TECHNICAL PRE QUALIFICATION REQUIREMENT

Name of Project : - 2x660MW Talcher TPP Stage-III

Name of Customer : - NTPC Ltd.

Name of Item : - 1000 KVA, 11/0.433 kV Oil type LT Outdoor Auxiliary Transformer

TECHNICAL PRE-QUALIFICATION REQUIREMENT
a) The Bidder should have manufactured & supplied at least two numbers (one each at two different installations) of 16 MVA, 11kV or higher rating oil filled transformers which should have been in successful operation for a period of at least two (2) years as on 06-June-2022. And b) Bidder should have his own facilities for conducting all routine and type tests as per IS: 2026 (except short circuit test). And c) 16 MVA, 11kV Class or higher rated oil filled transformer manufactured by Bidder should have been successfully short circuit tested. Bidder has to submit the certificate/relevant documents in support of above requirement.

SUPPORTING DOCUMENTS TO BE ATTACHED		
Sr	**Required Criteria**	**Supporting Documents to be submitted by bidder along with technical bid**
1	Manufacturing	Approved Drawings / GTP / Approved Quality Plan / Factory Inspection Test Report e.t.c
2	Supply	PO / Dispatch clearance / LR / Material Receipt certificate at site / installation or commissioning certificate etc.
3	Routine and Type test facilities	Routine & type test reports conducted at Vendor's works duly witnessed/ reviewed/ signed by the customer
4	Successful short circuit test	Short Circuit Test report of the Transformer

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.

PREPARED BY 02/12/23 REVIEWED BY 2.12.23 APPROVED BY

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS HVDC ENGINEERING & SYSTEMS

DOCUMENT No.	TB-419-316-015	Rev. No.	00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION		SIGN			
TITLE			NAME	PC	RD	VK
1000 kVA, 11/0.433 kV Oil type LT Outdoor Auxiliary Transformer			DATE	30/11/23	30/11/23	30/11/23
			GROUP	TBEM	W.O. No	

CUSTOMER	NTPC Ltd.
PROJECT	400kV GIS at Talcher Thermal Power Project Stage-III (2 X 660 MW)
NOA NO.	CS-4540-001A-2-SCNOA-7228 Dated 27-Sep-2022
Station	Talcher, Orissa

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To	TBEM	TBMM	TBQM	Vendor
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SECTION-1

Scope, Bill of Quantity, Specific Technical Requirements

1.1 Scope

This technical specification covers the requirements of design, engineering, manufacturing, assembly, stage testing, inspection, testing before supply, documentation, packing and loading at works and transportation to site of ***Three Phase, 1000 kVA, 11/0.433 kV BIS Certified*** Oil type LT Outdoor Auxiliary Transformer along with its accessories, foundation bolts and auxiliary equipments/instruments etc. as mentioned in this section and in various other sections of this specification.

Note: BIS Certification for rating upto 2.5MVA, 33kV Class as per IS: 1180 Part-I, however the impedance value, list of tests, fittings shall be as per those mentioned in the specification.

The scope shall include and encompass all the activities listed above.

The equipment is required for the following project:

Name of the customer *:* **NTPC Ltd.**

Name of the project : **400kV GIS at Talcher Thermal Power Project Stage-III (2X660 MW)**

Site : **Talcher, Orissa**

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

Refer section-3 of this document for project details and general specification.

In case of any conflict among the various sections of this specification, the order of precedence shall be section 1, section 2 & the section 3.

1.2 Bill of Quantities

1.2.1 Main Equipment:

S. No.	Item Description	Unit	Quantity
			Main
1	Transformer 11/ 0.433 kV, 1000 kVA, 3-Phase, Dyn1, ONAN, Oil type LT Outdoor Auxiliary Transformer with all fittings & accessories	Nos.	2
2	Type Test Charges: Full & Chopped Wave Lightning Impulse Test	No.	1
3	Type Test Charges: Short Circuit Test	No.	1
4	Type Test Charges: Temperature Rise Test	No.	1
5	Type Test Charges: Noise Level Test	No.	1

1.2.2 Spares:

Sl. No.	ITEMS DESCRIPTION	Quantity
1.	HV Bushing with metal parts and gaskets - See Note 2	3 No.
2.	HV Neutral bushing with metal parts and gaskets (if applicable)	1 No
3.	LV bushing with metal parts and gaskets - See Note 2	3 No.
4.	LV Neutral bushing with metal parts and gaskets (if applicable)	1 No.
5.	WTI with contacts	1 No.
6.	OTI with contacts	1 No.
7.	Pressure relief device (if applicable)	1 No.
8.	MOG	1 No.
9.	Buchholz relay complete	1 No.
10.	Set of gaskets (See note 3)	1 Set
11.	Set of valves (1 set = 1 No. of each type/size)	2 Set
12.	Air cell for conservator (if applicable)	1 No.

Note:

1. Final quantity may vary by ± 25%.
2. Each mandatory spare OIP/RIP bushing shall be provided with suitable “stand”.
3. 1 Set consists of gaskets required for 1 No. transformer for the following
    a. Protection and Monitoring Devices.
    b. Cooler Circuit.
    c. Largest inspection cover, if applicable

d. HV/LV turret, if applicable.
e. OLTC inspection cover, if applicable.

1.3 Specific Technical Requirements

SL. NO.	DESCRIPTION	UNIT	TECHNICAL REQUIREMENTS
1.0	Transformer applications		Switchyard Service Transformer
2.0	Type		Outdoor, two winding 3 phase
3.0	Applicable standard		IS: 2026, IS: 1180, IS: 6600 & IEC-60076, Latest BEE/ CEA notifications & guidelines
4.0	Full load rating	kVA	1000
5.0	Rating no load voltage HV/LV	kV	11 / 0.433
6.0	Percentage Impedance	%	5
7.0	Rated frequency	Hz	50
8.0	Winding connection of different windings and vector group		Dyn1
9.0	Type of cooling		ONAN
10.0	Type of tap changer off circuit/on load		Off Circuit
11.0	Tapping range and number of steps		±5% in steps of 2.5%
12.0	Phase Connection (a) HV Winding (b) LV Winding		 Delta Star
13.0	System Fault Level (c) HV (d) LV	 kA rms kA rms	 50 50
14.0	System earthing (a) HV (b) LV		 Low resistance earth to limit earth fault current to 600A Solidly earthed
15.0	Through fault withstand time		2 sec

SL. NO.	DESCRIPTION	UNIT	TECHNICAL REQUIREMENTS
16.0	Transformer energy efficiency level as per IS: 1180		Transformer shall be compliant to latest IS: 1180 & star rated as per prevalent latest BEE/ CEA notifications or guidelines. As per current latest IS: 1180 and BEE notification transformer shall be of energy efficiency level: STAR-2 rating or better as per BEE guideline
17.0	Overfluxing capability - a) For continuous rating b) For at least one minute c) For at least five seconds Note: Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap.		 110% 125% 140%
18.0	Winding insulation type – a) HV b) LV		 Uniform Uniform
19.0	Lightning Impulse withstand voltage of winding HV/LV	kVp	75 / NA
20.0	Power frequency withstand voltage of winding HV/LV	kV/rms	28 / 3
21.0	Maximum temperature rise above ambient 50deg. C at full load with 100% coolers (irrespective of tap): (a) Top Oil (Temperature rise measured by thermometer) (b) Winding (Temperature rise measured by resistance method)	 °C °C	 40 45

SL. NO.	DESCRIPTION	UNIT	TECHNICAL REQUIREMENTS
22.0 a)	Terminal arrangement - High voltage side-		Cable box Suitable for 11kV Cables of size: 3Cx150 sq. mm. Al Supply of Cable lugs for HV side shall be in bidder's scope
22.0 b)	Terminal arrangement - LV side (phase)		Flange throat for TPN non-segregated Al Busduct. Degree of protection of LV busduct flange enclosure shall be IP:55
22.0 c)	Terminal arrangement - LV side (Neutral)		One neutral as part of LV busduct flange throat and second neutral with copper earthing bar for system earthing brought near the base of the transformer
23.0	Details of cooling equipment		Detachable tank mounted radiators
24.0	Provision/ accommodation of CTs LV Neutral		2 Cores: PS Class & 5P20 CT for REF & standby EF protection. **Core 1:** 1600/1, CL-PS, Rct≤8 Ω , Vk≥400V, Ie≤30mA at Vk/2. **Core 2:** 1600/1, 5P20, 5 VA. CT particulars shall be finalized during detail engineering. There shall be no commercial implication to BHEL on this account.

SL. NO.	DESCRIPTION	UNIT	TECHNICAL REQUIREMENTS
25.0	Noise Level		As per NEMA TR-1
26.0	Loading Capability		Continuous operation at rated MVA on any tap with voltage variation of +/-10%, also transformer shall be capable of being loaded in accordance with IS:6600/ IEC60076-7.
	Bushing particulars.		
27.0	Applicable standard for bushing		IS-2099 & IEC-60076
28.0	Lightning Impulse withstand voltage of bushing HV/LV	kVp	75 / NA
29.0	Power frequency withstand voltage of bushing HV/LV	kV/rms	28 / 3
30.0	Clearance in air between phases	mm	HV – As per IS LV – As per IS
31.0	Creepage distance	mm/kV	31

Notes:

1. The equipment must conform to the latest revision of all relevant standards.
2. LT Auxiliary transformers shall be 3 Phase, 4 Wire system with additional LVN bushing for equipment earthing.

1.4 Tests

1.4.1 The bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The owner may waive conduction of any test subject to availability of test reports. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.

1.4.2 The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days' notice shall be given by the bidder. The owner may waive conduction of any test subject to test facility anywhere in the world. The bidder shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms,

recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

1.4.3 In case the bidder has conducted such specified type test(s) not earlier than five years prior to the date of techno-commercial bid opening i.e 06-June2022, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the bidder.

1.4.4 During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed below in specification and carried out not earlier than last five years from the date of techno-commercial bid opening i.e. 06-June-2022. The 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 witness by a client. However if the contractor is not able to submit report of the type test(s) conducted within last five years from date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/employer's representative and submit the reports for approval.

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

1.4.6 Each LT Outdoor Auxiliary Transformer shall be completely assembled with all fittings & accessories meant for the particular LT Outdoor Auxiliary Transformer before offering for inspection & testing by Employer.

1.4.7 Details of testing shall be as per Section II of this specification.

1.5 TECHNICAL PRE QUALIFYING REQUIREMENTS

The Bidder should have manufactured & supplied at least two numbers (one each at two different installations) of 16 MVA, 11kV or higher rating oil filled transformers which should have been in successful operation for a period of at least two (2) years as on 06-June-2022.

And

Bidder should have his own facilities for conducting all routine and type tests as per IS: 2026 (except short circuit test).

And

16 MVA, 11kV Class or higher rated oil filled transformer manufactured by Bidder should have been successfully short circuit tested.

Note:

a. Two different installations means two different project sites or two different contracts.

b. Equipment designed by the Bidder by itself or through its collaborator/associate/technology provider/licensor for reference plant, shall also be considered meeting the requirement of design.

c. Bidder to fill-up and attach filled up “Attachment 3K” with the technical offer.

1.6 Quality Plan

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

1.7 Special Tools & Tackles

The bidder shall include in his proposal the deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of the equipment. The Special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. A list of all such devices shall be furnished.

1.8 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.

SECTION-2

2.0 OIL TYPE LT OUTDOOR AUXILIARY TRANSFORMER

2.1 Type and Ratings

S.No.	Transfromer	Oil Type LT Outdoor Auxiliary Transformer
1	Rating	1000 kVA
2	Voltage Ratio (kV)	11 / 0.433
3	Winding	2
4	Nos. of Phase	Three
5	Vector Group	Dyn1
6	Cooling	ONAN
7	Tap Changer	Off Circuit
8	Impedance at 75°C	Refer Section 1
	a. Principal Tap	
	b. Other Taps	
9	Permissible Temperature rise over an ambient of 50 deg C (irrespective of tap)	
	a) Top Oil by thermometer	40°C
	b) Winding by resistance	45°C
10	Insulation level	Refer Section 1
11	Earthing (Copper Flat)	Refer Section 1
12	Termination, SC withstand time & Fault Level	Refer Section 1
13	Noise level	As per NEMA TR-1
14	Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-10%, also transformer shall be capable of being loaded in accordance with IS:6600/ IEC60076-7.
15	Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following overfluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating. b) 125% for at least one minute. c) 140% for at least five seconds.

Note:

1. LT Auxiliary transformers shall be 3 phase, 4 wire system with additional LVN bushing for equipment earthing.

2.2 Codes and Standard

Transformers	IS:2026, IS:6600, IEC:60076,IS 1180
Bushings	IS:2099, IEC:60137
Insulating oil	IEC:60296
Bushing CTs	IS:2705, IEC 60185
Indian Electricity Act 2003, BEE Guideline & CEA notification	

2.3 Operational Requirement

a. Cooling Requirement:

For Auxiliary Transformers & Neutral Grounding Reactor the radiators (if applicable) shall be detachable type, mounted on the tank. Each radiator shall be provided with a drain plug/valve at the bottom, an air release plug at the top, shut off valve at each point of connection to the tank.

b. LT Auxiliary outdoor transformers shall have maximum losses of STAR-2 rating or better as per latest BEE guideline. The outdoor transformer shall also comply with latest IS:1180.

2.4 Design and Constructional Features

2.4.1 NTPC may at their discretion have design review done to check the design of the transformers / shunt reactor by NTPC/their consultant.

2.4.2 All transformers shall be suitable for cable at HV side & Busduct at LV side. A dust tight cable box shall be provided. The transformer shall be provided with all fittings & accessories to be complete in all respects for satisfactory operation.

2.4.3 Tank

a. Tank shall be of welded construction & fabricated from tested quality low carbon steel of adequate thickness.
b. The main tank body shall be capable of withstanding full vacuum.
c. Auxiliary transformers shall have suitable bi-directional skids. However auxiliary transformers above 2 MVA shall be provided with four no. of bi-directional detachable flat rollers. Suitable locking arrangement shall be provided to prevent accidental movement of transformer.

d. At least two adequately sized inspection openings, one at the each end of the tank for easy access to bushings and earth connections & suitable manhole shall be provided.

2.4.4 Core

Core shall be high grade non-ageing cold rolled super grain oriented silicon steel laminations of M4 grade or better quality. The core isolation shall be able to withstand a voltage of 2 kV (rms.) for 1 minute in air.

2.4.5 Insulating Oil

No inhibitors shall be used in the transformer oil. The oil supplied with transformers shall be new and previously unused and must conform to following while tested at supplier's premises and shall have following parameters.

S.No.	Property	Permissible Values
1	Kinematic Viscosity, mm^2/s	≤ 12 at 40 ° C ≤ 1800.0 at (-)30 ° C
2	Flash Point, ° C	≥ 140° C
3	Pour point, ° C	≤ (-)40 ° C
4	Appearance	Clear, free from sediment and suspended matter
5	Density kg/dm^3 at 20 ° C	≤ 0.895
6	Interfacial Tension N/m at 25° C	≥ 0.04
7	Neutralisation value, mgKOH/g	≤ 0.01
8	Corrosive sulphur	Non Corrosive
9	Water content mg/kg	≤ 30 in bulk supply ≤ 40 in drum supply
10	Anti oxidants additives	Not detectable
11	Oxidation Stability -Neutralization value, mgKOH/g -Sludge, % by mass	 ≤ 1.2 ≤ 0.8
12	Breakdown voltage As delivered, kV After treatment, kV	 ≥ 30 ≥ 70
13	Dissipation factor, at 90° C And 40 Hz to 60 Hz	≤ 0.005
14	PCA content	≤1%
15	Impulse withstand Level, kVp	≥ 145
16	Gassing tendency at 50 Hz after 120 min, mm^3/min	≤ 5

Subsequently oil samples shall be drawn at:

Sr. No.	Parameters	Before filling in main tank at site & tested for	Prior to energization at site for following properties & acceptance norms:
1	BDV	60 kV (min)	60 kV (min)
2	Moisture content	10 ppm (max.)	10 ppm (max.)

10% extra oil shall be supplied for topping up after commissioning in non-returnable containers suitable for outdoor storage.

2.4.6 Windings

The conductors shall be of Electrolytic grade copper. All Windings of 66kV and below shall have uniform insulation. The contractor shall ensure that windings are made in dust proof & conditioned atmosphere.

2.4.7 Oil Preservation

Main tank and OLTC (if applicable) shall be provided with conservator tanks of adequate capacity for expansion of oil from minimum ambient to 100 deg.C. Conventional type conservator with indicating type cobalt free breather (transparent enclosure) shall be offered for transformer below 7.5 MVA.

2.4.8 Bushing

a. The electrical & mechanical characteristics of bushings shall be in accordance with IS: 2099, IS: 3347, IS: 12676 & IEC: 60137.
b. Bushings below 52 kV shall be with porcelain insulator and shall be of oil communicating / OIP (non-oil communicating type) / epoxy RIP type. All condenser bushings shall be non-communicating type.
c. All composite resin impregnated bushings (RIP) shall be provided with provision for long term storage to protect from moisture and rodents. The oil side shall be provided with tank which can be filled with oil. Tank shall have necessary provision for oil filling, level gauge etc. Suitable covering to be provided on air side to protect from any damage. The arrangement shall be suitable for storage in horizontal/ vertical direction in outdoor location.
d. The oil end dimension of RIP bushing shall be same for all bushings of similar voltage rating.
e. Condenser type bushings shall be provided with:
    i) Oil level gauge
    ii) Oil filling plug
    iii) Tap for capacitance and Tan delta test
f. Clamps & fittings shall be of hot dip galvanized steel.

g. Bushing & fittings shall be provided with vent pipes that shall be connected to route any gas collection through the Buchholz relay.
h. No arcing horns shall be provided on the bushings.
i. LV Bushing palm shall be Silver/Tin plated.

2.4.9 Bushing CTs

Bidder to provide neutral bushing CT as per details given in section-I, for restricted earth fault protection, standby earth fault protection. CT Shall be of adequate rating for protection as required, WTI etc. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted. All CT terminals shall be provided as fixed type terminals on the M. Box/CCC/CMB to avoid any hazard due to loose connection leading to CT opening or any other loose connection in power circuit. In no circumstances Plug in type connectors shall be used for CT & Power connection.

2.4.10 Marshalling box/ CCC (Cooler Control Cabinet) / CMB (common M. Box)

M. Box/CCC/CMB shall be of stainless steel (SS-316 or better), at least 2.5 mm thick, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55 & an additional canopy shall be provided. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. The gasket used shall be of neoprene rubber. Also Marshalling Box, CCC, CMB gland plate shall be atleast 450 mm above ground level.

Marshalling box shall be provided with thermostatically controlled space heaters.

For auxiliary transformer, wiring scheme shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

TB shall be stud type for all CT & Power connections with ring type lugs.

For other details please refer section 3.

2.4.11 Valves

a. All valves upto and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies with gun metal fittings.
b. Sampling & drain valves should have zero leakage rate.

2.4.12 Gaskets

a. For Auxiliary Transformers & Neutral Grounding Reactor, gasket shall be fitted with weather proof, hot oil resistant, rubberized cork gasket.
b. If gasket is compressible, metallic stops shall be provided to prevent over compression.
c. The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period of 3 months of the same. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established.

2.4.13 Painting

PARTS NAME	TYPE OF PAINT	NO.OF COATS	TOTAL DFT
Inside of tank and accessories (except CCC, CMB & M Box)	Oil & heat resistant fully glossy white	One coat	Atleast 30 micron
External surface of transformer and accessories (except coolers & radiators)	Chemical resistant epoxy zinc phosphate primer, MIO (Micaceious iron oxide) as intermediate paint followed by polyurethane finish paint (RAL 5012 Blue)	One coat each	Atleast 100 micron
External Cooler, Radiator surface	Anticorrosive primary paint followed by high quality full glossy outer finish paint (RAL 5012 Blue)	As per ISO 12944-5:2018, Table D.1, System no. G5.05 (at least Two coats each)	As per ISO 12944-5:2018, Table D.1, System no. G5.05 (at least 100 Micron)
Internal Radiator Surface	Hot oil proof, low viscosity varnish and subsequent flushing with transformer oil	---	---

2.5 Neutral Earthing Arrangement

The neutral of Transformers shall be brought through insulated support from tank to the ground level at a convenient point with copper flat, for connection to ground network (as applicable).

2.6 Fittings

Following fittings shall be provided with Transformers covered under this specification.

A	-Conservator for main tank with MOG (with low oil level alarm contact), drain valve & indicating type free Cobalt free breather with transparent enclosure (maximum height 1400 mm above rail level) etc. Aircell (for 7.5 MVA & above).
B	-Buccholz relay (magnetic type), double float type with alarm and trip contacts (with plug & socket type arrangements), along with suitable gas collecting device.
C	-Diaphragm type explosion vent shall be provided.
D	-OTI & WTI shall be 150 mm dial type with alarm and trip contacts with max. reading pointer & resetting device. (maximum height 1500 mm above rail level)
E	Top & bottom filter valves with threaded male adapters, bottom sampling valve, drain valve/sludge removal valve at the bottom most point of the tank.
F	Air release plug, bushing with metal parts & gaskets, terminal connectors on bushings (as applicable) & surge arrestor (as applicable).
G	Prismatic/toughened glass oil gauge for transformers
H	Followings items are as applicable: Bi-directional wheel & skids, M. Box, OLTC, OCTC, Bushing CTs, Insulating Oil, Fans, pumps & oil flow indicator, Cooling equipment, Valve Schedule Plate.
I	Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs, additional 4 nos. lifting lugs for bell tank cover, inspection cover, manhole, Bilingual R&D Plate, Terminal marking plates, two earthing terminals etc.
J	Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS.
K	Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.
The fittings listed above are only indicative and other fittings, which generally are required for satisfactory operation of the Transformers & Shunt Reactor are deemed to be included.	

2.7 Testing Requirements

2.7.1 The bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The owner may waive conduction of any test subject to availability of test facility. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.

2.7.2 The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days' notice shall be given by the bidder. The owner may waive conduction of any test subject to test facility anywhere in the world. The bidder shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

2.7.3 In case the bidder has conducted such specified type test(s) not earlier than five years prior to the date of techno-commercial bid opening i.e 06-June-2022, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the bidder.

2.7.4 Following components to be supplied shall be of tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed below in specification and carried out within last five years from the date of techno-commercial bid opening i.e 06-June-2022. The reports should be for the test 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 witness by a client. However if the contractor is not able to submit report of the type test(s) conducted within last five years from date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/employer's representative and submit the reports for approval.

Type test reports applicability criteria for Auxiliary oil filled transformers for which earlier conducted type test reports are being submitted:

The Type Test reports should be of a transformer which is generally similar to the transformer being offered as per IEC 60076-5, Annexure-B and also identical to the offered transformer in the following aspects:

i) Voltage ratio
ii) MVA/KVA rating
iii) Percentage Impedance
iv) Internal design
v) Type of tap changer equipment
vi) Cooling arrangement
vii) Temperature rise
viii) Individual and total loss values of the offered transformer shall be same as that indicated in the GTP of transformer for which Type Test Reports are submitted.

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

2.7.6 Each LT Outdoor Auxiliary Transformer shall be completely assembled with all fittings & accessories meant for the particular LT Outdoor Auxiliary Transformer before offering for inspection & testing by Employer.

2.7.7 Routine / Type Tests on Transformers:

I. Routine Tests

S.No.	Transformer Type	Auxiliary Trans.
	Voltage Class	**Um ≤ 72.5kV**
1	All routine test in accordance with IEC 60076 shall be carried out in all the transformers.	
2	Measurement of Voltage Ratio & phase displacement (as per IEC 60076-1)	
3	Measurement of winding resistance on all the taps (as per IEC 60076-1)	
4	Vector group and Polarity Check (as per IEC 60076-1)	
5	Magnetic Balance and Magnetising Current Test	
6	Measurement of no load current with 415 V, 50 hz AC supply	
7	Measurement of no load losses and current at 90%, 100% & 110% of rated voltage (as per IEC 60076-1)	
8	Load Loss & Short Circuit Impedance Measurement on principal & Extreme Taps	
9	IR measurement (As per IEC 60076-1)	
10	Measurement of capacitance & tan delta to determine capacitance between winding & earth. (For Aux transformer the limiting value of tan delta shall be	

	1.0% @ 20deg C)
11	Dielectric tests shall be carried out as per IEC 60076-3.
12	Applied Voltage Withstand Test (as per IEC 60076-3)
13	Induced overvoltage test
14	Repeat no load current/loss measurement & IR after completion of all electrical test
15	Oil leakage test on completely assembled transformer along with unit coolers/ radiators (as per relevant clause of this sub section)
16	Jacking test followed by D.P. test
17	Marshalling Box/Cable box: It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.
18	IR measurement on wiring of Marshalling Box.

II. Type Tests (#)

S. No.	**Transformer Type**	**Auxiliary Trans.**
	Voltage Class	**Um ≤ 72.5kV**
1	Lightning impulse (Full & Chopped Wave) test on windings (as per IEC 60076-3)	
2	Short circuit test (special test) as per IEC 60076-5.	
3	Temperature Rise test at a tap corresponding to maximum losses. Gas Chromatography shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599).	
4	Measurement of acoustic noise level as per NEMA TR-1 (special test)	

Notes:

i. (#) All the type/special tests & temperature rise test shall be conducted after performing Short Circuit Test. If Tank Vacuum & Pressure Test is to be carried out then it shall be conducted before SC test.

ii. The power factors should not exceed 0.5% (at 20 °C). However in case of deviation from limiting values the same shall be resolved in line with IEEE Std-62.

2.7.8 Tank Type Tests

a. Routine Tests:

Oil leakage test on assembled transformer - All tank and oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature and applying pressure equal to the normal pressure plus 35 kN/m2 measured at the base of the tank. The pressure shall be maintained for a period of not less than 6 (six) hours during which time no sweating shall occur.

b. Type Tests:

For auxiliary transformers & Neutral Grounding Reactor, each type of tank shall be subjected to the vacuum & pressure tests as per CBIP norms.

2.8 Initial Operation for Transformers

a. Continuously observe the transformer operation at no load for 24 hrs. w.r.t. Voltage, no load current, temperature rise and noise.

b. Gradually put the transformer on load, check and measure increase in temperature in relation to the load and check the operation with respect to temperature rise and noise level etc.

2.9 BUSDUCT TERMINATION

If LV terminals are specified to be connected by means of a busduct, a flanged throat or equivalent connection shall be provided to suit purchaser's busducts. The winding termination shall be on outdoor type of bushing. Necessary flexibles shall be provided by purchaser to connect the bushing terminals to the busbars of the busduct. Details of busduct shall be furnished during detail engineering stage. Rain hood/Protruded Type of Inspection Cover shall be used.

2.10 TERMINAL POINTS

a. HV bushings with terminal connector for cable glands in case of cable box.
b. LV bushings with terminal connector (3 Phase + 1 Neutral) for bus duct
c. For LV Earthing: From LV neutral bushing, Neutral earth copper busbar supported on insulators brought near the base of transformer with fork arrangement for 2 point earthing.
d. Transformer earthing pads.

Sub QR Data to be filled in to meet the proveness requirements (Refer Clause No. 5.12.1 of Sub-Section-IA provenness , Part-A, Section-VI. **for AUXILIARY OIL FILLED TRANSFORMERS AND HT TRANSFORMERS**

(I) We hereby confirm that We/Subvendor M/s ..... have manufactured & supplied atleast two (2) numbers (One each at two different installations) of 16MVA, 11 KV or higher rating oil filled transformers which have been in successful operation for a period of atleast two (2) years as per stipulated requirements mentioned at Clause No.5.12.1.1 of Sub-Section- IA provenness, Part-A of Section-VI. The details of the same are given below:

Sl. No.	Item Description	Installation No. 1	Installation No. 2
1.00.00	Name of the Installation and its location		
1.01.00	Client name and its address, Fax and Tel. No., email id		
1.02.00	Name and designation of the responsible person in client's organization		
1.03.00	Contract No. & Date		
1.04.00	Voltage Ratio		
1.05.00	MVA Ratings		
1.06.00	Voltage Class of Transformers		

Sl. No.	Item Description	Installation No. 1	Installation No. 2
1.07.00	Date of Commissioning of transformers		
1.08.00	Date of commencement of successful operations		
1.09.00	Scope of work executed for aforesaid transformers included the following :		
	(i) Manufactured	Yes/No	Yes/No
	(ii) Supplied	Yes/No	Yes/No
1.10.00	No. of years in successful operation		

Sl. No.	Item Description	Installation No. 1	Installation No. 2
2.00.00	Certificate(s) from the client(s) are enclosed along with the bid at Annexure-…….to this Attachement-3K.		

II. We hereby further confirm that we/sub-vendor M/s ..... have our/his own facilities for conducting all routine and type tests on transformers as per IS:2026 (except short circuit test) as per Clause No. 5.12.1.2 of Sub-Section- IA provenness Part-A of Section-VI. The details of the same are given below:

Sl. No.	Name of Test	Yes/No

Note :

1) Sub-vendor to use their own performa for giving details of all routine and type test facilities available with them.

2) Certificates from client(s) must also be attached as Annexure..... to this Attachment-3K.

Signature of authorized signatory.....

III. We/sub-vendor ..... hereby confirm that 16MVA, 11KV Class or higher rated oil filled transformer manufactured by We/sub-vendor have been successfully short circuit tested as per requirement of Clause No. 5.12.1.3 of Sub-Section- IA provenness, Part-A of Section-VI. The details of the same are given below:

Sl. No.	Item Description	Details
1.00.00	Name of the station and its location	
1.01.00	Client name and its address, Fax and Tel. No. ., email id	
1.02.00	Name and designation of the responsible person in client's organisation	
1.03.00	Contract No. & Date	
1.04.00	Voltage Ratio	
1.05.00	MVA Ratings	

Signature of authorized signatory.....

Sl. No.	Item Description	Details
1.06.00	Voltage Class of transformers	
1.07.00	Short Circuit Test Carrying Agency (Test Lab) Name and Address	
1.08.00	Date of Short Circuit Test	
1.09.00	Short circuit test conducted successfully	Yes/No
2.00.00	Certificate(s) from the client(s) / Lab are enclosed along with the bid at Annexure-…… to this Attachement-3K.	

Note :

1) Sub-vendor may provide any additional information regarding short circuit test on transformers and enclose along with the proposal at Annexure..... to this Attachment-3K.

2) If needed Sub-vendor may use own performa for giving necessary details regarding short circuit test conducted on transformers and enclose with the proposal at Annexure..... to this Attachment-3K.

Date :

(Signature).....

Place : (Printed Name).....

(Designation).....

(Common seal).....

**LETTER OF TECHNICAL SUPPORT FOR SATISFACTORY PERFORMANCE OF …….....
(TRANSFORMER*/ REACTOR*) FOR (PROJECT NAME)……..**

TO:

[EMPLOYERS NAME & ADDRESS]

Sub: Letter of Technical Support submitted by Associate*/Collaborator*/Technology provider*/Licensor* undertaking the complete responsibility of the scope as detailed here.

Dear Sirs,

In consideration of NTPC Limited (hereinafter referred to as "Employer") having awarded to M/s…… with its Registered Office at …….. (hereinafter referred to as "Contractor") a contract for "…….(package name)…….. for its …….(project name)……. Vide Contract no. ……dated…….. (hereinafter referred as "Contract").

AND WHEREAS, the Contractors scope of supply and services in the contract also includes…… (Name and quantity of equipment)…….

AND WHEREAS, the Contractors have established manufacturing facilities for 400kV class Transformer/Shunt Reactor based on the technological support from their Associate/ Collaborator/Technology provider/ Licensor ie. M/s…….

AND WHEREAS in term of clause …….no…., Part-A, Sub-Section – II, Section-VI of bidding documents, the Bidder/Sub-vendor can be considered for manufacturing and supply of ……..(equipment name)…. Provided the qualified Associate/ Collaborator/Technology provider/ Licensor provides a Letter of Technical Support for satisfactory performance of the …….(equipment name)…… under this contract.

NOW THEREFORE, THIS DEED WITNESSETH AS UNDER:

1. That in accordance of the Award of the Contract by the Contractor to M/s. ……., we the aforesaid Associate*/ Collaborator*/Technology provider*/Licensor*, will be fully responsible in accordance with the contract to the Employer for the satisfactory performance of the ……..(equipment name)…….

2. Without prejudice to the generality of the Undertaking in paragraph 1 above, the manner of achieving the objective set forth in paragraph 1 above shall be as follows
   For Transformers and reactors (as applicable):
   (a) We shall provide design, manufacturing and assembly drawings of Transformer/Reactor. Transformer/Reactor shall be manufactured and supplied as per above design provided by us and the drawings approved by Employer.

(b) We shall depute technical experts to Bidder's/sub-vendor's works for supervision during core-coil assembly and final testing of the transformer/reactor.

(c) We shall promptly carry out all the corrective measures and shall promptly provide corrected design and shall undertake replacements, rectifications or modifications to the equipment as required in case of the equipment fails to demonstrate successful performance as per contract at site.

3. We, the Associate/ Collaborator/Technology provider/Licensor do hereby undertake and confirm that this Letter of Technical Support shall be irrevocable and shall not be revoked till ninety (90) days after the end of the defect liability period of the plant under the contract and further stipulate that the Letter of Technical Support herein contained shall terminate after ninety (90) days of satisfactory completion of such defect liability period. In case of delay in completion of defect liability period, the validity of this Letter of Technical Support shall be extended by such period of delay. We further agree that this LETTER OF TECHNICAL SUPPORT shall be without any prejudice to the various liabilities of the Contractor including Contract Performance Security as well as other obligations of the Contractor in terms of the Contract.

4. Any dispute that may arise in connection with this LETTER OF TECHNICAL SUPPORT shall be settled as per arbitration procedure/rules mentioned in the Contract Documents. This LETTER OF TECHNICAL SUPPORT shall be construed and interpreted in accordance with the Laws of India and the Courts of Delhi shall have exclusive jurisdiction.

5. We, the Associate/Collaborator/Technology provider/Licensor and the Contractor agree that this Letter of Technical Support shall be irrevocable and shall form an integral part of the Contract awarded to the Contractor and shall be operative from the date of its execution.

IN WITNESS WHEREOF, the Associate*/Collaborator*/Technology provider*/Licensor* through their authorised representatives, have executed these presents and affixed common seal of their companies, on the day, month and year first mentioned above.

For M/s …….

(Associate/Collaborator/Technology provider/Licensor)

Signature of authorized signatory.....

WITNESS:

1. ……. Signature of the Authorised Representative (Sub-Vendor):……..…

Name ……

Designation …….

Date:……

Common Seal of the Company

Signature of the Authorised Representative (Main Bidder):……..…
Name ……

Designation …….

Date:……

Common Seal of the Company

Note: Power of Attorney of the persons signing on behalf of Associate/ Collaborator/Technology provider/Licensor is to be furnished by the bidder and to be attached with the signed Letter of Technical Support.

***: Strike off whichever is not applicable.**

AUXILIARY / LT TRANSFORMER

Attributes / Characteristics / Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties		Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	Functional check	WPS & PQR	Routine Test as per relevant standard / NTPC Specification
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y						Y					Y	
Conservator / Radiator / Cooler / Pipes	Y	Y						Y						
Copper Conductor (IS:191)	Y	Y	Y			Y								
Insulating Material	Y	Y	Y	Y		Y	Y							
CRGO Lamination & Built Core	Y	Y	Y			Y	Y				Y			
Bushing / Insulator (IS:2544 / 5621)	Y	Y									Y			Y
Gasket	Y	Y				Y	Y		Y		Y			Y
Transformer Oil (IEC296)			Y											Y
OLTC / Off-Circuit Tap Changer	Y										Y			Y
Core Coil Assembly & Pre-tanking	Y									Y	Y			
Marshalling Box	Y										Y	Y		Y
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Valves	Y										Y	Y		
Welding (ASME Sect-IX)	Y							Y					Y	
Complete Transformer (IS:2026/ IEC-60076)	Y													Y

Note: 1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2) All major Bought Out Items will be subject to NTPC approval.

SECTION-3

Refer document

General Technical Requirements – TB-419-316-000 Rev 00.

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

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

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

3.1 PROJECT DETAILS

	Particular	Details
a)	Customer	NTPC Ltd.
b)	Project Title	Talcher Thermal Power Project Stage – III (2X 660MW) – 400kV GIS Switchyard at Talcher TPP
c)	Project Location	Place: Talcher District: Angul State: Orissa
d)	Latitude & Longitude	**Latitudes and Longitudes of the site are as follows:** Latitude-20°55' N Longitude-85°25' E
e)	Nearest Railway Station	Talcher – At a distance of about 4 km on Talcher-Cuttack section of North-Eastern Railway.
f)	Distance of project location from the Railway station	4 km (approx.)
g)	Nearest Major Town	Bhubaneswar
h)	Distance of the town from the project site	150 km by Road
i)	Nearest commercial airport	Biju Patnaik International Airport, Bhubaneswar
j)	Distance of airport from the project site	150 km by Road
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000meter
d)	Pollution Severity	Heavily polluted
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3)
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	50m/sec
g)	Category of terrain	Category-II
h)	Risk Coefficient "K1"	1.08
i)	Seismic Zone	III

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV
1	Highest system voltage	420 kV rms
2	Lightning Impulse voltage	±1425kVp
3	Switching impulse voltage	±1050kVp
4	Power frequency withstand for 1 min (rms)	630 kV(rms)
5	Max. fault level (1 sec.)	63 kA
6	Minimum creepage distance (31mm/kV)	13020 mm

3.1.2 **AUXILIARY POWER:**

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

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

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

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

Voltage	Equipment /1st Level	Line Take Off Gantry Height	Peak
400kV	8000mm	22000mm (for GT intermediate gantry)/ 16000mm (for other bays)	8500mm

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

The minimum height of intermediate gantry tower for 400kV wherever required shall be 22 m and the peak (s) shall be of 8.5 m. The gantry width for 400kV AIS shall be minimum 27m or as required to meet the specified clearances.

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

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

3.2 INSTRUCTION TO BIDDERS:

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

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

The supplier should be approved by Employer. If not, it is the responsibility of the vendor to be assessed and approved Employer, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Purchaser. Sufficient amount of information for justifying such proposals shall be furnished to Purchaser alongwith the bid to enable the Purchaser to determine the acceptability of these proposals.

Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood to be indicative of the function and quality desired and not restrictive. Other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

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

3.3 CODES AND STANDARDS

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 asof the locality where they will be installed, including the following:

a) Indian Electricity Act

b) Indian Electricity Rules

c) Indian Explosives Act

d) Indian Factories Act and State Factories Act

e) Indian Boiler Regulations (IBR)

f) Regulations of the Central Pollution Control Board, India

g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

h) Pollution Control Regulations of Department of Environment, Government of India

i) State Pollution Control Board.

(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996

(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998

(m.) Explosive Rules, 1983

(n.) Petroleum Act, 1984

(o.) Petroleum Rules, 1976,

(p.) Gas Cylinder Rules, 1981

(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981

(r.) Workmen's Compensation Act, 1923

(s.) Workmen's Compensation Rules, 1924

(t.) NTPC Safety Rules for Construction and Erection

(u.) NTPC Safety Policy

(v.) Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening: 06-June-2022), of the codes and standards given below shall also apply:

a) Bureau of Indian standards (BIS)

b) Japanese Industrial Standards (JIS)

c) American National Standards Institute (ANSI)

d) American Society of Testing and Materials (ASTM)

e) American Society of Mechanical Engineers (ASME)

f) American Petroleum Institute (API)

g) Standards of the Hydraulic Institute, U.S.A.

h) International Organization for Standardization (ISO)

i) Tubular Exchanger Manufacturer's Association (TEMA)

j) American Welding Society (AWS)

k) National Electrical Manufacturers Association (NEMA)

l) National Fire Protection Association (NFPA)

m) International Electro-Technical Commission (IEC)

n) Expansion Joint Manufacturers Association (EJMA)

o) Heat Exchange Institute (HEI)

p) IEEE standard

q) JEC standard

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

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

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

In case of any change in codes, standards & regulations between 06-June -2022 and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

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

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

3.5 ENGINEERING DATA

3.5.1 Drawings

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

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

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

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

All manufacturing, fabrication and execution of work in connection with the equipment/system prior to the approval of the drawings shall be at the bidder's risk. The bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Purchaser. However, if some changes are necessitated in the design of the equipment/system at a later date, the bidder may do so, but such changes shall promptly be brought to the notice of the Purchaser indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. Approval of bidder’s drawing or work by the Purchaser shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

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

3.5.2 Bidder’s Drawing Submission and Approval Procedure

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

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

b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be furnished by the bidder. This list shall be updated if required at suitable interval during detailed engineering.

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

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

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

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

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

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

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

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

j. As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Bidder will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per clause 3.5.5.

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

3.5.3 Erection Drawings

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

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

3.5.4 Instruction Manual

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

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

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

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

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

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

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

The Instruction Manuals shall comprise of the following:

3.5.4.1 Erection Manuals

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

a) Erection strategy.

b) Sequence of erection.

c) Erection instructions.

d) Critical checks and permissible deviation/tolerances.

e) List of tool, tackles, heavy equipments like cranes, dozers, etc.

f) Bill of Material

g) Procedure for erection and General Safety procedures to followed during erection/installation.

h) Procedure for initial checking after erection.

i) Procedure for testing and acceptance norms.

j) Procedure / Check list for pre-commissioning activities.

k) Procedure / Check list for commissioning of the system.

l) Safety precautions to be followed in electrical supply distribution during erection.

3.5.4.2 Operation and Maintenance Manuals

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

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

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

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

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

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

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

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

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

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

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

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

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

(b) Limiting values of all protection settings.

(c) Various settings of annunciation/interlocks provided.

(d) Start-up and shut down procedure for equipment along-with the associated systems in step mode.

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

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

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

(h) Equipment isolating procedures.

(i) Trouble shooting with causes and remedial measures.

(j) Routine testing procedure to ascertain healthiness of the safety devices along-with schedule of testing.

(k) Routine Operational Checks, Recommended Logs and Records

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

(m) Preservation procedure on long shut down.

(n) System/plant commissioning procedure.

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

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

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

(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.

(d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.

(e) Preventive Maintenance schedules linked with running hours/calendar period along-with checks to be carried out.

(f) Overhauling schedules linked with running hours/calendar period along-with checks to be done.

(g) Long term maintenance schedules

(h) Consumables list along-with the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.

(i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement.

(j) Tolerance for fitment of various components.

(k) Details of sub vendors with their part no. in case of bought out items.

(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.

(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.

(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.

(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.

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

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

3.5.5 Final Submission of drawings and documents:

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

a. List of drawings bearing the Employer's and Contractor's drawing number.
b. Six (6) bound sets along-with two (2) sets of CD-ROMs/ DVD/Portable hard disk of all final drawings/documents.
c. Bidder shall also furnish six (6) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.
d. The Bidder shall also furnish four (4) copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of instruction/ operations & maintenance manuals (after approval) for all the equipments.

3.5.6 TEST REPORTS

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval six (6) bound copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of all type and routine test reports shall be submitted to Employer.

3.6 MATERIAL /WORKMANSHIP

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

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

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

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

3.7 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

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

SPACE HEATERS

The heaters shall be suitable for continuous operation at 240 V as supply voltage. On –off switch and fuse shall be provided.

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

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

Control cubicles installed in air-conditioned area need not be provided with space heaters. These cubicles shall, however, have space heaters in case of storage of cubicles for long duration.

FUNGI STATIC VARNISH

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

Ventilation opening

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

Degree of Protection

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

a. Installed outdoor: IP- 55
b. Installed indoor in air conditioned area: IP-32
c. Installed in covered area: IP-52
d. Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e. For LT Switchgear (AC & DC distribution Boards) : Indoor:IP-52, Outdoor: IP-54

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

PRESERVATIVE SHOP COATING

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

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

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

3.8 RATING PLATES, NAME PLATES AND LABELS

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

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

3.8.3 Each equipment shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.

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

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

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

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

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

3.9 GALVANISING:

3.9.1 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, clean, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at bidder's cost.

3.9.2 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area or a minimum of 30 microns. The threads shall have extra deposit of zinc which shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have the required deposits of zinc on them as specified.

3.10 PAINTING

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

3.11 QUALITY ASSURANCE PROGRAMME

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

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

i. His organisation structure for the management and implementation of the proposed quality assurance programme.
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process controls and fabrication and assembly controls.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.

ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing quality plans for manufacturing detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed as Annexure-I.

3.12 GENERAL REQUIREMENTS - QUALITY ASSURANCE

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

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

3.12.3 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.

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

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

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

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

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

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

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

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

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

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

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

3.12.15 All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40mm shall be ultrasonically tested.

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

3.12.17 For components/equipment procured by the Bidders for the purpose of the contract, after obtaining the written approval of the Employer, the Bidder's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control

organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

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

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

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

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

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

3.12.23 Environmental Stress Screening

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

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

Or

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

Elevated Temperature Test Cycle

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

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

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

Burn In Test Cycle

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

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

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

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

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

3.13 QUALITY ASSURANCE DOCUMENTS

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

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

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

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

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

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.

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

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

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

3.14 TRANSMISSION OF QUALITY DOCUMENTS

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

3.15 INSPECTION, TESTING & INSPECTION CERTIFICATE

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

3.15.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection

and if part of the works is being manufactured or assembled on other premises or works, the Bidder shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works.

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

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

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

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

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

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

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

3.16 PACKAGING & TRANSPORTATION

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

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

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

a) Each item identifiable with KKS / PGMA-DU / other identification scheme of the bidder/OEM/OES shall have a RFID/QR.
b) Even if the BOQ is identified in tonnage/ cumulative of multiple items, unique identification shall be provided for each item as mentioned above (Eg – GIS Duct, Gis bay module, Panels etc., however each sub item shall have its own RFID/equivalent).
c) For items which are interchangeable and dispatched together (eg Foundation bolts in a box / Identical beams in a single consignment), the entire consignment can be tagged with a single RFID if the software system has the capability to track partial consumption (eg 100 bolts consumed from a package of 1000 bolts) from a consignment.

3.17 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

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

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

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

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

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

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

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

3.18 SPACERS

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

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

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

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

3.19.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 60137 while hollow column insulators shall be manufactured and tested in accordance with IEC62155/IS 5284. The support insulators shall be manufactured and tested as per IS: 2544/IEC 60168/IEC 60273. The insulators shall also conform to IEC 60815 as applicable having alternate long and short sheds.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.19.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

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

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

3.19.5 Post type insulators shall consist of a porcelain/polymer part permanently secured in metal base to be mounted on supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand all shocks to which they may be subjected to during operation of the associated equipment.

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

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

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

3.20 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

3.20.1 All types of control cabinets, junction boxes, marshalling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:60439 as applicable.

3.20.2 They shall be of Stainless steel or Aluminium. The thickness of Stainless steel shall be minimum 1 mm. The thickness of aluminium shall be minimum 3 mm and shall provide rigidity. Top of the boxes shall be sloped towards the rear of the box.

3.20.3 BAY MARSHALLING BOX

Bay Marshalling Box located at a convenient location to receive and distribute cables shall be provided as required. It shall meet all the requirements as specified for cabinets/boxes.

It shall have three separate distinct compartments for following purposes:

- To receive two incoming 415V, three phase, AC supplies controlled by 100A four pole MCBs with auto changeover provision, and to distribute five (5) three phase ac supplies controlled by 32A four pole MCBs. It shall also be provided with 63A, 3 phase 4 pin industrial grade receptacle with rotary switch.

- To receive three phase incoming from first compartment and to distribute ten (10) single phase ac supplies controlled by 16A two pole MCBs.

- 150 nos. terminal blocks in vertical formation for interlocking facility.

3.20.4 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

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

3.21 CABLE GLANDS AND LUGS/FERRULES

3.21.1 Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine

finished and nickel chrome plated. Thickness of plating shall not be less than 10 microns. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

3.21.2 Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards.

3.22 CONDUITS, PIPES AND ACCESSORIES

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

3.22.2 The size of the conduit/pipe shall be selected to limit the fill to a maximum of 40%. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed in an approved manner to prevent damage to threaded portions and en- trance of moisture and foreign materials.

3.22.3 PVC conduits shall be of high impact, heavy gauge (at least class 2) conduit conforming to BS-4607.

3.22.4 The outer surface of the steel conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanized. All rigid conduits/pipes shall be of a reputed make.

3.22.5 The hume pipes and accessories shall be of reinforced concrete conforming to class NP2 of IS-458. All tests on hume pipes shall be conducted as per IS-458.

3.22.6 Flexible conduits shall be of heat-resistant lead coated steel, water-leak, fire and rust proof.

3.23 MOTORS

The voltage level for motors shall be as follows:

a) Upto 0.2 KW	: Single phase 240V AC / 3 phase 415V AC
b) Above 0.2 KW and upto 200 KW	: 3 phase, 415V AC
c) Above 200 KW and upto 1500 KW	: 3 phase, 3.3 kV AC
d) Above 1500 KW	: 11 kV

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

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

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

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

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

3.23.4 Degree of Protection

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

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

3.23.5 Type:

AC Motors:

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

DC Motors Shunt wound

3.24 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

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

3.25 LAMPS AND SOCKETS

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

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

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

3.26 SWITCHES & FUSES

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

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

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

3.27 TYPE, ROUTINE & ACCEPTANCE TESTS:

3.10.1 TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN GIS

a) All equipments to be supplied shall be of type tested design. During detail engineering, the bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out not earlier than ten years prior to the date of techno-commercial bid opening (06-June -2022). These reports should be for the test 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.
b) However, if contractor is not able to submit report of the type test(s) conducted not earlier than ten years prior to the date of techno-commercial bid opening (06-June -2022)., or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.
c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

3.28 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

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

3.29 Enclosures:

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

ANNEXURE – A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1.0 General

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

2.0 Test Levels

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3.0 Test Methods for RIV (400kV):

3.1 RIV tests shall be made according to measuring circuit as per International Special committee on Radio Interference (CISPR) Publication 16 -1 (1993) Part – I. The measuring circuit shall preferably be tuned to frequency with 10 % of 0.5 MHz but other frequencies in the range of 0.5 MHZ to 2 MHz may be used, the measuring frequency being recorded. The result shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107 – 1964 except otherwise noted herein.

3.3 In measurement of RIV temporary additional external corona shielding may be provided. In measurement of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

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

3.5 The metering instruments shall be as per CISPR recommendations or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to the voltage read by the noise meter.

4.0 Test Methods for visible Corona (400kV AIS only)

The purpose of this test is to determine the corona extinction voltage of the apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 130 % of RIV test voltage

ANNEXURE – A

and maintained there for five minutes. In case corona inception does not take place at 130 %, the voltage level shall be raised till inception of corona or rated voltage whichever is lower. The voltage will then be decreased slowly until all visible corona disappears. The test procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which the visible corona (negative or positive polarity) disappears.

ANNEXURE – B

SEISMIC WITHSTAND TEST (400kV AIS only)

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

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

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

ANNEXURE-I

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

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

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

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

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

ANNEXURE-II

ENDORSEMENT SHEET FOR QP

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

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

SECTION-4

Guaranteed Technical Particulars.

Refer Annexure: GTP- Oil type LT Outdoor Auxiliary Transformer

CLAUSE NO.	Bidder's Name ……..

TECHNICAL DATA SHEETS

SUB-SECTION	TITLE
I	TECHNICAL INFORMATION & DATA TO BE SUBMITTED WITH THE PROPOSAL
II	TECHNICAL INFORMATION & DATA TO BE SUBMITTED AFTER THE AWARD OF CONTRACT

CLAUSE NO.	Bidder's Name ……..

SUB-SECTION – I

(TRANSFORMERS/REACTOR)

TECHNICAL INFORMATION & DATA TO BE SUBMITTED

WITH THE PROPOSAL

This volume contains Data sheets for ~~Generator Transformer, Station Transformers/ Standby/Startup Transformer, Unit Transformers,~~ Oil Filled Auxiliary Transformer, ~~Dry Type Transformer, Shunt Reactor, Neutral Grounding Reactor, Neutral Grounding Resistor & Maintenance equipments~~. All copies duly completed and preferably typed or written in indelible black ink in sets of five for each transformer are to submitted along with the Bid.

CLAUSE NO.	Bidder's Name ……..	
1.00.00	**~~GT/ ST/SUT/ UT/~~ AUXILIARY/~~DRY TYPE~~ TRANSFORMER**	
1.01.00	Manufacturer's name and address	…….
1.02.00	Project Name	…….
1.03.00	Standard Applicable	…….
1.04.00	Rating (MVA)	…….
1.05.00	Voltage ratio	…….
1.06.00	Vector group	…….
1.07.00	Type of cooling with (% capacity)	…….
1.08.0	Impedance data	
	For GT, UT, Aux & Dry Type Transformers	
	Guaranteed positive sequence impedance between HV & LV at 75 deg.C at	
	Principal tap (& tolerance)	……..
	Maximum tap (& tolerance)	……
	Minimum tap (& tolerance)	…….
	For ST/SUT	
	Guaranteed positive sequence impedance at 75 deg.C B/W:	HV & LV1 HV & LV2
	Principal tap (& tolerance)	…… …….
	Maximum tap (& tolerance)	…… ……
	Minimum tap (& tolerance)	……. ……..
	LV1-LV2 (Min.)	……..
1.09.00	Tap changing equipment (Make, Type & range)	……. ……
1.10.00	Number of coolers and rating as % of transformer cooling equipment	…….
1.11.00	Fan/ Pump (Nos. & rating of fan motors)	…….

CLAUSE NO.	Bidder's Name ……..

1.12.00	Permissible Thermal Data (irrespective of tap)	
	a) Temperature rise in top oil over an ambient of 50 deg.C (deg.C) (not applicable for dry type)	.....……..
	b) Temperature rise in winding by resistance measurement method over an ambient of 50 deg.C.	.....……..
1.13.00	Bushings	
	a) High voltage	
	i) Manufacturer	..... …….
	ii) Type	.....……
	b) Neutral (HV)	
	i) Manufacturer	..... …….
	ii) Type	..... …….
	c) Medium Voltage (MV)	
	i) Manufacturer	..... …….
	ii) Type	..... …….
	d) Low voltage (LV)	
	i) Manufacturer	..... …….
	ii) Type	..... …….
	e) Neutral (LV)	
	i) Manufacturer	..... …….
	ii) Type	..... …….
1.14.00	Proposed method of transformer transportation	.....……..
	(i). Oil filled or N2 or Dry air filled	..... …….
	(ii). Road Freight/ Rail Freight	..... …….

CLAUSE NO.	Bidder's Name ……..

1.15.00	Tap changing equipment (Make & Type)	……	
1.16.00	Approximate Dimensions		
	a) Tank (lxbxh) (mm) (if applicable)	.....	……
	b) Overall dimensions with coolers/enclosure (lxbxh) (mm)	.....	……
	c) Height for un-tanking (mm)	.....	……
	d) Shipping dimensions	.....	……
	e) Dimensions of largest package (lxbxh) (mm)	.....	……
1.17.01	Approx. Weights of Transformer including oil & coolers/radiators/enclosure	.....	……
1.17.02	Weight of cooler (if separately mounted)	.....	……
1.18.00	Tank cover-Conventional/BellType/Enclosure IP	.....	……

- **Drawings to be submitted:-**
  Outline and Foundation drawings of GT, ST/SUT & UT showing principal dimensions with reference to C/L and location of components.

1.00.00	DATA SHEET FOR SHUNT REACTOR (BUS/LINE)	
1.01.00	Maker's Name & country of manufacture	
1.02.00	Type of reactor(Gapped/Air core)	
1.03.00	Standards applicable	
(a.)	Temperature rise in top oil over an ambient of 50 deg.C at highest voltage (deg. C) (by thermometer)	
(b.)	Temperature rise in winding by resistance measurement method over an ambient of 50 Deg C at highest voltage (deg. C)	
1.04.00	Number of phases	
1.05.00	Approximate Weights of reactor including cooler	

Drawing to be submitted:-
-Outline drawing of Shunt Reactor showing principal dimensions & location of components.

CLAUSE NO.	Bidder's Name ……..

SECTION -II

(TRANSFORMERS/REACTOR)

TECHNICAL INFORMATION & DATA TO BE SUBMITTED

AFTER THE AWARD OF CONTRACT

Technical Data Requirements For Post Award

PART - B

This volume contains Data sheets for the following items.

1. ~~Generator Transformer(GT)~~
2. ~~Station Transformers(ST)/ Standby(SBT)/Startup Transformer (SUT)~~
3. ~~Unit Transformers(UT)~~
4. Auxiliary Transformer
5. ~~Dry Type Transformer~~
6. ~~Shunt Reactor(Bus/Line)~~
7. ~~Neutral Grounding Reactor~~
8. ~~Surge Arrestor~~
9. ~~NGR~~

Measuring instruments / Equipments

10. Online DGA
11. Oil BDV Measu
12. Oil tan delta an
13. Dew point meas
14. FRA Test Kit
15. Capacitance & tan delta measuring equipment (with cables etc.)
16. Transformers turns ratio (TTR) Kit
17. Oil Purifying Equipment
18. Vacuum pump with motor
19. Winding resistance measurement KIT
20. Off Line laboratory model oil DGA Kit
21. Oil tanker, wheel mounted
22. CMS
23. Dielectric Response Analyser
24. Hydraulic jacking system
25. On line moisture removal system

All copies duly completed and preferably typed or written in indelible black ink to submitted during detailed engineering.

CLAUSE NO.	Bidder's Name ……..

1.00.00 TECHNICAL DATA REQUIREMENTS

Clause No.	Item	~~(For GT / ST/SBT/SUT/ UT /~~ AUX Transformer) (Mark appropriately)		
1.00.00	Manufacturer's name and address			
1.01.00	Standard Applicable			
1.02.00	Rating (MVA)			
1.03.00	Voltage ratio			
1.04.00	Winding connection			
1.05.00	Vector group			
1.06.00	Number of phases			
1.07.00	Frequency (Hz)			
1.08.00	Type of cooling			
1.09.00	Impedance data Guaranteed positive sequence impedance @ 75 deg. C			
	GT/UT /AUX TR	**HV-LV**	**-**	**-**
	ST/SUT (Specify Base)	**HV-LV1**	**HV-LV2**	**LV1-LV2**
(a.)	At Principal Tap			
(b.)	At Maximum Tap			
(c.)	At Minimum Tap			
1.10.00	Guaranteed max. losses in KW at 100 % rated voltage at 75 deg. C at principal tap			
	(1) Iron loss at rated voltage & frequency			
	(2) Copper loss at full load			
	(3) Guaranteed Cooler losses at 100% load			
1.11.00	HV & MV winding DC resistance at 75 deg. C			
	(a) Principal tap			
	(b) Maximum tap			
	(c) Minimum tap			
1.12.00	LV (LV1 / LV2) winding DC resistance at 75 deg. C			
1.13.00	**Cooling Equipment Details**			

CLAUSE NO.	Bidder's Name ……..	
	(a)Number of coolers and rating as % of transformer cooling equipment	
	(b)Mounting	
	(c)Fan Motor Data	
	(i)Number per cooler/radiator Cooling requirement (indicate no. of spare fans also)	
	(ii) Type & make	
	(iii) Rating	
	(iv) Speed	
	(v) Locked rotor current	
	(d) Oil Pump Motor Data	
	(i) Number per cooler and rating as % of Cooling requirement (indicate no. of spare pumps also)	
	(ii) Type	
	(iii) Rating	
	(iv) Locked rotor current	
	(e) Cooler/radiator details	
	(i)Overall dimensions l x b x h (mm)	
	(ii)Type of mounting	
	(iii)Weight with oil (kg)	
	(iv)Weight without oil (kg)	
	(f) Type of oil pump & motor	
1.14.00	**Thermal Data**	
	(a) Temperature rise in top oil over an ambient of 50 deg.C	
	(b) Temperature rise in winding by resistance measurement method over an ambient of 50deg. C.	
	(c) Thermal time constant (Hours)	
	(d) Oil temperature at cooler inlet at rated load at max temperature	
	(e) Oil temperature at cooler outlet at rated	

CLAUSE NO.	Bidder's Name ……..	
	load at max temperature	
	(f) Calculated Hot Spot Temperature (Design value)	
1.15.00	Withstand time for short circuit at terminals (sec.)	
1.16.00	Over excitation withstand time (secs.) for % over excitation of	
	(i) 110%	
	(ii)125%	
	(iii)140%	
	(iv)150%	
	(v)170%	
1.17.00	Bushings	
	a) High voltage	
	(i) Manufacturer	
	(ii) Type	
	(iii) Rated current (Amps)	
	(iv) Total creepage distance (mm)	
	(v) Mounting	
	b) Medium voltage	
	(i) Manufacturer	
	(ii) Type	
	(iii) Rated current (Amps)	
	(iv) Total creepage distance (mm)	
	(v) Mounting	
	c) Low voltage	
	(i) Manufacturer	
	(ii) Type	
	(iii) Rated current (Amps)	
	(iv) Total creepage distance (mm)	
	(v) Mounting	
	d) High voltage (N)	
	(i) Manufacturer	

CLAUSE NO.	Bidder's Name ……..	
	(ii) Type	
	(iii) Rated current (Amps)	
	(iv) Total creepage distance (mm)	
	(v) Mounting	
	e) Low voltage (N)	
	(i) Manufacturer	
	(ii) Type	
	(iii) Rated current (Amps)	
	(iv) Total creepage distance (mm)	
	(v) Mounting	
1.18.00	Proposed method of transformer transportation	
	(i). Oil filled or N2 filled	
	(ii). Road Freight/ Rail Freight	
1.19.00	Is vacuum filling required, if so state absolute pressure (mm of Hg)	
1.20.00	Total quantity of oil (liters)	
1.21.00	Tap changing equipment	
	(a) Make	
	(b) Type & model	
	(c) Voltage class & current	
	(d) Number of steps	
	(e) Range	
	(f) Step voltage	
	(g) Rated Short circuit current	
	(i) Dynamic	
	(ii) Thermal	
	(h) Withstand time for Short circuit (sec.)	
	(i) Dynamic	
	(ii) Thermal	
	(i)No. of revolution to complete One step	
	(j)Insulation level of the connecting leads	

CLAUSE NO.	Bidder's Name ……..	
	between tap changer & transformer winding	
	(k) Total quantity of oil	
	(I)Whether On load Type or Off load Type	
1.22.00	Insulation level	
	HV/MV Windings	
	(i) (a) Lightning impulse withstand voltage(kVp)	
	(b) CW Impulse withstand voltage (kVp)	
	(ii) Switching surge withstand voltage (kVP)	
	(iii) Power frequency withstand voltage (kV)	
	(iv) HV winding insulation (Graded/ Uniform)	
	MV Windings	
	(i) Lightning impulse withstand voltage (kVp)	
	(ii) Power frequency withstand voltage (kV)	
	LV Windings	
	(i) Lightning impulse withstand voltage (kVp)	
	(ii) Power frequency withstand voltage (kV)	
	HV Bushings	
	(i) (a) Lightning impulse withstand voltage(kVp)	
	(b) CW Impulse withstand voltage (kVp)	
	(ii) Switching surge withstand voltage (kVP)	
	(iii) Power frequency withstand voltage (KV)	
	MV Bushings	
	(i) Lightning impulse withstand voltage (kVp)	
	(ii) Power frequency withstand voltage (kV)	
	LV Bushings	
	(i) Lightning impulse withstand voltage (kVp)	
	(ii) Power frequency withstand voltage (kV)	
	HVN Bushings	
	(i) Lightning impulse withstand voltage (kVp)	

CLAUSE NO.	Bidder's Name ……..	
	(ii) Power frequency withstand voltage (kV)	
	LVN Bushings	
	(i) Lightning impulse withstand voltage (kVp)	
	(ii) Power frequency withstand voltage (kV)	
1.23.00	Approximate Dimensions	
	a) Tank (lxbxh) (mm)	
	b) Overall dimensions with coolers (lxbxh) (mm)	
	c) Height for un-tanking (mm)	
	d) Shipping dimensions	
	e) Dimensions of largest package(lxbxh) (mm)	
1.24.00	Weights of Transformer Components	
	a) Core (kg.)	
	b) Windings (kg.)(copper)	
	c) Total cellulose weight (kg)	
	d) Weight of Paper insulation (kg)	
	e) Weight of Press board, frame, barrier, spacer etc (kg)	
	f) Tank and fittings (kg)	
	g) Oil (kg)	
	h) Untanking weight (heaviest piece) (kg)	
	i) Total weight (kg)	
	j) Weight of heaviest pkg. (kg)	
	k) Total shipping weight (kg)	
	l) Parts detached for transport(furnish list)	
1.25.00	Permissible overloading (% of rating and time in minutes)	
1.26.00	(a.)Clearances to tank in oil (mm)	
	(b.) Minimum clearance of HV winding to earth in oil (mm)	
	(c.) Clearance between coils & core(mm)	
	(d.) Clearance between coils (mm)	
	(e.) Clearance between neutral to ground (mm)	
1.27.00	Conservator	
	a) Total volume (Liters)	

CLAUSE NO.	Bidder's Name ……..	
	b) Volume between highest and lowest levels (Liters)	
1.28.00	Capacitance Values (pF)	
	b) LV /LV1/LV2 to earth	
	c) HV to LV/LV1/LV2	
	d) HV to MV	
	e) MV to LV	
	d) Tap winding to earth	
1.29.00	a) Type of oil preservation	
	b) Material of diaphragm/air cell	
	c) Continuous temperature withstand/ capability of the diaphragm/air cell	
1.30.00	Oil	**Before filling in main tank**
	a) Quality of oil	
	i) Moisture content (ppm)	
	ii) Max. tan-delta value	
	iii) Interfacial tension(N/m)	
	iv) Breakdown strength (kV)	
	b) Total Quantity including 5% extra (liters)	
		Before Energizing
	i) Moisture content (ppm)	
	ii) Max. tan-delta value	
	iii) Interfacial tension(N/m)	
	iv) Breakdown strength (kV)	
	b) Total Quantity including 5% extra (liters)	
	c) Oil flow inside Transformer (Directed/ Forced/ Normal)	
1.31.00	Core	
	a) Type of construction(core/shell)	
	b) Net core area (mm^2)	
	c) Core material and grade used	
	d) Type of joint between core and yoke	
	e) Thickness of stamping (mm)	
	f) Percentage silicon content (%)	

CLAUSE NO.	Bidder's Name ……..	
	g) Maximum flux density in core at rated frequency and at	
	i) 90% voltage (wb/m^2)	
	ii) 100% voltage (wb/m^2)	
	iii) 110% voltage (wb/m^2)	
1.32.00	Winding	
	a) Type of winding	
	i) HV	
	ii) MV	
	iii) LV /LV1/LV2	
	iv) Tap	
	b) Current density at rated load	
	i) HV (A/mm^2)	
	ii) MV	
	iii) LV/LV1/LV2 (A/mm^2)	
	iv) Tap	
'	c) Conductor area (mm2)	
	i) HV	
	ii) MV	
	iii) LV /LV1/LV2	
	iv) Tap	
	d) Magnetizing inrush current(Amps)	
	i) % Component of 2^{nd} harmonic current (max & min)	
	e) No load current (Amps) at rated frequency and at	
	i) 90% voltage	
	ii) 100% voltage	
	iii) 110% voltage	
	f) Magnetising current at rated frequency and at rated voltage	
	g) Leakage reactance	
	i) HV	
	ii) MV	
	iii) LV /LV1/LV2	
	h) Resistance	
	i) HV	
	ii) MV	
	iii) LV /LV1/LV2	
	i) Air core reactance of HV winding	
1.33.00	Tank	

CLAUSE NO.	Bidder's Name ……..	
	a) Tank cover-Conventional/Bell Type	
	b) Approximate thickness of	
	i) Side (mm)	
	ii) Bottom (mm)	
	iii) Cover	
1.34.00	Vacuum withstand capability of	
	a) Main tank	
	b) Coolers and accessories	
1.35.00	Minimum draw bar pull required to move the transformer on level track(kg)	
1.36.00	Size of filter hose	
1.37.00	Fault level	
2.00.00	**NGR**	
	i) Name of Manufacturer	
	ii) Type	
	iii) Resistance material	
	iv) Voltage	
	v) Rated Current	
	vi) Rated Duty	
	vii) Total Resistance of resistor	
	viii) Max. Allowable temp. rise	
	ix) Service	
	x) Degree of protection	
	xi) Weight of complete NGR	
	xii) Reference Standard	
	xiii) Enclosure material & Thickness	
	xiv) Max. overall dimensions	
	xv) Test Voltage(withstand value)	
3.00.00	**SHUNT REACTOR (BUS/LINE)**	
3.00.00	Maker's Name & country of manufacture	
3.01.00	Type of reactor(Gapped/Air core)	
3.02.00	Standards applicable	

SECTION-5

CHECKLIST FOR OIL TYPE LT OUTDOOR AUXILIARY TRANSFORMER

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.

TECHNICAL PARAMETER

Sl. No.	Parameters	Data	Compliance	Remark
(1)	Applicable IS	IS: 2026, IS: 1180, IS: 6600 & IEC-60076, Latest BEE/ CEA notifications & guidelines	Yes	
(2)	Rated Voltage (i) HV Winding (kV) (ii) LV Winding (kV)	 (i) 11 (ii) 0.433	 Yes Yes	
(3)	Service- (i) Outdoor/ Indoor	 (i) Outdoor	 Yes	
(4)	Percentage Impedance	5%	Yes	
(5)	Rated frequency (Hz)	50	Yes	
(6)	Number of phases	3	Yes	
(7)	Connections (i) HV Winding (ii) LV Winding	 (i) Delta (ii) Star	 Yes Yes	
(8)	Winding Connections	 Dyn1	 Yes	
(9)	Type of cooling	ONAN	Yes	
(10)	Tap changing equipment (i) Type (ii) No. of steps	 Off circuit tap change switch ±5% in steps of 2.5% on HV side	 Yes Yes	

Sl. No.	Parameters	Data	Compliance	Remark
(11)	Guaranteed positive sequence impedance at 75 °C with 100 % rating at (i) Principal tap- As per IS/IEC/customer specified (ii) Maximum tap- As per IS/IEC/Customer specified (iii) Minimum tap- As per IS/IEC/Customer specified	Vendor to furnish data		
(12)	Maximum Temperature rise over an ambient of 50 °C (i) Oil (°C), if applicable (ii) Windings (°C)	 (i) 40°C (ii) 45°C	 Yes Yes	
(13)	Transformer energy efficiency level as per IS: 1180	Transformer shall be compliant to latest IS: 1180 & star rated as per prevalent latest BEE/ CEA notifications or guidelines. As per current latest IS: 1180 and BEE notification transformer shall be of energy efficiency level: STAR-2 rating or better as per BEE guideline	Yes Yes	

Sl. No.	Parameters	Data	Compliance	Remark
(14)	Withstand time for short circuit (second)	2 sec	Yes	
(15)	Insulation level (A) Power frequency voltage withstand (i) HV Winding (kV rms)- (ii) LV Winding (kV rms)- (B) Basic Impulse level (i) HV Winding (kVp) (ii) LV Winding (kVp) (C) Highest voltage (i) HV Winding (kV) (ii) LV Winding (kV)-	 (A) (i) 28 (ii) 3 (B) (i) 75 (ii) NA (C) (i) 12 (ii) 1.1	 Yes Yes Yes Yes Yes Yes	
16a)	Terminal arrangement - (i) High voltage side- Suitable for Cables /Overhead conductor (ii) Supply of Cable lugs for HV side in bidder's scope	Cable box Suitable for 11kV Cables of size: 3Cx150 sq. mm. Al Yes	Yes Yes	
16b)	Terminal arrangement - LV side (phase)	Flange throat for TPN non-segregated Al Busduct. Degree of protection of LV busduct flange enclosure shall be IP:55	Yes Yes	

Sl. No.	Parameters	Data	Compliance	Remark
16c)	Terminal arrangement - LV side (Neutral)	One neutral as part of LV busduct flange throat and second neutral with copper earthing bar for system earthing brought near the base of the transformer	Yes	
(17)	Bushing			
	(A) High voltage	(A)		
	(i) Rated Voltage(kV)	(i) 12	Yes	
	(ii) Rated Current(A)	(ii) 100	Yes	
	(iii) Basic Impulse level (kV)	(iii) 75	Yes	
	(iv) Minimum Creepage distance	(iv) 31mm/kV	Yes	
	(v) Wet and dry power frequency withstand Voltage (kV rms)	(v) 28	Yes	
	(B) Low voltage and Neutral	(B)		
	(i) Rated Voltage(kV)-	(i)1.1	Yes	
	(ii) Rated Current(A)-	(ii)2000	Yes	
	(iii) Minimum Creepage distance	(iii)31mm/kV	Yes	
(18)	Minimum clearance (mm) in air			
	(i) Phase to Phase (HV side)	(i) As per IS/ IEC	Yes	
	(ii) Phase to Earth(HV side)	(ii) As per IS/ IEC	Yes	
	(iii) Phase to Phase (LV side)	(iii) 25mm	Yes	
	(iv) Phase to Earth (LV side)	(iv) 25mm	Yes	
(19)	Method of Earthing	Solidly earthed	Yes	

(20)	Provision/ accommodation of CTs LV Neutral	2 Cores: PS Class & 5P20 CT for REF & standby EF protection. **Core 1:** 1600/1, CL-PS, Rct≤8 Ω, Vk≥400V, Ie≤30mA at Vk/2 **Core 2:** 1600/1, 5P20, 5 VA CT particulars shall be finalized during detail engineering. There shall be no commercial implication to BHEL on this account.	Yes	

TESTS

A) ROUTINE TESTS

Whether during manufacture and on completion, all transformers are subjected to the routine tests in accordance with latest IS/IEC and are in line with clause no. 2.7.7 (I) of section-2 of this specification.

(YES/NO)

B) TYPE TESTS

i) The bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The owner may waive conduction of any test subject to availability of test reports. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.

(YES/NO)

ii) The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days' notice shall be given by the bidder. The owner may waive conduction of any test subject to test facility anywhere in the world. The bidder shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

(YES/NO)

iii) In case the bidder has conducted such specified type test(s) not earlier than five years prior to the date of techno-commercial bid opening i.e 06-June-2022, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the bidder.

(YES/NO)

iv) During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed below in specification and carried out within last five years from the date of techno-commercial bid opening i.e 06-June-2022. The reports should be for the test 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 witness by a client. However if the contractor is not able to submit report of the type test(s) conducted within last five years from date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/employer's representative and submit the reports for approval.

(YES/NO)

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

(YES/NO)

vi) Details of testing shall be as per Section II of this specification.

(YES/NO)