions:

SL. NO.	CLAUSE NO. OF TERMS AND CONDITIONS	STATEMENT OF DEVIATION
	NIL DEVIATION	NIL DEVIATION

In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the General Terms and Conditions.

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

Note : 1. Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

2. Deviation mentioned in this schedule shall only be considered.

This Format is to be submitted in original duly signed by bidder. Reproduction of the same in any sort is not acceptable.

Signature of the authorized representative of

Place: é é é é é é é

Bidder's name
Date : é é é é é é é .
:é é é é é é é é é é é é é é é
Designation:é é é é é é é é é é é é é é é
..
Company
Seal:é é é é é é é é é é é é é é

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations/ variations exception from the Technical Specifications:

SL. NO.	CLAUSE NO. OF TERMS AND CONDITIONS	STATEMENT OF DEVIATION
	NIL DEVIATION	NIL DEVIATION

In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the Technical Specifications,

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

Note : 1. Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

2. Deviation mentioned in this schedule shall only be considered.

This Format is to be submitted in original duly signed by bidder. Reproduction of the same in any sort is not acceptable.

Signature of the authorized representative of

Place: é é é é é é é .
Date : é é é é é é é .

Bidder's name :é é é é é é é é é é é é é é é
Designation:é é é é é é é é é é é é é é é ..

PROJECT:	**TANGEDCO Kodyar**
ITEM:	**Supply & Services of CIRCUIT BREAKERS**
SUBJECT:	**BID SPECIFIC ATC**

UNPRICED BID

Item No.	Item Description	Item Quantity	Unit of Measure	Unit Price (Inclusive of F&I & GST)	GST % Applicable
1	SUPPLY- CIRCUIT BREAKER: 110KV, 40KA FOR 3S, 25MM/KV CREEPAGE, 1250A, 3-PHASE CIRCUIT BREAKER ALONG WITH SUPPORT STRUCTURE, INTERPOLE CABLES, OPERATING MECHANISM, MARSHALLING BOX, CONTROL BOXES AND ALL ACCESSORIES COMPLETE IN ALL RESPECT.	03	SET	Mention as "Quoted"	Mention GST %
2	SUPPLY- CIRCUIT BREAKER: 110KV, FOUNDATION BOLTS FOR COMPLETE 3-PHASE CIRCUIT BREAKER ASSEMBLY (STRUCTURE, CONTROL CUBICLE PLATFORM AND/OR LADDER)	03	SET	Mention as "Quoted"	Mention GST %
3	SUPPLY- CIRCUIT BREAKER : SF6 GAS FILLING ADOPTER, INCLUDING COUPLING , REGULATOR, CONNECTING HOSE PIPE UP TO GROUND LEVEL.	01	SET	Mention as "Quoted"	Mention GST %
Supervision of ETC					
Item Number	**Item Description**	**Item Quantity**	**Unit of Measure**	**Unit Price (Inclusive of GST)**	**GST % Applicable**
4	SERVICES- CIRCUIT BREAKER : 110KV, 40kA FOR 3S SUPERVISION OF ERECTION TESTING AND COMMISSIONING OF CIRCUIT BREAKER	03	LOT	Mention as "Quoted"	Mention GST %

Signature & Seal of Supplier
Date: