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	26/05/14	28/5/14	29/5/14
		GROUP	TBEM	W.O. No	83012
CUSTOMER	MADHYA PRADESH POWER TRANSMISSION CO. LTD.				
CONSULTANT	------				
PROJECT	400kV SUBSTATION PACKAGE AT BALAGHAT, BADNAWAR, BHOPAL, CHHEGAON AND NAGDA				

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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 complete with accessories as listed in this specification.

The fitment and equipments offered shall be of approved make of MPPTCL or its subsequent approval from MPPTCL 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 MPPTCL, the bidder has to supply alternate MPPTCL 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: Checklist

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

Note: The term 'Owner' appearing in this specification shall refer to MPPTCL, the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.

1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of customer: Madhya Pradesh Power Transmission Co. Ltd. (MPPTCL)

Name of consultant: ----------

Name of Projects: 400kV Substation Package at Balaghat, Badnawar, Bhopal, Chhegaon and Nagda

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** (Outdoor, Oil-filled, live/dead tank, hermetically sealed)
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 between secondary terminal & earth [kV]	As per Annexure-I, Section-2
6	Rated frequency [Hz]	50
7	Rated Short Time current [kA]	40
8	Rated Dynamic current withstand [kA (peak)]	100
9	Rated Primary Current [A]	2000
10	Rated Extended Primary Current	As per Annexure-I, Section-2
11	Rated secondary current [A]	1
12	Minimum creepage Distance (phase to ground) [mm/kV]	25
13	Max temperature rise over design ambient temp	As per Annexure-I, Section-2
14	Type of Insulation	Oil Immersed Class A
15	Radio Interference voltage at 266kV (rms) for frequency range 0.5 to 2Mhz [micro volts]	As per Annexure-I, Section-2
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.

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 2000A Current Transformer

Core No	Current Ratio (A)	Output Burden at lowest tap (VA)	Accuracy class	Min. Knee Point Voltage Vk (Volts)	Max. CT Secondary winding resistance (ohms)	Max. exciting current at KPV (mA)
1	2000-1000-500/1	-	PS	2000-1000-500	10-5-2.5	30mA on 2000/1 Tap 60mA on 1000/1 Tap 120mA on 500/1 Tap
2	2000-1000-500/1	-	PS	2000-1000-500	10-5-2.5	30mA on 2000/1 Tap 60mA on 1000/1 Tap 120mA on 500/1 Tap
3	2000-1000-500/1	20	0.2s ISF $\leq$ 5	-	-	-
4	2000-1000-500/1	-	PS	4000-2000-1000	10-5-2.5	30mA on 2000/1 Tap 60mA on 1000/1 Tap 120mA on 500/1 Tap
5	2000-1000-500/1	-	PS	4000-2000-1000	10-5-2.5	30mA on 2000/1 Tap 60mA on 1000/1 Tap 120mA on 500/1 Tap

1.3 BILL OF QUANTITY

Item No.	Description	Quantity						
		Balaghat	Badnawar	Bhopal	Chhegaon	Nagda	Mandatory Spares	Total
01	Single Phase, 400kV, 2000A, 40kA for 1s, 5 core Current Transformer	18 Nos.	27 Nos.	6 Nos.	3 Nos.	6 Nos.	12 Nos.	**72 Nos.**
02	Single Phase, 400kV, 2000A, 40kA for 3s, 5 core Current Transformer	18 Nos.	27 Nos.	6 Nos.	3 Nos.	6 Nos.	12 Nos.	**72 Nos.**

Note-

1. Hardware (Nut, Bolts and Washers) for Mounting CT on structure – 1 set for each CT to be included by bidder in their offer.
2. Marshalling Box for a set of three (3) CTs shall be provided by BHEL.
3. Substation-wise break-up of mandatory spares shall be informed to the bidders during ordering.
4. **Bidder to quote for both type of CT as per Sl. No. 01 and 02 of BOQ; however, only one type of CT shall be ordered.**

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 **five years from 20.11.13**. 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
d) Catalogue and Technical Leaflets for the offered Equipments

SECTION-2

Volume-II, Part-8

2.1.3 (A)TECHNICAL SPECIFICATION FOR 400 KV CURRENT TRANSFORMERS

1.0 SCOPE :

The scope of this specification covers design, manufacturing and supply of equipment as per Volume-II, Part-8, Book-I. The bidder mentioned in the Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The Purchaser means the "MPPTCL".

In case bidder is not OEM, sole responsibility of offering equipment/material of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS :

Applicable Standards for the offered equipments / items shall be as per ~~Volume-II, Part-8, Book-I.~~ APPENDIX-A .

3.0 CLIMATIC CONDITIONS :

- Applicable climatic conditions shall be as per ~~Volume-II, Part-8, Book-I.~~ SECTION-3 .

4.0 SYSTEM PARTICULARS :

Applicable System Particulars shall be as per ~~Volume-II, Part-8, Book-I.~~ SECTION-3

5.0 BASIC DESIGN AND TECHNICAL REQUIREMENT FOR 400 KV CURRENT TRANSFORMERS:

5.1 BASIC DESIGN:

a. The 400 KV Current Transformer will be of dead tank or live tank design. In case of dead tank CT, only hair-pin design shall be acceptable. The equipment shall be outdoor, single phase oil immersed and self cooled type suitable for services indicated as above complete in all respect, conforming to modern practices of design and manufacture.

As stated, Current transformers shall be paper insulated, oil filled, dead tank / live tank type. The Current transformer after providing paper insulation shall be housed in the tank containing oil. Please note epoxy casting in primary & secondary cores is not acceptable. The compound filled CTs are also not acceptable. Manufacturers should briefly describe complete process of manufacturing.

Current Transformer with cascade design / interposing CTs / auxiliary CTs are not acceptable

b. The insulation as per the latest version of IS:4800 or equivalent International Standard of the current transformers shall be so designed that the internal insulation shall have higher electrical withstand capability than the external insulation. The designed dielectric withstand values of external and internal insulations shall be clearly brought out in the guaranteed technical particulars. The dielectric withstand values specified in this specification are meant for fully assembled current transformers.

c. The current transformers covered under this specification shall meet the technical requirements indicated in Annexure I & Annexure II enclosed with the specification.

5.2 PORCELAIN HOUSING:

a. The Current transformer should be designed using single porcelain housing. No metallic joints shall be provided in the porcelain. The housing shall be made of homogeneous, vitreous porcelain of high mechanical and electric strength. Glazing of porcelain shall be of uniform brown or dark brown colour with a smooth surface arranged to shed away rain water or condensed water particles (fog.).The profile of porcelain shall be aerodynamic type as per latest version of IEC-815.

b. Details of attachment of metallic flanges to the porcelain shall be brought out in the Bid.

5.3 METAL TANK :

Special precaution will have to be taken towards selection of material for the metal tank and the following will have to be ensured.

i. Material for metal tank which should be minimum 3 mm. thick (i. e. mild steel/stainless steel/aluminium alloy) shall be carefully selected depending upon the primary current and the material should be clearly mentioned against technical questionnaire.

ii. The practice of providing inserts of non-magnetic material in the body of the tank with suitable welding to reduce eddy current shall not be acceptable. This problem should be avoided by selection of tank of suitable material.

iii. Welded joints have to be minimised to avoid possibility of oil leakage. In any case welding in horizontal plane shall be avoided.

iv. The slot / hole cutting in the bottom tank should be done smoothly to avoid any sharp edges within the tank. All welded surfaces need to be smoothened and shall be covered with pressboard or other insulating material of good mechanical properties.

v. The bottom tank should not have any dents and pitting to ensure proper tightening of gasket and to avoid any oil leakage. Fabrication of bottom tank shall be done by utilizing fresh sheet steel only.

The material selected for the tank shall be justified with suitable explanation.

5.4 PREVENTION OF OIL LEAKAGES AND ENTRY OF MOISTURE:

a. The sealing of Current transformer shall be properly achieved. The following should be properly taken care of & arrangement provided by the bidder shall be described.

i. Locations of emergence of primary and secondary terminals.

ii. Interface between porcelain housing and metal tank.

iii. Cover of the secondary terminal box.

b. For gasketed joints, wherever used, nitrite butyl rubber gaskets, neoprene or any other improved material shall be used. No cork gaskets shall be used The nitrite butyl rubber 'O' Ring should be fitted in properly machined groove with adequate space for accommodating the gasket under compression at interface between main porcelain bottom flange and main tank neck cover. You have to submit complete details and justify that the quality of gaskets which will be used between the joints will be of best quality to avoid leakage of oil. The quality of gasket should be selected keeping in mind that the ambient temperature in MP now touches 50 deg. centigrade.

c. The CT shall be of dead tank or live tank design and shall be so constructed that it can be easily transported to site within the allowable transport limitation and in horizontal position if the transport limitations so demand. The CTs shall be hermetically sealed and method of such sealing shall be detailed out in the bid.

5.5 TERMINAL CONNECTORS:

The terminal connectors required for connection of the current transformer to owner's bus bar, shall be in the bidder's scope. The terminal connectors shall be suitable for 4 inch IPS tube / Twin Moose ACSR conductor. The terminal connector shall conform to the latest version of IS: 5561 or equivalent International Standard. The drawing of terminal connector is enclosed with bid document for guidance. The type of terminal connectors for 400 KV CT shall be as under:-

i) Expansion type terminal connector for 4 inch IPS tube suitable for horizontal take off.
ii) Rigid type terminal connector for 4 inch IPS tube suitable for vertical take off.
iii) Rigid type terminal connector for twin moose ACSR suitable for vertical take off.

The design of clamp shall be to our approval. The details of current take off as required by us should be detailed out in drawing and should be submitted along with the bid. In respect of the terminal connectors, following should be ensured: -

a. The terminal connector should be made of A6 Aluminium Alloy and by pressure/gravity diecast only. Sand casted terminal connectors are not acceptable. The current rating of terminal connector will be 1.5 times the rated current. The current density shall not exceed 1 Amp/sq.mm. in any part.

b. All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges should be rounded off.

c. No part of clamp shall be less than 12mm thick.

d. All current carrying parts shall be designed and manufactured to have minimum contact resistance. The bimetallic strips/sleeve shall be 2 mm thick.

e. All nuts/bolts/washers shall be made of HDG Mild steel with minimum diameter of 12 mm.

g. The conductor should be tightened by six bolts. Conductor hold length must not be less than 100mm.

h. The clamp for Twin Moose ACSR conductor shall be made of three pieces so that each conductor may be tightened separately.

i. Size of terminal connector for which the clamp is designed and also rated current under site conditions shall be embossed / punched on each part of clamp except hardware.

j. The surface of clamps to be tightened by six bolts should be flat in shape so that it may be possible to open the nuts and bolts by normal spanners. Therefore, any type of groove in the clamp body for fixing of nuts should be avoided.

k. The portion of clamp to hold the conductor should be flat and straight and not zig-zag in construction, at both the sides, so that heating of clamp by throttling action of current may be avoided.

l. Space of at least 50% of diameter of nuts should be available after the hole at both the sides of conductor holding portion for better mechanical strength.

5.6 MOUNTING :

The Current transformer shall be suitable for mounting on our steel structure, which shall be arranged by the purchaser. The mounting dimensions of equipment shall match with the mounting dimensions of structure indicated in enclosed Annexure-V.

5.7 INSULATING OIL :

The insulating oil for first filling of oil in each transformer shall be in the scope of bidder. Only best quality new EHV Grade transformer oil should be used with the equipments with minimum BDV of 70KV. The oil shall comply in all respect with the provisions of the latest version of IS: 335 or IEC publication no. 60296 (as amended up to date). The oil parameters viz., Tan Delta value, resistivity, PPM and BDV of oil filled in the CTs shall be recorded in the test certificates of respective CT.

5.8 SURFACE FINISH :

The metal tanks shall be coated with at least two coats of zinc rich epoxy painting or hot dip galvanized. All the ferrous hardware, exposed to atmosphere, shall be hot dip galvanised conforming to the latest version of IS: 2629 or equivalent International Standard. All other fixing nuts, bolts, washers shall be made of HDG Mild steel.
The internal and external surfaces of metal tanks to be painted shall be shot or sand blasted to remove all rust and scale of foreign adhering matter or grease. All steel surfaces in contact with insulating oil shall be hot dip galvanized or painted with two coats of heat resistant, oil insulating varnish. All paints shall be carefully selected to withstand extremes of weather. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.

5.9 TEMPERATURE RISE :

The temperature rise of a current transformer winding when carrying a primary current equal to 125% of rated current at a rated frequency and with a unity power factor burden corresponding to rated output connected at the secondary winding shall be 5° (five degrees) less than the permissible values given in the latest version of IS : 2705 or equivalent international standard.

5.10 ARRANGEMENT FOR COMPENSATION OF OIL VOLUME :

For compensation of variation in the oil volume due to variation in ambient temperature, stainless steel bellows shall be used. No other arrangement for this purpose shall be acceptable. For indication of oil level, a ground glass window shall be provided to monitor the position of metal bellow.

5.11 SECONDARY TERMINALS TERMINATION :

The following may please be noted for strict compliance: -

(a) The C.T. secondary terminals shall be brought out in a weather proof terminal box. Firstly the connections will be terminated on an internal board and then the same shall be brought out in the outer secondary terminal box. The secondary terminals termination should be bolted type with wire size 4 sq.mm. copper for connections.

(b) The outer secondary terminal box should have two separate compartments with separate covers for the purpose of sealing. Each compartment will have the terminals of each metering core. Suitable gland plates for both the compartments will have to be provided. This is required because covers of metering cores compartment will be provided with suitable seals to be operated by separate agencies who will verify the cover periodically for metering purpose.

(c) The terminal box shall be provided with removable gland plate and gland/s suitable for 1100 volts grade, PVC insulated, PVC sheathed multicore 2.5 sq.mm. stranded copper cable.

(d) The terminal box shall be dust and vermin proof. Suitable arrangement shall be made for drying of air inside the secondary terminal box.

(e) The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with use of normal tools.

(f) The outer cover of secondary terminal box shall have provision for sealing by way of insertion of wire in the bolt hole. A drawing indicating above arrangement may please be furnished alongwith the bid.

(g) For measuring tan delta values, a separate tan delta test terminal shall be provided on the opposite side of the secondary terminal box.

5.12 POLARITY :

Polarity shall be invariably marked on each primary and secondary terminal. Facility shall be provided for short circuiting & grounding of the CT secondary terminals inside the terminal box. All marking shall be engraved or through anodized plate which should be firmly fixed.

5.13 RATING PLATE :

The C.T. shall be provided with a rating plate with dimensions and markings as per the latest version of IS: 2705/IEC-60044 (1). The markings shall be punched/ engraved and not painted. This rating plate shall also contain our purchase order no. and date.

5.14 OIL FILLING AND SEALING :

The current transformer shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture from entering the tanks. Oil sampling valve provided at the bottom of CT should be protected by providing metallic cover or blanking plug/plate. Valve should be welded to avoid any leakage. The method adopted for hermetic sealing shall be described in the bid.

5.15 CASTING :

The castings of base, collar etc. shall be die-cast and tested before assembly to detect cracks and voids if any.

5.16 INSTRUMENT SECURITY FACTOR :

The instrument security factor of metering core shall be low enough and not greater than 5. This shall be demonstrated on all the ratios of the metering core, in accordance with procedure specified in the latest version of IS:2705 or IEC-60044 (1).

5.17 EARTHING :

Current transformer shall be provided with two separate earthing terminals for bolted connection to 75 x 10 mm MS flat to be provided by the Purchaser for connection to station earth-mat.

5.18 LIFTING ARRANGEMENT :

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

arrangement drawing. Lifting arrangement (lifting eye) shall be positioned in such a way as to avoid any damage to the porcelain housing or the tanks during lifting for installation/ transport. Necessary sling guides shall be offered which shall be of removable type.

5.19 PRIMARY WINDING :

a) Primary winding shall be made out of electrolytic grade 99.9% conductivity copper or electrical conductor grade aluminium. Conductors used for the primary winding shall be rigid and housed in rigid metallic shell. Joints in the primary winding shall not be provided. For primary winding, current density shall not exceed 1.50 Amp / sq.mm in case of copper and 1.0 Amp / sq.mm in case of aluminium, at continuous overloading of 25% above rated current.

(b) The design density for short circuit current as well as conductivity of the metal used for primary winding shall meet the requirement of latest version of IS:2705 or IEC-60044 (1). The bidder shall in his bid furnish detailed calculations for selection of winding cross-sections. The selected amp-turns for CTs shall be justified on the basis of type test reports.

(c) It is desired that from the point of view of adequate mechanical strength in the normal course and also during short circuit, proper precaution should be taken. The following arrangement or any equivalent suitable arrangement, which should be described in the bid, shall be provided for this purpose:

i. The primary conductor should be housed in suitable tube of adequate mechanical strength. The arrangement shall be explained through suitable drawing and material of tube should be indicated.

ii. The primary conductor should be held firmly and for this purpose suitable clamping arrangement at the bottom shall be provided and explained through suitable sketch. Firm clamping arrangement is a must and holding of winding using nylon rope etc. shall not be acceptable.

iii. The neck of tube should be properly fixed to support the primary windings of CT. It is suggested that piece of strong material of length around 8 inches on both the sides of tube should be fixed to properly hold the primary windings so that dislocation of primary windings during transport is avoided.

iv. The edges of the pipe should be smoothened to avoid any damage to insulation.

v. A sturdy arrangement should be provided to secure the bottom of primary winding in place. Also separate arrangement will be necessary to hold the secondary windings in place. The arrangements for primary winding and for secondary cores shall be independent of each other. Any common arrangement is not acceptable.

vi. At least two clampings should be done on each side of the primary winding and a minimum number of 4 No. nuts and bolts should be provided on each side. The nuts and bolts arrangement used for holding active parts should be suitably dimensioned. The bolts should be tightened with the nuts and also a check nut for proper locking.

vii. The arrangement for bringing out connection from outer shielding for grounding purpose should be made properly. For this purpose the full length copper strip of width around 2 cm. may be used on the outer

dia. of bottom portion to ensure proper shielding / earthing of outer condenser. For shielding preferably aluminium foil should be used.

viii. Minimum 10 mm space should be available between insulation and porcelain for adequate passage of oil.

5.20 SECONDARY WINDINGS :

Suitably insulated copper wire of 99.9% conductivity electrolytic grade shall be used for secondary windings. The exciting current of the CT shall be as low as possible. The bidder shall furnish along with his bid the magnetization curve / s for all the core/s.

Enamel, if used for conductor insulation, shall be either polyvinyl acetate type or amide emide type and shall meet the requirements of latest version of IS: 4800 or equivalent International Standard.

5.21 PRIMARY TERMINALS:

For various ratings of CTs selection of primary terminal only of copper material shall be made carefully. Primary terminal on either side of tank should be of minimum 100 mm length. to accommodate terminal connector. The dia / size of the primary terminal shall be such that the current rating available is at least 1.5 times the rated current of the CT. It would be obligatory on the part of the tenderer to specify material, diameter, length and current rating of primary terminal which shall be used for CTs of different ratio. The primary terminal studs to accommodate terminal connector for take-off shall be plain and not threaded. The details may be explained through suitable sketch.

For CT having primary winding made of copper, the primary terminals shall be of heavily tinned electrolytic copper of 99.9% conductivity. The minimum thickness of tinning shall be 15 microns. For CT having primary winding made of aluminium, the primary terminals shall be of aluminium alloy of 99.9% conductivity.

5.22 SECONDARY TERMINALS:

Secondary terminal studs shall be provided with at least three nuts and adequate plain and spring washers for fixing the leads. The studs, nuts and washers shall be of brass, duly nickel-plated. The minimum outside diameter of the studs shall be 8mm. The length of at least 15mm shall be available on the studs for inserting the leads. The horizontal spacing between centres of the adjacent studs shall be at least 1.5 times the outside circumdia of the nuts. The arrangement should be shown through suitable sketch.

5.23 CORE :

The grade M4 toroidal core or any equivalent/superior grade core material shall be of high-grade non-ageing electrical silicon laminated steel of low hysterisis loss and high permeability to ensure high accuracy at both normal and over currents. The current transformer core to be used for metering shall be made of mumetal and shall be of accuracy class specified. The saturation factor of this core shall be low enough not to cause any damage to measuring instruments in the event of maximum short circuit current. The 5P10 core shall be designed for a minimum saturation factor of 10 for the highest setting. The magnetization curves for this core shall be furnished with the bid. As far as PS class core is concerned all precautions shall be taken in design to achieve the knee point voltage without exceeding requirement of excitation current as specified in Annexure-II. Magnetisation curve for the same shall be furnished.

5.24 RATIO CHANGING ARRANGEMENT:

Primary current ratio changing arrangement in 400 KV CTs shall be provided by way of tappings on secondary windings.

5.25 SPECIAL REQUIREMENT FOR CURRENT TRANSFORMERS:

a) OVERLOADING:

The CTs shall be suitable for continuous overloading upto 125% maximum rated primary current. The following requirements therefore should be noted:-

i). It should be specifically confirmed that the CTs offered against the specification are suitable for continuous overloading of 25% above rated current. For this purpose, precaution taken in design of equipment may be suitably explained.

ii) For all the CTs which are to be designed for 25% overloading, the permissible temperature rise of CT winding over the reference ambient temperature of 50° C at 125% rated current, rated frequency and with a unity power factor burden corresponding to the rated output connected to the secondary windings shall not exceed 45°, i.e. 5° less than the permissible values as specified in IS.

b) CONSISTENCY OF ACCURACY:

It should be specifically confirmed that with 25% continuous overloading, the ratio/phase angle errors of the CTs shall be maintained strictly within specified limits without any drift and no variation shall take place due to overloading of Current Transformers.

6.0 TESTS :

6.1 TYPE TEST :

All the equipments offered, shall be fully type tested as per relevant Indian Standards or any equivalent International Standard during the last **five** years from the date of bid opening. Copy of type test reports shall be enclosed with the bid. For any change in the design/ type already type tested and the design/ type offered against this bid, the Purchaser reserves the right to demand repetition of same or all type tests without any extra cost.

In the event of our order, the supplier has to furnish type test report for the following tests:-

i. Chopped Impulse Test
ii. Multiple Chopped Impulse Test
iii. RIV Test
iv. Mechanical Test on Terminals
v. Seismic Test
vi. Tan Delta Test at full Voltage
vii. Thermal Stability Test
viii. Temperature Coefficient Test

6.2 ACCEPTANCE AND ROUTINE TESTS :

6.2.1 The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or equivalent International Standards in presence of purchaser's representative.

6.2.2 In addition to other acceptance tests for CTs, the following tests shall also be carried out:-

a/ Sealing test :

The sealing test shall be carried out on minimum one randomly selected CT out of each offered lot of CTs. The procedure for sealing test is as under:-

i. Test shall be performed on completely assembled unit.

ii. Test shall be performed on proto-type as well as during acceptance test on minimum one randomly selected unit.

iii. Temperature of CT under test will be elevated and maintained at 50^0C and simultaneously it shall be subjected to internal pressure of 103 kPa (@1.1 kg / sq.cm) for 12 hours.

iv. Arrangement shall be made by manufacturer to maintain required pressure and temperature for 12 hours.

v. During and after the test, there shall not be any oil leakage from any part or joint of CT.

vi. Readings of temperature, internal pressure applied and duration of test along with observation of leakage, if any, shall be noted in inspection report.

b/ Temperature Coefficient Test:

This test will be carried out on minimum one randomly selected CT out of each offered lot of CTs.

c/ Tests on Oil:

The following tests shall be carried out on minimum one randomly selected CT out of each offered lot and shall be conducted after HV test:-

i) BDV Test
ii) Tan Delta Test
iii) Water ppm Test
iv) Specific Resistance at 75 Deg C & 90 deg C
v) Viscosity
vi) Total Acidity
vii) Dissolved Gas Analysis Test

Copy of test report received from oil manufacturer will have to be submitted.

6.2.3 Immediately after finalization of the programme of type/ acceptance/ routine testing, the manufacturer shall give sufficient advance intimation to the Purchaser, to enable him to depute his representative for witnessing the tests.

6.2.4 During measurement of errors, the resistance of leads connecting the CT under test, the burden box and the standard CT to the measuring bridge should be kept minimum so that accuracy of measurement of CT errors is negligible.

7.0 INSPECTION :

i. The Purchaser shall have access at all times to the works and all other places of manufacture, where the current transformers and potential transformers are being manufactured and the bidder shall provide all facilities for unrestricted inspection of the bidder's works, raw materials,

manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii. The successful bidder shall keep the purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages, so that arrangements could be made for inspection.

iii. The Purchaser reserves the right to carry out thorough internal inspection of one or two randomly selected CTs out of offered lot, at the time of final inspection of CTs, during which the CTs will be completely opened to verify the dimensional and other details.

iv. Besides above, the Purchaser reserves the right to carry out type test at NABL accredited laboratory on one of the randomly selected CT out of the supplied / offered CTs. The supplier shall extend co-operation for organizing the type tests in the presence of Purchaser's representative.

v. No material shall be dispatched from the point of manufacture unless the material has been satisfactorily inspected and tested.

vi. The acceptance of any quantity of the equipments shall in no way relieve the successful bidder of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipments are later found to be defective.

8.0 QUALITY ASSURANCE PLAN & STAGE INSPECTION :

8.1 For the purpose of supply of above equipments, you will have to follow strict quality assurance programme, which will include thorough verification of samples of critical assemblies and accessories by us, verification of sources of raw materials, detailed verification of your drawing & design, checking up of all calculations regarding size of terminals, primary winding etc, stage inspection at various critical stages of manufacture and minor modifications consequent to such stage inspections as per our requirements and all other related requirements, which have generally been brought out in bidding documents and the detailed contract. It is expected that you would be very serious and prudent in meeting these requirements without any loss of time, so that supply of equipments in line with quality assurance programme is ensured within targeted schedule.

The purchaser reserves the right to specify various stages for stage inspections and also for manufacture of a proto type unit for inspection & testing, before according clearance for bulk manufacturing.

8.2 The bidder must establish that they are following a proper quality assurance programme for manufacture of current transformers and potential transformers.

The bidder shall invariably furnish following information along with his bid.

i. Statement giving list of important raw materials, names of sub supplier for the raw material, list of standards according to which the raw material are tested, list of tests normally carried out on raw material in presence of bidder's representative, copies of test certificates.

ii. Information and copies of test certificates as in (i) above in respect of bought out items.

iii. List of manufacturing facilities available.

iv. Levels of automation achieved and list of areas where manual processing exists.

v. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.

vi. Special features provided in the equipment to make it maintenance free.

vii. List of testing equipment available with the bidder for final testing of equipment specified and test plant limitations, if any vis-à-vis type, special, acceptance and routine tests specified in the relevant Indian Standards or equivalent international standard. These limitations shall be very clearly brought out in schedule of deviations from specified test equipments.

8.3 The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

i. List of raw materials as well as bought out accessories and the names of sub supplier selected from the lists furnished along with bid.

ii. Type test certificate of the raw material and bought out accessories.

iii. Quality Assurance Plan (QAP) with hold points for purchaser's inspection. The quality assurance plans and holds points shall be discussed between the Purchaser and Bidder before the QAP is finalized.

8.4 The successful Bidder shall submit the routine test certificates of bought out items and for raw material at the time of routine testing of the fully assembled equipment.

9.0 DOCUMENTATION :

9.1 All drawings shall conform to the latest version of international standards organization (ISO) 'A' series of drawing sheet/ Indian Standards Specification IS-11065. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

9.2 LIST OF DRAWINGS AND DOCUMENTS :

The Bidder shall furnish four sets of following details and drawings along with his bid :-

a. General outline and assembly drawings of the equipments.
b. Graphs showing the performance of equipments in regard to magnetization characteristics.
c. Sectional views showing:
   General Constructional Features.
   Materials/ Gaskets/ Sealings used.
   The insulation of the winding arrangements, method of connection of the primary/ secondary winding to the primary/ secondary terminals etc.
   Porcelain used and its dimensions alongwith the mechanical and electrical characteristics.
d. Complete primary terminal assembly which should include the following:-
   i. Complete primary terminal.
   ii. All sub-assemblies with the help of which the primary terminal shall be brought out from the top tank including washers/ locking arrangements, check nut, main nut etc.

iii. Sub-assembly to demonstrate the arrangement of connection of primary winding to primary terminal inside the tank.

iv. Terminal connectors suitable for 4 inch IPS tube/ Twin Moose ACSR Conductor.

e. Name plate.
f. Schematic drawing.
g. Type Test reports in case the equipment has already been type tested.
i. Test reports, literature, pamphlets of the bought out items and raw material.

9.3 The successful Bidder shall within two weeks of placement of order, submit four sets of final versions of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments/approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 20 prints and two good quality reproducible of the approved drawings for Purchaser's use.

9.4 The Bidder, for distribution before commencement of supply, shall submit six sets of the type test reports, duly approved by the Purchaser. Adequate copies of acceptance and routine tests certificates, duly approved by the Purchaser shall accompany the dispatched consignment.

9.5 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Bidder's risk.

9.6 Twenty (20) copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English Language, for each type and rating of equipment supplied shall be submitted by the Bidder for distribution, prior to the dispatch of the equipments. The manual shall contain all the drawings and information required for erection, operation and maintenance of the equipments. The manual shall also contain a set of all the approved drawings, type test reports etc.

9.7 Approval of drawings/ work by Purchaser shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

10. 0 Important Requirements for ensuring quality of manufacture and processing of equipments.

10.1 For processing and vacuum treatment of core / coil assembly, it is desired that a separate heating chamber and a separate vacuum chamber should have been installed for vacuum treatment of core / coil assembly. Facility should be available to measure quantum of water released during vacuum treatment of core/coil assembly. Make, quality and capacity of vacuum chamber alongwith vacuum level may be brought out.

10.2 Completely dust free shop should be available for preparation of winding. This should be confirmed.

10.3 What is the process employed for wrapping of insulation on primary winding. Is it being done manually or through suitable wrapping machine.

10.4 Various stages of quality checks during manufacture should be highlighted.

11.0 PACKING AND FORWARDING :

11.1 The equipment shall be packed in crates suitable for vertical/ horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The Bidder shall be responsible for any damage during transit, due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Bidder shall supply any material found short inside the packing cases without any extra cost.

11.2 Each consignment shall be accompanied by a detailed packing list containing the following information.

a. Name of the consignee.
b. Details of consignment.
c. Destination
d. Total weight of consignment.
e. Handling and unpacking instructions.
f. Bill of material indicating contents of each package.

11.3 The Bidder shall ensure that the packing list and bill of material are approved by the Purchaser before dispatch.

12. 0 DEVIATION IN TECHNICAL PARTICULARS :

No deviation from technical particulars of equipment and materials will be allowed, which may please be noted.

ANNEXURE-I

PRINCIPAL TECHNICAL PARAMETERS OF 400 KV CURRENT TRANSFORMERS

SNo.	Item	Specification for 400 KV Current Transformers
1	Type of CT/Installation	Single phase, dead tank / live tank, oil filled, hermetically sealed, outdoor type
2	Type of mounting	Pedestal Type
3	Suitable for system Frequency	50 Hz
4	Highest System voltage (KV rms)	420
5	Current Ratio	2000-1000-500/1-1-1-1-1 Amp
6	No. of Secondary Cores	Five
7	Ratio taps	On secondary side
8	Method of earthing of the system to be connected to	Effectively earthed
9	Rated continuous thermal current	125% of rated current.
10	Acceptable limit of temperature rise above the specified ambient temperature for continuous operation at rated current	5 degrees centigrade less than the limits specified in IS 2705 taking ambient temperature as 50 degrees centigrade
11	Acceptable partial discharge level at 1.1 times the rated voltage	Less than 10 pico coulombs
12	Max. radio interference voltage at 1.1 times the rated voltage	Less than 500 micro volts
13	1.2/50 microsecond lightning impulse withstand voltage (KVp)	1425
14	250/2500 microsecond switching impulse withstand voltage (KVp) dry & wet	1050
15	1 minute dry power frequency withstand voltage for primary winding (KV rms)	630
16	Power frequency withstand voltage for secondary winding (KV rms).	As per Cl. 7.4 & 7.5 of IS:2705 (part-I) 1981. Additionally, for cores No. 4 & 5 the test voltage will be 10KVp for 1 minute.
17	Min. creepage distance of porcelain housing (mm)	10500
18	Rated short time withstand current with duration (kA rms for seconds)	40
19	Rated dynamic withstand current (kAp)	100
20	Visual corona extinction voltage (KV rms)	320
21	Seismic acceleration (horizontal)	0.3g
22	Tan Delta at 90 ^{0}C	0.005 (Max)
23	Capacitance value	Not less than 700 picofarads (for dead tank CT)

ANNEXURE-II
DETAILS OF RATIO AND CORE PARTICULARS
FOR 400 KV CT

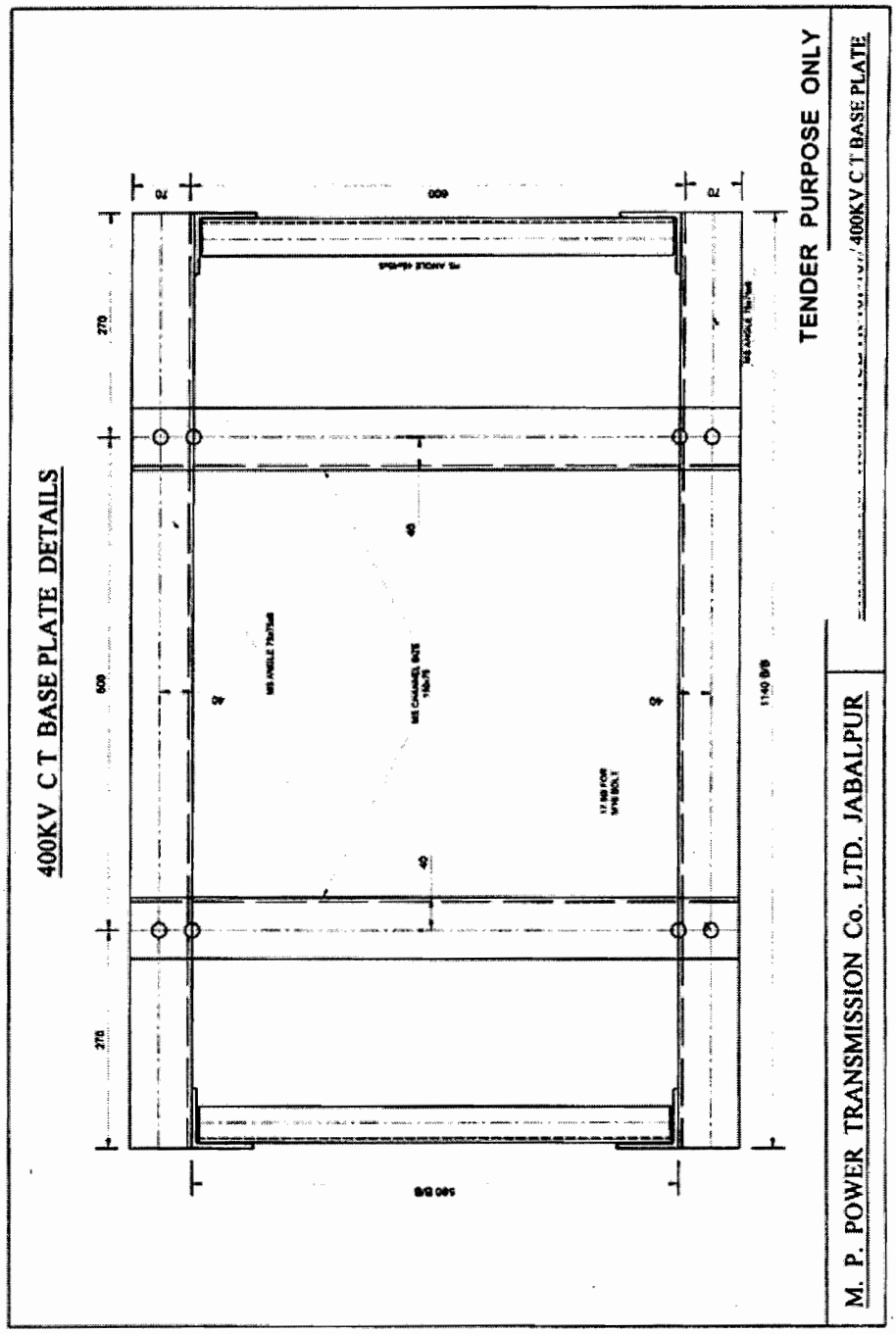
No. of cores	Core no.	Application	Current ratio	Output burden (VA)	Accu-racy Class as per IEC 185	Min. knee point voltage (Volts)	Max. CT Sec. Winding resistance at 75° C (Ohms)	Max. Exciting current at knee point voltage (mA)	Instru-ment Secu-rity factor
1	2	3	4	5	6	7	8	9	10
5	1	BUS DIFF. CHECK	2000-1000-500/1	N.A.	PS	2000/ 1000/ 500	10/5/2.5	30 on 2000/1 Tap 60 on 1000/1 Tap & 120 on 500/1Tap	-
	2	BUS DIFF. MAIN	2000-1000-500/1	N.A.	PS	2000/ 1000/ 500	10/5/2.5	30 on 2000/1 Tap 60 on 1000/1 Tap & 120 on 500/1Tap	-
	3	METERING	2000-1000-500/1	20	0.2S	N.A.	N.A.	N.A.	5 or Less
	4	TRANSFOR MER BACKUP/ LINE PROTEC-TION	2000-1000-500/1	N.A.	PS	4000/ 2000/ 1000	10/5/2.5	30 on 2000/1 Tap 60 on 1000/1 Tap & 120 on 500/1Tap	-
	5	TRANSFOR-MER DIFF./ LINE PROTEC-TION	2000-1000-500/1	N.A.	PS	4000/ 2000/ 1000	10/5/2.5	30 on 2000/1 Tap 60 on 1000/1 Tap & 120 on 500/1Tap	-

NA-Not applicable
mA- milli Amperes

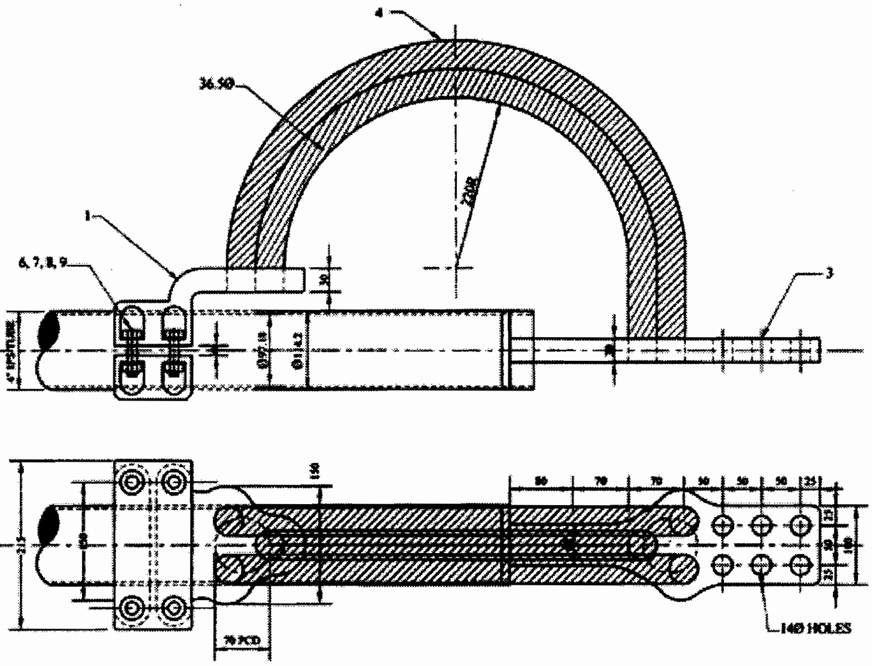
ANNEXURE-V

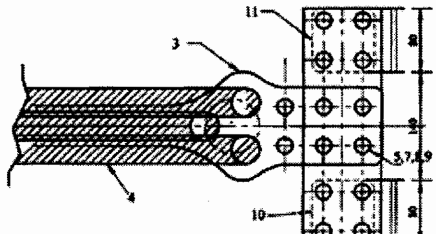
The following drawings showing mounting dimensions of structure for 400 KV Current Transformer and general requirement of terminal connector are enclosed herewith for general guidance:

SNo.	Description
1.	Base Plate details for mounting of 400 KV CT
2.	Expansion Type terminal connector for 4 inch IPS tube


400KV C T BASE PLATE DETAILS
TENDER PURPOSE ONLY
M. P. POWER TRANSMISSION Co. LTD. JABALPUR
400KV C.T BASE PLATE

EXPANSION TYPE TERMINAL CONNECTOR FOR 400KV C T





Qty.	DESCRIPTION	P	MATERIAL
1	CLAMPING BODY	1	AL ALLOY 4600 (A 6) IS : 617
2	SADDLE	2	AL ALLOY 4600 (A 6) IS : 617
1	SUPPORTING BASE	3	AL ALLOY 4600 (A 6) IS : 617
2	AL CONDUCTOR	4	A C C STANDARD CONDUCTOR [illegible], 37 WIRES
12	HEX. SCREW M12x40	5	STEEL 8% IS : 1363
4	HEX. SCREW M12x60	6	STEEL 8% IS : 1363
16	HEX. NUT M12x0.80	7	STEEL 8% IS : 1363
32	PLAIN WASHER [illegible]	8	STEEL 8% IS : 1363
16	SPRING WASHER B12	9	SPRING STEEL IS : 1363 ELECTRO ZINC PLATED
1	CONNECTING LINK 100x20, 200L	10	AL ALLOY 4600 (A 6) IS : 617
2	BIMETALLIC PLATE 100x100x[illegible]	11	AL Cu

FREE DIMENSIONS TOLERANCES
UP TO 50mm 5%
ABOVE 50 to 100mm 4%
ABOVE 100 mm 3%

TECHNICAL PARTICULARS :-

1. RATED VOLTAGE UP TO 400 KV
2. RATED CURRENT 2000 A Min.
3. SHORT CIRCUIT CURRENT RATING 40kA for 3 Sec
4. RIV LEVEL NOT MORE THEN 1000μV AT 266KV (rms)
5. CORONA EXTINCTION VOLTAGE NOT LESS THEN 320KV (rms)
6. POWER CONDUCTOR IS AS PER IS : 3941 - 1970
7. ALL DIAMENSIONS ARE IN mm
8. ALL EDGES & CORNERS TO BE ROUNDED OFF BY 2 mm Min Radius
9. NET Wt. ALUMINIUM kg. + FASTNERS kg. = kg. Aprox.
10. MINIMUM THICKNESS OF ANY CURRENT CARRYING PART IS 15mm

ALL DIAMENSIONS ARE IN MM

FOR TENDER PURPOSE ONLY

M. P. POWER TRANSMISSION Co. LTD. JABALPUR

7/Expansion Type Ter. Conn. For 400 C. T.

* TERMINAL CONNECTOR NOT IN BIDDER'S SCOPE.

APPENDIX-A

LIST OF STANDARDS
GENERAL

Indian Electricity Rules, Indian Electricity Act, Indian Electricity (Supply) Act, Indian Factories Act

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
1	IS-5	Colours for Ready Mixed Paints & Enamels	-
2	IS-335	New Insulating Oils	-
3	IS-617 (P1 to P145)	Aluminium and Aluminium Alloy Ingots and Castings for General Engineering Purposes	-
4	IS-1448 (P1 to P145)	Methods of Test for Petroleum and its Products	-
5	IS-2071 (P1 to P3)	Methods of High Voltage Testing	-
6	IS-12063	Classification of degrees of Protection provided by enclosures of electrical equipment	-
7	IS-2165 1:1997 P2:1983	Insulation Coordination	-
8	IS:3043	Code of Practice for Earthing	-
9	IS-6103	Method of Test for Specific Resistance (Resistivity) of Electrical Insulating Liquids	-
10	IS-6104	Method of Test for Interfacial Tension of Oil against Water by the Ring Method	-
11	IS-6262	Method of Test for Power Factor & Dielectric Constant of Electrical Insulating Liquids	-
12	IS-6792	Method for Determination of Electric Strength of Insulating Liquids	-
13	IS-5578	Guide for Uniform System of Marking & Identification of Conductors & Apparatus Terminals	-
14	IS-11353	Methods for Radio Interference Test on High Voltage	-
15	IS-8263	Methods of Radio Interference Test on High Voltage Insulators	-
16	IS-9924 (Part 1,2 & 4)	Low Voltage Fuses	-
17	-	High Voltage Test Techniques	IEC-60060 (Part 1 to P4)
18	-	Environmental Test	IEC-60068

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S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
19		Graphical Symbols	IEC-60117
20	-	Methods for the Determination of the Electrical Strength of Insulation Oils	IEC-60156
21	-	Partial Discharge Measurements	IEC-60270
22	-	Specification and Acceptance of New Sulphur Hexafluoride	IEC-60376
23	-	Radio Interference Test on High Voltage Insulators	IEC-60437
24	-	Artificial Pollution Tests on High Voltage Insulators to be used on AC Systems	IEC-60507
25	-	Common Sp4cification for High Voltage Switchgear & Control gear Standards	IEC-60694
26	-	Guide for the Selection of Insulators in respect of Polluted Conditions	IEC-60815
27	-	Short Circuit Current – Calculation of effects	IEC-60865 (P1 & P2)
28	-	National Electrical Code	ANSI-C.1/ NFPA.70
29	-	Guide for Surge Withstand Capability (SWC) Tests	ANSI-C37.90A
30	-	Specification for Electromagnetic Noise and Field Strength Instrumentation 10 KHz to 1 GHz	ANSI-C.6321, C63.3
31	-	Techniques for Dielectric Tests	C36.4 ANSI-C68.1
32	-	Standard General Requirements and Test Procedure for Outdoor Apparatus Bushings	ANSI-C76.1/EEE21
33	-	Specification for Sound Level Meters	ANSI-S14
34	-	Drawing Symbols	ANSI-Y32-2/C337.2
34	-	11Gray Finishes for Industrial Apparatus and Equipment No.61 Light Gray	ANSI-Z55.
35	-	General Standards for Industrial Control & Systems Part ICSI-109	NEMA-ICS-II
36	-	Specification for CISPR Radio Interference Measuring Apparatus for the frequency range 0.15 MHz to 30 MHz	CISPR-1
37	-	Quality Assurance Program Requirements	CSA-Z299.1-1978h

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
38	-	Quality Control Program Requirements	CSA-Z299.2-1979h
39	-	Quality Verification Program Requirements	CSA-Z299.3-1979h
40	-	Inspection Program Requirements	CSA-Z299.4-1978h
EQUIPMENT-WISE SPECIFICATION			
A) 400KV, 220KV, 132KV & 33KV CIRCUIT BREAKERS:			
1	-	Specification for alternating current circuit breakers	IEC-62271-100-2001
2	-	Specification and acceptance of new supply of SF6	IEC-376
3	IS-1885	Electro technical vocabulary	IEC-50
4	IS-375	Marking and arrangement for switchgear bus-bar, main connections and auxiliary wirings.	-
5	IS-2147	Degree of protection provided for enclosures for low voltage switchgear and control gear.	-
6	IS-325	Specification for three phase induction motors.	-
7	IS-13947	LV Switchgears & control gear.	IEC-947
8	IS-2629	Recommended practice for hot dip galvanizing of iron and steel.	-
9	IS-5	Colour for ready mix paints.	-
10	IS-2099	High voltage porcelain bushings.	IEC-137
11	IS-5561	Electric Power connectors	-
12	IS-2516	Specification for circuit breaker	-
13	-	Synthetic Testing of High Voltage alternating current circuit breakers	IEC-6047
14	-	Pressurised hollow column insulators	IEC-61264
15	IS-13118	Specification for alternating current circuit breakers	IEC-62271-100-2001 & IEC 60056 or latest amendment thereof
B) 400 KV, 220 KV, 132 KV & 33KV C&R PANELS:			
1	IS-3842	Application guide for electric relays for AC system	-
2	IS-3231, 3231 (P-3)	Electric relays for power system protection.	-
3	IS-1885	Electric technical vocabulary electrical relays and Electrical power system protection	IEC 50
4	IS-1248/2419	Indicating instruments	-

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
I) CURRENT TRANSFORMERS & POTENTIAL TRANSFORMERS FOR 400 KV, 220 KV, 132 KV & 33KV			
1	IS:2165	Insulation Co-ordination for equipment of 100 KV and above.	-
2	IS:2705 (I to IV)	Current Transformers	IEC-60044-1
3	IS:2099	High voltage porcelain Bushings	IEC-60137
4	IS:3347	Dimensions of porcelain transformer bushings.	-
5	IS:2071	Method of High Voltage Testing	-
6	IS:335	Insulating oil for transformers and switchgears	-
7	IS:2147	Degree of protection provided by enclosures for low voltage, switchgear and control.	-
8	-	Partial Discharge Measurement	IEC-270
9	-	Instrument Transformer measurement of PDs	IEC-60044-4
10	-	Insulation co-ordination	IEC-171
11	-	High voltage testing techniques	IEC-60
12		Method for RIV test on high voltage insulators	IEC-8263
13	-	Indian Electricity Rules 1956.	-
14	IS:3156	Voltage Transformers	IEC-60044-2
15	-	First supplement to IEC Publication 186	IEC:186A
16	IS:5561	Electrical Power Connector	-
17	IS:4800	Enamelled Round Winding Wires	-
18	IS:2629	Recommended practice for hot dip galvanising of Iron & Steel	-
19	-	Fluids for electrotechnical applications - Unused mineral insulating oils for transformer & switchgear	IEC-296
20	-	Guide for selection of Insulators in polluted conditions	IEC-815
J) LIGHTNING ARRESTERS FOR 400 KV, 220 KV, 132 KV & 33KV			
1	-	Metal Oxide Surge Arrestors without gap for AC System	IEC-60099-4
2	IS: 3070: (Part-III) 1993	Specification for Lightning Arresters for alternating current system	-
3	IS: 4759	Hot dip zinc-coating on structural steel and other allied products	-
4	IS: 2633	Method for testing uniformity of coating on zinc coated articles	-

SECTION-3
Project Details and General Technical Requirements

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, equipments and services covered under other respective sections 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 hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Madhya Pradesh Power Transmission Company Ltd.				
b)	Project Title	Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turn-key basis (Lot no. 1) – Balaghat, Badnawar, Bhopal, Chhegaon and Nagda substation				
c)	Location	Balaghat	Badnawar	Bhopal	Chhegaon	Nagada
		Balaghat is Located in district of Balaghat of Madhya Pradesh. Distance between Jabalpur to Balaghat is 232 km by Road and 130 km by Rails.	Badnawar is Located in district of Dhar of Madhya Pradesh. Distance between Badnawar to Ujain is 70 km by Road.	Bhopal site is located 20 kM away from Bhopal city.	Chhegaon is located in Khandwa district of Madhya Pradesh. Distance between Chhegaon to Khandwa is 15 km by Road.	Nagda is located in Ujjain district of Madhya Pradesh. The road distance between Nagda to Ujjain is 47 km.
d)	Transport Facilities	Road/Rail				

e)	Postal Address	To follow
SITE CONDITIONS		
a)	Maximum ambient air temperature	50°C
b)	Minimum ambient air temperature	1°C
c)	Average daily ambient temperature	35°C
d)	Maximum Relative humidity	95 %(sometimes approach saturation)
e)	Pollution Severity	Heavily Polluted
f)	Seismic level (horizontal acceleration)	0.3g
g)	Wind zone as per IS 802 (PART 1) - 1995velocity	4
h)	maximum wind pressure	150kg/sq.mts
i)	Average annual rainfall	1250 mm
j)	Maximum altitude above mean see level	1000m
k)	Isolceraunic level	90 days per year
l)	Climate	Moderately hot & humid tropical climate, conducive to rust & fungus growth

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V 50 Hz, 3-phase 4 wire, solidly earthed
1 phase A.C power supply	240V, 50 Hz, 1-phase, 2 wire
D.C. power supply	**220V, 2-wire ungrounded**, for all equipments and panels except PLCC of 400kV /220kV /132kV /33kV substation
D.C. power supply	48V, 2 wire system positively earthed for PLCC

The above supply voltage may vary as below and all devices shall be suitable for continuous operation over entire range of voltage.

i.	AC supply	Voltage + 10 % to -25% , frequency ± 4%
ii.	DC supply	Voltage + 10 % to -20%

SYSTEM PARAMETERS

Description parameters	**400kV System**	**220kV System**	**132kV System**	**33kV System**
System operating voltage	400 kV	220kV	132kV	33kV
Maximum operating voltage(rms)	420 kV	220kV	145kV	36 kV
Rated frequency	50Hz			
Full wave impulse withstand voltage (1.2/50 micro second)	1425kVP	1050kVP	650kVP	250kVP/ 170kVP
One minute Power frequency dry/wet withstand voltage (rms)	630kV/ 520kV	460kV	275kV	95kV/70kV
Switching Impulse withstand voltage (250/2500 micro sec.) dry and wet	1050kVP	-	-	-
Corona extinction voltage	320kV	156kV	105kV	-
Maximum radio interference voltage for frequency between 0.5MHz and 2 MHz at 320kV rms phase for 400kV system , 156kVrms for 220kV system & 92 kV rms for 132kV system	1000 Micro volt	1000 Micro volt	500 Micro volt	-
Rated short time current	40 kA for three seconds/one second as applicable			25 kA for three seconds/2 6.2kA for two second
Creepage distance @25mm/kV	10500mm	6125mm	3625mm	900mm
System Earthing	Effectively Earthed			

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of bid opening (i.e. 20.11.13)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

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.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 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 purpose 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 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 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 modem practices will be accepted. Installation shall be constructed 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 and 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. In 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.

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

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The contractor shall propose a color 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.

Painting process shall be of powder coating type.All surface shall be cleaned , phosphated and given two coats of rust –resistant primer followed by two coats of finish paints . The interior of all panels cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey shade(697 of IS-5) shall be given to exterior surface of all the panels. Sufficient quantities of touch paint shall be furnished for application at site. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

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.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGI STATIC 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.

3.7 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 suitabley 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. All external painting shall be as per shade no. 697 of IS:5.

3.8 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 4759 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.m** 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.

3.9 PACKING

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) Net 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. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

Mandatory spares shall be packed in separate packing with clear identification.

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3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. 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.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.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.

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.

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area IP:52

d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41

e) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be **1100 V grade box** –clamp type and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be **non-disconnecting stud type equivalent to Elmex type CATM4**, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the

terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm, copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. **At least 20 % spare** terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publictions, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of **CRCA** sheet steel of minimum 2.5 mm thickness. The thickness of door s/covers shall not be less than 2.5 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and

rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required

3.16 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater 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 air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in 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.

3.17 QUALITY

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

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor 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 equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant ,the unit designation, contract no. , and the name of the Project .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.

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

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

approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings

2) Guaranteed Technical Particulars

3) Type Test Reports

4) Manufacturing Quality Plan

3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1.	Drawings and Data Sheets	1	6	21	7 nos of all drawings/documents
2.	Drawings "As Built "	-	-	21	
3.	Type Test Reports	1	6	21	
4.	Erection Manuals	-	6	21	
5.	Operation and Maintenance Manuals	-	6	21	
6.	Manufacturing Quality Plan	1	6	21	
7.	Field Quality Plan	1	6	21	
8.	Inspection Test Reports	-	-	21	

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on 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/√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

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	2000A	YES/NO	
6	Rated short time thermal current	40 KA	YES/NO	
6A	Current Density	As per spec	YES/NO	

7	Rated dynamic current	100 kA	YES/NO	
8	Max. Temperature rise over design ambient temperature	As per Annexure-I, Section-2	YES/NO	
9	One minute power frequency withstand voltage - Secondary Terminal and Earth	As per Annexure-I, Section-2	YES/NO	
10	Cantilever Strength of CT at the terminal	Not less than 500Kg	YES/NO	
11	Class of Insulation	Oil Immersed Class A	YES/NO	
12	Core parameters	As per table at clause 1.2.2 of Section-1	YES/NO	
13	Technical parameters	As per table at clause 1.2.1 of Section-1	YES/NO	
14	**External Surface**			
	Tank and Top Metallics	As per Clause 5.8 of Section-2	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	As per Annexure-I, Section-2	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	Valid Type test reports are available and attached along with this offer.		YES/NO	

24.	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	
25.	**a.** Bidder to confirm that there are no deviations and the offer is in full compliance with the Specification. **b.** Bidder to confirm that there are no deviations in any other form such as comments, variations and / or exceptions. **c.** Bidder to confirm that all drawings / data sheets/ QP / valid type tests reports / all relevant information shall be submitted to BHEL for organizing approval of ultimate customer.		YES/NO YES/NO YES/NO	
26.	Bidder to confirm Qualifying requirements, if any, mentioned in the tender document are being met.		YES/NO	