TECHNICAL QUALIFICATION REQUIREMENT

Name of Project: 110KV Switchyard for RMU of Kodayar Power House-1

Name of Customer: Tamilnadu Generation and Distribution Corporation Limited

Name of Item: 110kV, 1250A, 0.5mH Wave trap

TECHNICAL QUALIFICATION REQUIREMENT
The manufacturer whose equipment is being offered should have designed, manufactured and supplied 110kV Wave trap or higher voltage class Wave trap as on the original date of technical bid opening of this tender.

SUPPORTING DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH TECHNICAL BID		
Sr	**Required Criteria**	**Supporting Documents**
1	Manufacturing	Approved Drawings / GTP / Approved Quality Plan / Factory Inspection Test Report etc. stabilising bidder as manufacturer of offered item in line with TQR
2	Supply	PO / Dispatch clearance / LR / Material Receipt certificate at site / installation or commissioning certificate etc. stabilising bidder as proven supplier of offered item in line with TQR

NOTES (GENERAL POINTS):

1. Consideration of offer shall be subject to customer's approval of bidder's, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self- attested English translated document should also be submitted.
3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
4. After satisfactory fulfilment of all the above criteria / requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

4/04/22 PREPARED BY

4/04/22 REVIEWED BY

4.4.22 APPROVED BY

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

Document No.	TB-413-510-101	Rev No.-00	Prepared	Checked	Approved
Type Of Document.	Technical Specification	NAME	YLK	YLK	VK
TITLE		SIGN			
		DATE			
110kV, 1250A,0.5mH Wave Trap		GROUP	TBEM	W.O. No	
CUSTOMER	Tamilnadu Generation and Distribution Corporation Limited				
PROJECT	110KV Switchyard for RMU of Kodayar Power House-1				

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To		O/C	TBMM		
	Copies	-	1	4		

SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 400kV Wave Traps complete with accessories as listed under this specification.

This section covers the specific technical requirements of Wave Trap. This constitutes minimum technical parameters for the above item as specified by the customer (TANGEDCO). The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

The specification comprises of following sections:

Section-1: Scope, Specific Technical Requirements & Bill of Quantities
Section-2: Equipment Specification
Section-3: Project Details & General Technical Requirements
Section-4: Guaranteed Technical Particulars
Section-5: Checklist

- In case of any conflict between various sections, **order of precedence** shall be in the same order as listed above.

1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of customer: Tamilnadu Generation and Distribution Corporation Limited

Name of Project: 110KV Switchyard for RMU of Kodayar Power House-1

Refer Section - 3 for Project Details and General Specifications.

1.2 PRE-QUALIFYING REQUIREMENTS

As per Annexure TQR.

1.3 SPECIFIC TECHNICAL REQUIREMENTS

Sl. No.	Technical Parameters	Value
i)	Rated System Voltage	110 kV
ii)	Highest System Voltage	132 kV
iii)	Rated Power Frequency	50 Hz
iv)	Rated continuous current at 40 degree Centigrade ambient	1250 Amps
v)	System short time current for three second.	40 KA
vi)	Maximum symmetrical short circuit current rating (one second)	40KA
vii)	Asymmetrical Phase value of the first half wave of the short time current	102KA

viii)	Nominal discharge current of protective devices at 8/20micro sec. wave.	10 KA
ix)	Type of tuning	Broad band
x)	Carrier frequency blocking Range	--
xi)	Minimum resistive component of impedance within the rated blocking band width	> 940 ohms for 200/500kHz > 1000 ohms for 210/500kHz
xii)	Rated inductance of main coil	0.5 mH
xiii)	Radio interference voltage at 97 kV (r.ms.)	Not more than 500 micro volts
xiv)	Rated blocking Band width.	200-500 kHz or 210-500kHz
xv)	Capacitance of CVT	13200pF
xvi)	Dynamic limiting current	102A (peak)
xvii)	Attenuation in the tuned frequency band	>7.6dB
xviii)	Attenuation at a distance of 10kHz from the tuned frequency band	>7.6dB

Note: Please refer Annexure-1 of section -1 for detailed equipment specification received from TANGEDCO.

1.4 QUANTITIES

Sl. No.	Description	Quantity
1.	110kV, 1250 A, 1-ph, 0.5 mH Wave Trap suitable for pedestal mounting	1 No.
2.	Terminal Connectors for 110 kV Wave Trap (suitable for Bersimis/Moose conductor*)	1 Set

Each Wave Trap is required with following **accessories**

(a) Hardware (Nuts, Bolts and Washers) for mounting Wave Trap – 1 set with Each Wave Trap
(b) Grading ring, if necessary – 1 set with Each Wave Trap

* The final requirements of terminal connectors will be furnished to the successful bidder during contract stage.

1.5 TYPE TESTS

The offered equipment should have been successfully type tested as per relevant IS/IEC and valid test reports shall be submitted. Bidder shall submit valid reports of type tests for Wave Trap, carried out within last five years from the date of bid opening. If these tests have been conducted more than five years prior to the abovementioned date or do not have valid test report, the type test shall be repeated with no extra cost to BHEL/SJVNL.

1.6 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each Wave Trap in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and SJVNL in accordance with agreed quality plan with 3 weeks advance information.

Type test reports on identical rating shall be submitted for approval. In event of non-acceptability of submitted test reports on technical grounds at the contract stage, the type tests shall be conducted at no additional cost.

1.7 QUALITY PLAN

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirements shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval.

LINE TRAPS:

SL.NO.	DESCRIPTION	PARTICULARS
1.	Name of the manufacturer and country of origin.	
2.	Type	: 0.5/1250
3.	Continuous current rating.	: 1250 Amps
4.	a. Maximum symmetrical short circuit current rating (one second)	: 40 KA
	b. Asymmetrical phase value of the first Half wave of the rated short time current.	: 102 KA
5.	Inductance	: 0.5 mH
6.	Whether the line trap is narrow or broad band.	: Broad Band
7.	Frequency blocking range	: 200/500 KHz or 210/500KHz
8.	The number of frequency to which the trap can be tuned on parallel resonance.	: As above
9.	a. Impedance at tuned frequency for various band width.	: >940 ohms for 200/500KHz & >1000 ohms for 210/500 KHz
	b. Resistive component of the blocking Impedance for various band width	: >940 ohms for 200/500KHz & >1000 ohms for 210/500 KHz
10.	Change in impedance per deg. C change in Ambient temperature.	: Negligible
11.	Change in resonant frequencies due to ambient temperature variation (Per deg. C)	: Negligible
12.	Dynamic limiting current.	:102 Amps (peak)
13.	Attenuation in the tuned frequency band.	: >7.6 dB
14.	Attenuation at a distance of 10 KHz from the tuned frequency band.	: >7.6 dB

PROTECTIVE DEVICE

SL.NO.	DESCRIPTION	PARTICULARS
	I. DRAINAGE COIL:	
1.	Manufacturer's name	
2.	Type	Dry Type
3.	Inductance	40 mH
4.	Q factor	>30
5.	Rated current	1 Amps
6.	maximum current	50 A for 0.2 secs
	II. LIGHTNING ARRESTER:	
1.	Manufacturer's name	Reputed make - Gapped
2.	Type	Air cooled
3.	Rated voltage	1000 volts
4.	Setting voltage	1500 volts
5.	Limiting current	5 kAp
6.	Impulse spark over voltage	4200 kVp
7.	Residual voltage at 10 KA	Not applicable
	III. GROUNDING SWITCH:	
1.	Rated voltage	10 kV
2.	Rated current	200 Amps

SECTION-2

EQUIPMENT SPECIFICATION

2.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and despatch of Line Traps. No deviation from the requirements specified in various clauses of this specification shall be allowed.

2.1 APPLICABLE STANDARDS

The Line Traps shall comply with applicable parts of the following standards, except as otherwise specified herein:

IEC: 60099(Part –1 and 4)	Surge arrester
IEC: 60353	Line Trap.
IS 8792	Line Traps.
IS 8793	Method of Tests for Line Trap.
IEC: 60	High Voltage Test Techniques.
IS 3070 (Part I)	Specification for Surge Arresters for AC System.
IS 5561	Specification of electric power Connectors.

The equipment shall also meet with following International publication on the subject:

CIGRE	319- 1962
CIGRE	35-01-1974
IEEE (USA)	Vol.83 No.7 PAS

The equipment shall conform to the latest applicable standards and their amendments.

2.2 FEATURES

2.2.1 General Description

The wave traps offered shall be complete with tuning devices. These shall be suitable for 420KV three phase neutral solidly grounded systems and prevent undue loss of carrier signal for all power system conditions. The wave trap should offer negligible impedance to any frequency of 50 Hz and high impedance to any frequency band appropriate to the carrier communication.

2.2.2 Construction

The wave traps shall be designed and manufactured to withstand, without damage under service conditions, the effects of external short circuits. The wave traps should be robust in construction and shall be capable of withstanding the electromagnetic forces and thermal effects of the rated short time current for a duration of one second after previous operation at rated continuous current at the specified maximum air temperature.

2.2.3 Frequencies for PLCC

Power line carrier communication, the frequencies for Dhalkebar feeders shall be finalized during detailed engineering.

2.2.4 General Technical requirements

a) Wave traps consisting of a main coil in the form of inductor, a tuning device and a protective device shall be inserted into transmission line to prevent undue loss of carrier signal for all power system conditions. Its impedance shall be negligible at power frequency (50 Hz) so as not to disturb power transmission but shall be relatively high over the frequency band appropriate to carrier transmission.

b) The surge arrester shall be station class current limiting ~~active gap /~~ gap-less type. Its rated discharge current shall be 10 ~~/ 20~~ kA. Co-ordination, however, shall be done by taking 20kA at 8/20 micro sec discharge current into account. Bidder has to furnish full justification in case the gap-less metal oxide arrester is recommended at contract stage. The SA provided with line trap of each rating shall fully comply with the requirements of IS 3070 Part-I/ IEC-60099-1Part-1/IEC-60099-4. The SA provided with the line trap shall be subjected to routine and acceptance tests as per IEC-60099-1 (Part-1) /IEC-60099-4.

c) Wave trap shall consist of a main coil designed to carry continuously the rated current without exceeding the limit of temperature rise. It shall be supplemented with a protective device and tuning device. Also, suitable corona rings shall be provided to meet corona and radio interference performance.

d) Wave trap shall be broad band tuned for its entire carrier frequency range. Resistive component of impedance of the wave trap within its carrier frequency blocking range shall not be less than 450 ohms.

e) Wave trap shall be provided with a protective device in the form of surge arresters which shall be designed and arranged such that neither significant alteration in its protective function nor physical damage shall result from either temperature rise or the magnetic field of the main coil at continuous rated current or rated short time current. The protective device shall neither enter into operation nor remain in operation, transient actuation by the power frequency voltage developed across the wave trap by the rated short time current. The protective device shall be shunt connected to the main coil turning device.

f) The surge arrester shall be station class metal oxide type. Its rated discharge current shall be 10 KA.

g) The surge arrester provided with the wave trap shall fully comply with the requirements of IS-3070. It shall conform to type tests as applicable and type test certificate for the same shall be submitted by the Bidder.

h) The surge arrester provided with the wave trap shall be subject to routine and acceptance tests as per IS-3070.

i) The wave trap shall show no visual corona discharge at 320 KV rms power frequency voltage. Suitable corona rings shall be incorporated in the wave trap.

j) Wave trap shall be equipped with the bird barriers and shall be painted.

k) The wave traps offered shall be complete with tuning devices. These shall be suitable for 420KV three phase neutral solidly grounded system and prevent undue loss of carrier signal for all power system conditions. The wave traps should offer negligible impedance to any frequency of 50 Hz and high impedance to any frequency band appropriate to the carrier communication.

l) Wave trap shall be spray painted with light gray paint (Shade 631 of IS:5).

2.2.5 Terminal Connector

i)	Terminal connectors shall conform to IS:5561/relevent IEC/
ii)	a) Terminal connectors for conductor shall be suitable for either horizontal or vertical takeoff of the conductor. Sub conductor spacing for bundle shall be intimated to the successful Bidder. *b)* The wave trap shall be suitable for connecting to ACSR Quad Moose conductor with horizontal or vertical takeoff.
iii)	No part of clamp or connector (including hardware) shall be of magnetic material.
iv)	All castings shall be free from blow holes, blisters, cracks and cavities. All sharp edges shall be blurred and rounded off.
v)	Clamps and connectors shall be designed corona controlled. Visual corona extinction voltage shall not be less than 320 KV (rms). All nuts and bolts shall be suitably shrouded.
vi)	Radio interference voltage of clamps/connectors shall not exceed 1000 micro volts at 320 KV (rms).
vii)	Clamps/connectors shall be designed for the same current ratings as wave trap and temperature rise shall not exceed 35 deg. centigrade over 40 deg. centigrade ambient. No current carrying part shall be less than 10 mm thick.
viii)	Clamps/connectors shall conform to type test and shall be subjected to routine tests as per IS. Test reports shall also be submitted for following additional type tests.
	a) Visual corona extinction test.
	b) Radio interference voltage measurement.

2.2.6 Mounting

The wave trap shall be suitable for outdoor pedestal mounting and shall be mechanically strong enough to withstand the stresses due to maximum wind pressure. For pedestal mounting, each wave trap shall be mounted on a tripod structure formed by three insulator stacks arranged in a triangular form. All the accessories and hardware, mounting arrangement including bolts for fixing the wave trap on insulators shall be of non-magnetic material and shall be supplied by the Bidder. Support structures and insulator stacks shall also be provided by the Bidder.

2.2.7 Temperature Rise

The maximum temperature rise of any part of the wave trap in service under given site conditions and at continuous full load current should not exceed the limits prescribed in IS-8792 for that particular class of insulation. The Bidder should clearly mention the class of insulation provided for the wave trap.

2.2.8 Rating Plates

Each Line Traps shall be provided with anodized aluminium rating plate of thickness not less than 2 mm, secured permanently on the main coil, tuning device and protective device as per clause 15 of IEC: 353.

The inscriptions shall be indelibly marked. The rating plate shall include the following data:

a)	Rating Plate of Main Coil
i)	Manufacturer's name and year of manufacture.
ii)	Type.
iii)	Manufacturer's serial number
iv)	Rated inductance in mH.
v)	Rated continuous current in amperes.
vi)	Rated power frequency in hertz (Hz).
vii)	Rated short time current in kA and duration in seconds.
viii)	Total weight in kg.
ix)	Purchase Order Number
b)	Rating Plate of Tuning Device
i)	Manufacturer's name and year of manufacture.
ii)	Type.
iii)	Manufacturer's serial number
iv)	Blocking impedance in ohms.
v)	Blocking resistance in ohms.
vi)	Frequency band in KHZ.
vii)	Rated impulse protective level (kV).
viii)	Purchase Order Number.
c)	Rating plate of protective device :
i)	Manufacturer's name and year of manufacture.
ii)	Type.
iii)	Manufacturer's serial number
iv)	Voltage rating
v)	Nominal discharge current of the arrestor.
vi)	Purchase Order Number

2.2.9 WELDING

All the welding included in the manufacture of line traps shall be performed by personnel and

procedure qualified in accordance with ASME-IX and all the critical welds shall be subjected to NDT as applicable.

2.3 TESTS

The Line Traps, Connectors & Surge Arresters shall be accompanied by Type, routine and acceptance testing as per latest IS/ IEC standards.

The Bidder shall only submit the certificates from Govt. approved labs/ accredited laboratories of the type tests listed under Category -II for the respective equipment which should have been carried out within last five (5) years from the date of bid opening **09.02.2018**. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct the test without any financial implication to purchaser.

Wave trap shall conform to the type test as per IEC-353. Type test certificate for the following tests shall be submitted by the bidder. The type test certificate from the manufacturer shall only be acceptable All valid type test reports as per latest IS/ IEC for Line Traps shall be submitted for approval at contract stage, which shall include the following.

1	Measurement of rated inductance of main coil.
2	Measurement of temperature rise.
3	Impulse voltage test.
4	Short time current test.
5	Measurement of blocking resistance and blocking impedance.
6	Measurement of tapping loss and tapping loss based on blocking resistance
7	Measurement of radio Influence Voltage
8	Power frequency voltage test on Tuning Device.
9	Measurement of power frequency inductance of the main coil

The SA provided with the WT of each rating shall fully comply with the requirement of IS: 3070 Part-1 & IEC-60099-1/IEC-60099-4. It shall conform to type tests as applicable & type test certificate for the same shall be submitted by the Bidder for approval. The SA provided with Line Trap shall be subject to routine & acceptance tests as per IEC-60099-1/IEC-60099-4.

Bidder shall also submit type test charges for conducting type tests on Line Traps, Connectors & Surge Arresters in the event of these tests being conducted even after availability & approval of valid type tests reports. Such tests shall be conducted on payable basis.

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.

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

	WAVE TRAPS	110 kV
1	Name of manufacturer and country	:
2	Type Model and Catalogue No	:
3	System Voltage Rating	:
4	Continuous current rating at 50° C ambient	:
5	Continuous current rating at 65° C ambient	:
6	Maximum Symmetrical short circuit current rating for 1 sec Duration	:
7	Asymmetric peak value of first half wave of rated short time current	:
8	Rated Inductance	:
9	Blocking Range	:
10	Minimum Guaranteed Resistive Component in Blocking frequency range	:
11	Type of Tuning	:
12	Variation in 50Hz Impedance per Degree Centigrade variation in ambient temperture	:
13	Variation in Resonant frequency band per degree centigrade variation in ambient temperature	:
14	Details of protection of capacitors and coils against voltage surges indicate type of protective device.	:
15	Basic Insulation level	:
16	Standard Nominal Discharge Current of Protective Device for 8/20 Micro second wave impulse	:
17	Rated voltage of the Arrestor (Protective device)	:
18	Min. value of power frequency sparkover voltage (Dry and wet) of protective devices	:
19	Maximum 1.2/50 usec Impulse Sparkover voltage of protective device	:

GUARANTEED TECHNICAL PARTICULARS

20	Virtual steepness and max front of wave impulse sparkover voltage of protective device	:
21	Max. residual discharge voltage of protective device for 8/20 usec impulse discharge current of	
	(a) 5000 Amps	:
	(b) 10000 Amps	:
22	Class of Insulation of line traps as per table - 1 of IEC 353	:
23	Temperture Rise in line trap under rated continuous current	:
24	Visual corona Extinction voltage	:
25	Radio Interference voltage	:
26	Type of incoming and outgoing terminals	:
27	Visual corona Extinction voltage for terminal concurrence	:
28	Radio interference voltage in terminal connectors	:
29	Continuous current rating of terminal connector at 50^{o} C ambient	:
30	Short time current rating of terminals connectors	:
31	Temperature rise in terminal connector under rated continuous current over 50^{o} C ambient	:
32	Type of Mounting	:
33	Maximum working stress	:
34	Ultimate tensile strength	:
35	Material of main coil	:
36	Material of terminal connector	:
37	Material of pedestal	:
38	Material of mounting hardware	:
39	Net weight (Approx)	:
40	Whether corona rings are provided	:
41	Whether Bird Barries are provided	:
42	Overall Dimensions provided	
	(a) Diameter	:
	(b) Height	:
43	Any other feature	:

GUARANTEED TECHNICAL PARTICULARS

44	No of turns in theline trap main coil	:
45	Type of conductor whether solid or standard	:
46	Overall conductor size	:
47	Cross sectional area of conductor of one layer	:
48	Type of construction (no of coils and whether open type or covered with insulating material	:

SECTION-5

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

BHEL ENQUIRY. NO:

BIDDER OFFER REFERENCE:

A)

S.No.	Parameters	Data	Yes / No	Remarks
		110 kV Wave Trap		
1.	Applicable Standard	IEC: 60353 with amendment, IS:8792, IS: 8793, IEC: 60099 (Part I&IV), IS: 3072 (Part -I) and IS: 5561		
2.	Type			
3.1	Rated Inductance	0.5 mH		
3.2	Rated Frequency	50 Hz		
3.3	System Voltage	110 kV		
3.4	Rated current	1250 Amp		
3.5	System Short Circuit Current	40kA for 3 sec.		
3.6	Asymmetrical Phase value of the first half wave of the short time current	40kA for 1 sec		
3.7	Tuning device type (Indentor to tick)	Factory fixed / Field adjustable		
3.8	Type of tuning	Broad Band		
3.9	Tuning range	200 to 500 kHz or 210 to 500kHz		
3.10	Minimum resistive component of impedance within the rated blocking band-width	Not less than 940 ohms for 200/500kHz & Not less than 1000 ohms for 210/500kHz		
3.11	Visual Corona Extinction voltage	Not less than 105 kV (rms) (for 110 kV)		

S.No.	Parameters	Data	Yes / No	Remarks
3.12	Radio Interference voltage	Not exceed 500 μV at 97 kV (rms)		
3.13	Material of main coil	Non magnetic		
3.14	Mounting arrangement	Pedestal mounting		
3.15	Line Trap shall be mechanically strong enough to withstand the stresses due to maximum wind pressure 150 Kg /m^2	150 Kgf /m^2		
4.1	Station class current limiting type Lightning arrestor.	Provided		
4.2	Rated discharge current of lighting arrestor	10 kA		
5.1	Terminal connectors	Provided		
5.2	Terminal connection	Suitable for Bersimis/Moose conductor		
5.3	Material of clamp and connector	Non magnetic		
6.0	Bird barriers	Provided		

B) TYPE TESTS

i) Whether all type test reports (as per relevant IS/IEC) of tests conducted earlier on identical or similar material are available (test reports are of the tests conducted not earlier than five years from the date of bid opening.)

(YES / NO)

ii) If type test reports are not acceptable to BHEL/Customer then above tests shall be conducted by the bidder free of cost. **(YES)**

C)

S.No.	Description	Confirmation of Supplier

1.	Bidder to confirm that there are no deviations and the offer is in full compliance with the specification. a) Bidder to confirm that there are no deviations in any other form such as comments, variations and/ or exceptions. b) Bidder to confirm that at all drawings / data sheets/QP/ valid type tests reports/ all relevant information shall be submitted to BHEL for organising approval of ultimate customer.	
2.	Bidder to confirm that it will offer approved Make of the components and fitments at contract stage. In case the offered make is not approved by the customer, then alternate make shall be supplied without any commercial implications to BHEL.	
3.	Qualifying requirements, if any, mentioned in the specification are being met	
4.	a) SJVNL Approved Quality Plan is available for the offered equipment OR b) Standard BHEL Quality Plan to be followed	

Date:

Signature of the authorized representative of Bidder

Company Seal