BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	RD	VK	RS
TITLE: 400kV CURRENT TRANSFORMER		SIGN			
		DATE			
		GROUP	TBEM	W.O. No	8001

CUSTOMER	RAICHUR POWER CORPORATION LIMITED (RPCL)
CONSULTANT	STEAG
PROJECT	400KV SWITCHYARD PACKAGE for 2 X 800MW TPP at YERAMARUS

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 400kV CURRENT TRANSFORMER at Yeramarus TPP complete with accessories as listed in this specification.

The fitment and equipments offered shall be of approved make of RPCL or its subsequent approval from RPCL shall be bidder's responsibility with no commercial implications to BHEL. If any of the make offered by the bidder is not acceptable to M/s RPCL, the bidder has to supply alternate RPCL approved make, meeting the specification, with no commercial implications to BHEL.

The specification comprise of following sections:

Section-1: Scope, Specific Technical Requirements and Quantities
Section-2: Equipment Specification
Section-3: Project Details & General Technical Requirements
Section-4: Guaranteed Technical particulars (GTP)
Section-5: Enclosures to Technical Specification

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

1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of customer : Raichur Power Corporation Limited (RPCL)

Name of Projects : 400kV Switchyard Package for 2 x 800MW TPP at Yeramarus for M/s RPCL

Refer Section - 3 for Project Details and General Specifications.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 System parameters and technical requirements

Sl No.	Parameters	400kV CT
1	Nominal voltage (Phase to Phase) [kVrms]	400
2	Max. Continuous voltage *Um* (Phase to Phase) [kVrms]	420
3a	1.2/ 50 micro sec Impulse withstand voltage [kVp]	±1425
3b	250/2500 micro sec Switching Impulse withstand voltage (Dry and Wet) [kVp]	±1050

4	One min. dry and wet power frequency withstand voltage [kVrms]	630
5	One minute power frequency withstand voltage secondary terminal & earth [kV]	5
6	Rated frequency [Hz]	50
7	Rated Short Time current for 1 sec [kA]	50
8	Rated Dynamic current withstand [kA (peak)]	125
9	Rated Primary Current [A]	3000/ 2000
10	Rated Extended Primary Current	120%
11	Rated secondary current [A]	1
12	Minimum creepage Distance (phase to ground) [mm]	13020
13	Max temperature rise over design ambient temp	As per IEC 60044-1
14	Type of Insulation	A
15	Radio Interference voltage at 266kV (rms) for frequency range 0.5 to 2Mhz [micro volts]	<1000
16	Corona Extinction voltage [kV]	320
17	Partial Discharge level [pC max]	10
18	Number of Terminals	All terminals of control circuits are to be wired upto terminal box plus 20% spare terminals evenly distributed on all TBs.
19	Cantilever strength of CT at the terminal [kg]	800

Each CT shall be equipped with an over voltage protective device to limit the voltage developed across the secondary terminals to a safe value not exceeding 3 kV.

1.2.2 Core Parameters for 3000A Current Transformer

Core no	Current Ratio (A)	Output Burden (VA)	Accuracy class as per IEC : 60044-1	Min. knee point voltage (volts) Vk	Max. CT Secondary winding resistance (ohms)	Max. exciting current (mA)
1	3000- 2000- 500/1	-	PS	4000V 2660V 665V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap
2	3000- 2000- 500/1	-	PS	4000V 2660V 665V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap
3	3000- 2000- 500/1	20VA 20VA 20VA	0.2s 0.2s 0.2s	-	-	ISF $\leq$ 5
4	3000- 2000- 500/1	-	PS	3000V 2000V 500V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap
5	3000- 2000- 500/1-	-	PS	3000V 2000V 500V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap

Intermediate tapping at 3000-2000 shall be suitable for use as 1000/1A

1.2.3 Core Parameters for 3000A Metering Current Transformer

Core no	Current Ratio (A)	Output Burden (VA)	Accuracy class as per IEC : 60044-1	Min. knee point voltage (volts) Vk	Max. CT Secondary winding resistance (ohms)	Max. exciting current (mA)
1	3000- 2000- 500/1	20VA 20VA 20VA	0.2s 0.2s 0.2s	-	-	ISF $\leq$ 5
2	3000- 2000- 500/1	20VA 20VA 20VA	0.2s 0.2s 0.2s	-	-	ISF $\leq$ 5

1.3 BILL OF QUANTITY

Item No.	Description	Quantity (Main)	Quantity (Spare)
01	Single Phase, 400kV, 3000A, 50kA for 1s Current Transformer	90 Nos.	-
02	Single Phase, 400kV, 3000A, 50kA for 1s Metering Current Transformer	24 Nos.	-

!! Note: The above quantity may vary by +/- 30% before placement of order.

Hardware (Nut Bolts and Washers) for Mounting CT on structure – 1set for each CT.

Note- Marshalling Box for a set of three (3) CTs shall be provided by BHEL, TBG

1.4 TYPE TEST

All equipments to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last 5 years from the date 9.4.2010. 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.

However if contractor is not able to submit report of the type test(s) conducted within last 5 years from the date mentioned above, 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 owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

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

1.5 DRAWINGS

The documentation requirements detailed under Section-3 shall be submitted to BHEL at various stages of contract. Softcopy of the drawings are to be submitted at contract stage.

1.6 DOCUMENTS REQUIRED WITH OFFER

a) "No Technical Deviation" Certificate
b) Un-priced schedule
c) Filled up Checklist. (*Guaranteed Technical Particulars is required at contract stage*)
d) Catalogue and Technical Leaflets for the offered Equipments

SECTION-2

EQUIPMENT SPECIFCATION

2.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Current Transformer (CT). in case of any discrepancies between requirements mentioned in this section and those mentioned in Section-3 of this specification, this specification shall prevail and shall be treated as binding requirement.

2.1 GENERAL

The AC Instrument Transformers and accessories shall conform to the latest version of IEC60044/ IS: 2705. The instrument transformers provided for control, metering and protective relaying functions shall have accuracy ratings and burden capabilities adequate to provide their designated functions within the overall accuracy requirements of the systems. The CT shall be designed for use in geographical and meteorological condition as specified for the project.

The specification given below relatesto oil filled instrument transformers.

2.2 TECHNICAL AND CONSTRUCTIONAL REQUIREMENTS

The features and constructional details of current transformers shall be in accordance with requirements stipulated hereunder:

2.2.1 Bushing/Insulators:

a) Current Transformer shall be of 420kV class, oil filled, with shedded porcelain bushings/ Insulators suitable for outdoor service and upright mounting on steel structures.

b) Bushings/Insulators shall conform to requirements of relevant IS.

c) CT tank shall be provided with oil filling and drain plugs, oil sight glass.

d) Instruments transformers shall be hermetically sealed units. Manufacturer shall furnish details of the arrangements made for the sealing of instrument transformers.

e) Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

2.2.2 Terminal box:

Each single phase instrument transformers shall be complete with its terminal box. The terminal box shall meet the requirements of IP55 as per IS-13947 Part-I.

2.2.3 Insulating Oil:

Insulating oil to be used for instrument transformers shall be of EHV grade and shall conform to IS: 335 (required for first filling) and IEC60296.

2.2.4 Tank

The tank alongwith top metallics shall be hot dip galvanised or painted.

2.2.5 Lifting arrangement

Current transformers shall be provided with suitable lifting arrangement, to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing.

2.2.6 Name Plate:

Nameplate shall conform to the requirements of IEC incorporating the year of manufacture. The rated current, extended current rating in case of current transformers shall be clearly indicated on the nameplate. The rated thermal current of CT shall also be marked on the name plate.

2.3 SPECIFIC TECHNICAL REQUIREMENT

a) Current transformers shall have single primary either ring type, or hair pin type and suitably designed for bringing out the secondary terminals in a weather proof (IP 55) terminal box at the bottom. These secondary terminals shall be terminated to stud type non disconnecting terminal blocks inside the terminal box.

b) Different ratios specified shall be achieved by secondary taps only and primary reconnection shall not be accepted.

c) Core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores used for protection shall produce undistorted secondary current under transient conditions at all ratios with specified CT parameters.

d) The expansion chamber at the top of the porcelain insulators should be suitable for expansion of oil.

e) Facilities shall be provided at terminal blocks in the marshalling box for star/delta formation, short-circuiting and grounding of CT secondary terminals.

f) The guaranteed burdens and accuracy class are to be simultaneous for all cores. The accuracy class for measuring cores shall be met upto the rated extended primary current.

g) For 400 kV class CTs, the rated extended primary current of the CTs shall be 120% of rated primary on all cores of CTs.

h) The current transformer shall be suitable for horizontal transportation. It shall be ensured that the CT is able to withstand all the stresses imposed on it while transporting and there shall be no damage in transit.

i) For current transformer, characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% to 100% of rated burden over a range of 5% to 120% of rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs.

j) The instrument security factor of metering core at all ratios shall be less than five (5). If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired upto the terminal blocks.

k) The CT shall be designed as to achieve the minimum risks of explosion in service.

l) The current transformers shall be suitable for high speed auto reclosing, if required.

m) Super enameled wire shall preferably be used for secondary windings. Copper conductor shall be used for all windings.

2.4 TYPE & ROUTINE TESTS

2.4.1 The CTs shall conform to Type Tests as per relevant IS and IEC

2.4.2 The CTs shall be subjected to routine tests as per IS and IEC

SECTION - 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

GENERAL TECHNICAL REQUIREMENTS

1.0 PROJECT DETAILS

Customer	:	M/s Raichur Power Corporation Limited
Consultant	:	M/S Evonik Energy Services (India) Pvt. Ltd.
Project Title	:	2x800MW Yeramarus Thermal Power Station at Raichur.
Project Location	:	Near Wadloor village 5 kms. from Raichur TPS Raichur District.
Nearest Railway station	:	Yeramarus railway station at a distance of 2 kms.
Nearest Airport	:	Hyderabad around 200 kms
Nearest Access Roads	:	State Highway No. 13 at a distance of 0.5 kms.
Postal Address	:	Chief Engineer Yeramarus Thermal Power Station Raichur Power Corporation Ltd. Raichur, Karnataka

1.1 SITE CONDITIONS (FOR DESIGN PURPOSES)

1.1.1 SITE CONDITIONS

a).	Average rainfall per year	:	621 mm
b).	Altitude	:	1000 m

1.1.2 DESIGN AMBIENT

a).	Minimum Temperature	:	17.7°C
b).	Maximum Temperature	:	45°C
c).	Design Ambient Temperature	:	50 °C

1.1.3 RELATIVE HUMIDITY

a).	Maximum	:	75%

1.1.4 WIND PRESSURE (AS PER IS:875-1987)

a). Design wind speed : 39 m/sec.

1.1.5 SEISMIC FACTORS

a). Horizontal Seismic Coefficient : As per latest IS : 1893

b). Vertical Seismic Coefficient : As per latest IS : 1893

} *Zone – III*

1.1.6 ELECTRICAL DATA

		400 kV System	415V AC System	240V AC System	220 V DC System	48 V DC System
I.	Nominal Voltage	400 kV	415 V	240 V	220 V	48 V
2.	Highest System Voltage	420 kV	457 V	264 V	242 V	55 V
3.	No. of phases	3	3	1	NA	NA
4.	Frequency	50 Hz	50 Hz	50 Hz	NA	NA
5.	Voltage variation	-	± 10 %	± 10 %	± 10 %	± 10 %
6.	Neutral Earthing	Effectively Earthed	Solidly Earthed	Solidly Earthed	-	-
7.	Fault Level	50 kA for 1 sec.	50 kA for 1 sec.	50 kA for 1 sec.	15 kA for 1 sec.	-

1.1.7 SYSTEM PARAMETERS

Dry and wet one minute power frequency withstand voltage	630 kVrms
Dry impulse withstand voltage positive and negative	1425 kVpeak
Minimum Total Creepage	31 mm/kV

1.1.8 MINIMUM CLEARENCE (AS PER IS: 10118)

Phase to phase (PP)	4100 mm
Phase to earth (PE)	3500 mm
Section clearance	6500 mm
Minimum ground clearance from plinth level (Plinth level : 300 mm)	8000 mm

Vertical ground clearance to nearest part not at earth potential of an insulator supporting live conductor/ equipment	2440 mm

1.2 INSTRUCTION TO BIDDERS

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

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification. It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

1.3 STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other. When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval. The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

1.4 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in
case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

The purchaser intends to repeat the type tests and additional type tests on cables for which test charges shall be payable as per provision of contract.

The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if pert of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any

equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of this test or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

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

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

1.5 MATERIAL/WORKMANSHIP

1.5.1 GENERAL REQUIREMENT

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood 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 purposes for which they are intended.

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 and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil 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 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 be interchangeable with, 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.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be construed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances /instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture’s limits. Suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.
All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare in the proposal where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

1.5.2 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 favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

1.6 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The contractor shall propose a colour scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

1.7 PAINTING

a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS: 6005 "Code of practice for Phosphating Iron and Steel".

b) Oil, grease, dirt and swerve shall be thoroughly removed from emulsion by cleaning.

c) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

d) After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute bichromate solution and over drying.

e) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "Flash dried" while the second coat shall be stoved.

f) After application of the primer, two coats of finishing epoxy paint shall be applied, each coat followed by stoving. The panel shall have colour conforming to shade 631 of IS-5 for outside and inside of the panel with black colour for base frame.

g) Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.

h) Finished painted appearance of panel shall present an asthetically pleasing appearance free from dents and uneven surface.

i) A small quantity of finishing paint shall be supplied for minor touching up required at site after the installation of the panels.

1.8 PROTECTION

a) All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

b) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

c) The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

d) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

1.9 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the 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 interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

1.10 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for paintaing shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

1.11 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvasized. Minimum weight of zinc coating shall be 610 gm/sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

1.12 AUXILIARY POWER SUPPLY

1.12.1 A.C power supply for auxiliaries will be available at 240 V, 50 C/s 1-phase, 2 wire and 415V, 50 C/s, 3-phase, 4 wire, neutral solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%

1.12.2 D.C. power supply at 220 V, 2-wire ungrounded will be available 187 V to 242 V.

1.13 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests/acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested within 5 years from the date of opening the bid. Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the subcontractor will have to carry out the type tests without any extra cost and without any delivery implications.

1.14 PACKAGING

Aluminium Tube shall be partially packed with Hessians cloths. Similar items shall be grouped and tied with steel wires/strip for convenient handling during transits.

MARKINGS

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.

b) Purchase order number.

c) Name of supplier/s.

d) Description of equipment / material.
e) Tare weight.

f) Gross weight.

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. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises, while packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage wagons and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

1.15 HANDLING, STORING AND INSTALLATION

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser.

Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment

damaged due to negligence or carelessness or otherwise shall be replaced by the contractor at his own expenses.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the Contractor' account.

The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance to the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of such nature, corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipments which require indoor storage.

The words erection and installation used in the specification are synonymous. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

1.16 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

1.17 EQUIPMENT BASES

A cast iron or welded steel base-plate shall be provided for all rotating equipment, which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base-plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units shall have a raised lip all around, and shall have threaded drain connections.

1.18 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

1.19 DOCUMENTATION

1.19.1 DRAWINGS

All drawings shall be prepared in AutoCAD and ultimate documentation would include drawings/documents on CDs. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts, which are to be dispatched to site from works in dispatchable units and are reassembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings for engineer's approval. All the items of the shipping list should be identified in the drawing.

The drawing submitted by the supplier shall be reviewed by the purchaser as far as practicable within two weeks of receipt of drawings and shall be modified by the sub-contractor if any modifications and/or corrections are required by the purchaser. The sub-contractor shall incorporate such modifications and / or corrections and submit the final drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings shall not alter the contract completion date.

Further work by the subcontractor shall be in strict accordance with these drawings and no deviation shall be allowed without the written approval of the purchaser.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at supplier's risk.

Approval of drawing or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modifications that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built drawings' and required no. of prints thereof.

1.19.2 INSTRUCTION MANUALS

The supplier shall submit to the purchaser, draft instruction manuals for approval within 30 days of placement of order. The final instruction manuals complete in all respects shall be submitted 60 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any modification/ addition / changes, the same shall be incorporated and the up- dated final instruction manuals shall be submitted as required.

1.19.3 TITLE BLOCK & DRAWING/ DOCUMENT NUMBERING SCHEME

Title block for drawing / document should be followed as per ANNEXURE-1

1.19.4 DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A.	For approval	No of Copies
	Copies of all drawings with project details, dimension, shipping weights, No. of cases & dimensions, fixing details, tolerance etc.	10
	Copies of type test reports.	5
	Copies of works quality plan & field quality plan.	5
	Copies of installation, operation & maintenance manual.	5
	Copies of drawings on floppies/CDs	1 set
B.	After approval and for information / distribution	
	Copies of all drawings	15
	Copies of installation, operation & maintenance manual including Routine test reports	15
	Sets of RTF of drawings	2
	CDs of Drgs.	3
C.	As Built Drawings	
	Hard copies of Drawings	15
	CDs	3

NOTE:

1. Any revision of drawings / documents shall be submitted in the same no. of copies submitted first time for approval

2. Final drawings / documents shall be submitted in bound volume with customer and project details etc. written on the top.

SECTION 4

GUARANTEED TECHNICAL PARTICULARS

1. Name and address of manufacturer
2. Manufacturer's type designation
3. Standards applicable
4. Rated frequency (Hz)
5. Rated voltage (kV)
6. Rated current
   - i. Rated continuous normal current (A)
   - ii. Rated extended primary current (A)
7. Short time thermal current withstand for 1 second (KA).
8. Dynamic current withstand (kA peak).
9. 1.2/50 micro second impulse withstand voltage (kV peak)
10. 250/2500 micro seconds switching surge withstand voltage (kV peak dry and wet)
11. One minute dry and wet power frequency withstand voltage (kV rms)
12. No. of cores per CT
13. Transformation ratio
14. No. of secondary turns (Nominal)
15. Rated output (VA) at different taps
16. Accuracy class
17. Knee-point voltage (V) at different taps

18. Secondary data
    a. Secondary resistance at different taps.
    b. Oversize factor and transient error under CO-t-CO duty condition with t=400 ms and duration of fault(100 ms)
19. Maximum exciting current
    a. 100% kpv (mA)
    b. 25% kpv (mA)
    c. 20% kpv (mA)
    d. 10% kpv (mA)
20. Instrument security factor at different ratios.
21. Radio interference voltage at $1.1Ur/\sqrt{3}$ kV (rms) at 0.5 to 2.0 MHz (micro volts)
22. Whether auxiliary CT/reactors provided for metering winding.
23. Corona extinction voltage (kV rms)
24. Partial discharge level (pico coulombs)
25. Total creepage distance (mm)
26. Primary
    a) No. of primary turns
    b) Material and cross section of primary(cm^2)
    c) Whether bar type or ring type primary
27. Whether CT is suitable for transportation horizontally

28. Composite error at rated burden and at
    a) 20% rated current
    b) 120% rated current
29. Composite error at 25% rated burden and at
    a) 20% rated current
    b) 120% rated current
30. Quantity of oil per CT (kg)
31. Whether spark gap/surge arrester provided at the primary
32. Standard to which oil conforms generally
33. Characteristics of Oil (Prior to filling)
    a) Breakdown voltage (kV)
    b) Dielectric dissipation constant at 90°C
    C) Water content(ppm)
    d) Gas content (ppm)
    e) Interfacial tension at 27°C (N/m)
    f) Specific resistance
       i) at 90°C (ohm-cm)
       ii) at 27°C (ohm-cm)
34. Whether current transformers are hermetically sealed. If so, how.
35. Total weight (kg)
36. Transport weight (kg)

37. Dimensional details

    i) Overall height from mounting plane

    ii) Height up to terminals from mounting plane

    iii) Mounting dimensions & diameter of mounting holes

    Iv) Terminal pad diameter and length

        i) Material of terminal pad

        ii) Diameter of insulator at

            a) top end

            b) bottom end

38. Temperature rise over an ambient temp. of 50° C (° C)

39. Transient over voltage withstand for

    a) 30 seconds (kV peak)

    b) 1 minute (kV peak)

40. Whether CT characteristic curves enclosed

41. Details of recommended support structure enclosed

42. Drawing showing clearance from earthed objects enclosed

43. Type test reports enclosed

44. OGA drawing enclosed

45. Details of spark gap provided at the primary enclosed

SECTION 5

List of Enclosures with Technical Specification:

CHECK LIST FOR 400KV CURRENT TRANSFORMER

Put a tick mark (√) on 'YES' if the specified requirement is met, or put a tick mark on 'NO', if the specified requirement is not met and give comments in the "Remarks" column.

Sl. No.	Parameters	Data	YES/NO	Remarks
1	Manufacturer's type designation	Bidder to furnish in Remarks Col.		
2	Type of CT			
	a) Insulating medium	Oil	YES/NO	
	b) Installation	Outdoor	YES/NO	
	c) Mounting	Upright	YES/NO	
	d) Tank design	i. Live tank	YES/NO	
		ii. Dead tank	YES/NO	
3	Standards Applicable	IEC 60044-1, IEC-60044-4 , IS-2705-(P1 to P4), ANSI-C5713	YES/NO	
4	Rated Voltage (kV rms)	400KV	YES/NO	
5	Rated Primary Current	3000A	Yes/No	
6	Rated short time thermal current	50 KA for 1(one)Sec	YES/NO	

7	Rated dynamic current	125 kA	YES/NO	
8	Max. Temperature rise over design ambient temperature	As per IEC:60044-1	YES/NO	
9	One minute power frequency withstand voltage - Secondary Terminal and Earth	5KV	YES/NO	
10	Cantilever Strength	Not less than 800Kg	YES/NO	
11	Class of Insulation	A	YES/NO	
12	Core parameters	As per table a clause 1.2.2 and 1.2.3 of Section -I	YES/NO	
13	Technical parameters	As per table a clause 1.2.1 of Section -I	YES/NO	
14	**External Surface**			
	Tank and Top Metallics	Hot dip galvanized	YES/NO	
16	**Specific requirements for Oil CT's**			
	a. Oil filled CT's:			
	i. Grade of oil	EHV grade	YES/NO	
	ii. Standard to which oil conforms	IS-335 / IEC-60296	YES/NO	
	iii. Oil filling and drain plug provided.		YES/NO	
	iv. Oil sight glass provided		YES/NO	

17	**Hermetic Sealing**			
	a. Hermetically Sealed		YES/NO	
	b. Details of arrangement made for Hermetical sealing of the CT's are available and shall be furnished at contract stage.		YES/NO	
	c. Details of Site test to check the effectiveness of the hermetic sealing are available and shall be furnished at contract stage .		YES/NO	
18	Polarity of CT permanently marked		YES/NO	
19	Name Plate			
	As per IEC standards, and shall clearly indicate Year of manufacture, Rated current , Extended current rating & rated thermal current		YES/NO	
20	Terminal Box -Ingress Protection	IP 55	YES/NO	
21	Rated extended current	120%	YES/NO	
22	Packing & Transportation			
	a. CT suitable for horizontal transportation.		YES/NO	
	b. Details of packing design shall be furnished for review at contract stage.		YES/NO	
23	CT suitable for High speed auto-reclosing.		YES/NO	
24	Valid Type test reports are available and attached along with this offer.		YES/NO	

25.	Following Documents are attached along with the offer :			
	a. Filled Checklist.		YES/NO	
	b. Filled GTP		YES/NO	
	c. Catalogue/ leaflets		YES/NO	
	d. Drawings		YES/NO	