BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

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TITLE: 400kV CURRENT TRANSFORMER				DATE	24.10.13	24.10.13	24.10.13
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				W.O. No	83003		

CUSTOMER	TAMIL NADU TRANSMISSION CORPORATION LIMITED
PROJECT	400/110 KV Substation at Thappagundu & 400/230-110 KV Substation at Anikadavu

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Rev.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	CUSTOMER	TBMM	O/C	
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SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1. SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of **400kV Current Transformers (Oil filled or SF6 filled)**

The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification. For environmental conditions, refer Section-3 carefully

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.
Section-2: Equipment specifications
Section-3: General technical requirements for all equipments under the project.
Section-4: Guaranteed Technical Particulars

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

The equipment is required for the following projects:

Name of the Customer : M/s Tamil Nadu Transmission Corporation Limited
Name of the Project : 400/110kV S/S at Thappagundu
400/230-110 KV Substation at Anikadavu

2. SPECIFIC TECHNICAL REQUIREMENTS

For detailed equipment specification of 400kV Current Transformer, refer to Section -2 of the document

3. BILL OF QUANTITIES (Station –wise breakup)

A. 400/110 kV THAPAGUNDU S/STN

S. No	DETAILS	Unit	Quantity
1.	**420 KV, 3000A, 63 KA for 1 second, 5 core single phase current Transformer with all accessories excluding support structure, terminal connectors and common Junction box**	Nos.	**42**

B. 400/230/110 kV ANIKADAVU S/STN

S. No.	DETAILS	Unit	Quantity
1.	**420 KV, 3000A, 63 KA for 1 second, 5 core single phase current Transformer with all accessories excluding support structure, terminal connectors and common Junction box**	Nos.	**56**

4. TYPE TESTING

The Type Test as per relevant IS/IEC for offered equipments/materials used for this project should have been conducted in any approved Government/Govt. recognized laboratories conforming to latest IS/IEC. The above type test certificates should accompany the drawings of the materials equipments, duly signed under seal by the Institution, who have issued the type test certificate.

The above type test should have been conducted not earlier than five (5) years as on the date of technical bid opening, which is 05/4/2013 for Anikadavu & 10/4/2013 for Thappagundu substations.

The copies of type test certificates shall be furnished for verification during contract execution stage.

Non furnishing of type test certificates by the tenderers, will be liable for rejection.

5. TECHNICAL QUALIFYING REQUIREMENT

The qualified manufacturer should have manufactured, Type tested and supplied at least 50% of the required quantity of the 400kV Current Transformers of same rating (Short Circuit level of 63kA for 1 second or lower i.e. 40kA for 1 second) to any of the 420KV Switchyards of Electricity Boards/Power Utilities in India in any one year during the last five years. The same should have been in satisfactory operation for a minimum period of two years as on date of technical bid opening, which is 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations.

6. QUALITY PLAN

Bidder to follow valid TANTRANSCO approved Quality Plan as per TANTRANSCO procedure. In case the bidder doesn't have approved QP, it will be the bidder's responsibility to get its QP approved directly from the ultimate customer.

SECTION -2

EQUIPMENT SPECIFICATION

1.0 SCOPE:

1.1 This scope covers design, manufacture, inspection, testing before dispatch, packing and delivery F.O.R (Destination) of 400 KV Outdoor Current Transformers along with all accessories with its terminal box specified herein for Protection and Metering services.

1.2 The instrument transformer shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standard at the time of offer and TANTRANSCO shall have the power to reject any work or material, which in its judgment, is not in full accordance therewith.

2.0 STANDARDS:

2.1 Unless otherwise specified elsewhere in this specification, the Current Transformers shall conform to the latest revisions and amendments thereof of the ISS & IEC Standards.

Sl. No.	Standard No.	Title
01.	IS:2705	Current Transformers
02.	IS:2099	High Voltage Porcelain Bushings
03.	IS:3347	Dimensions of porcelain for transformer
04.	IS:2165	Insulation co-ordination for equipments of 110KV and
05.	IS:335	Insulating oil for transformers
06.	IS:2071	Method of high voltage testing
07.	IS:2147	Degree of protection provided by enclosure for low voltage switch gear and control
08.	IS:185	Current Transformers
09.	IEC:60	High Voltage testing techniques
10.	IEC : 171	Insulation co-ordination
11.	IEC:44(4)	Instrument transformer measurement of P.Ds
12.	IEC:270	Partial discharge measurement
13.	IEC:8263	Method for RIV test on high voltage insulators.
14.	IEC:60044-1	Current Transformers

Besides the above, the standard minimum safety clearances stipulated in IE Rules 1956 shall also be complied with and the relevant IEC /IS applicable for the offered Technology.

3.0 PRINCIPAL PARAMETERS & CORE WISE DETAILS:

The current transformers covered in the specification shall meet the technical requirements listed here under:

3.1 PRINCIPAL TECHNICAL PARAMETERS OF CURRENT TRANSFORMERS:

A) PRINCIPAL TECHNICAL PARAMETERS OF 420 KV CURRENT TRANSFORMERS:

Sl. No	Item	420 KV CT
01	Type of CT/Installation	Single Phase, Dead/Live tank, oil filled, hermetically sealed, self cooled outdoor type
02	Type of mounting	Pedestal/structure mounting type
03	Suitable for system frequency	50 Hz
04	Highest system voltage	400 KV (rms)
05	Number of CT secondary	5 Nos.
06	Number of cores per CT	5
07	Current ratio A/A	(a) Core 1 & 2 – 3000-2000-1000/1A (b) Core3 – 3000-2000-1000–500/1A (c) Core 4 &5 - 3000-2000-1000/1A
08.	Ratio Taps	On Secondary side.
09.	Method of Earthing system where the Current Transformer will be installed.	Solidly earthed.
10.	Rated continuous thermal Current (A).	120% for higher two ratio taps and 200% for lower ratio taps.
11.	Acceptable limit of temperature rise above the specified ambient temperature for continuous operation at rated Current.	As per IS- 2705 / clause 4.11
12.	Acceptable partial discharge level at 1.2 Um /root 3	Less than 5 pico- coulombs.
13.	Max. Radio interference voltage at 1.1 times the maximum rated Voltage/Root 3	2500 micro Volts.
14.	1.2/50 micro second Lightning Impulse withstand Voltage (KV peak) Dry.	1050

15.	1 minute power frequency withstand voltage on primary (Dry) KV(rms)	460
16.	Power frequency over voltage withstand requirement for secondary winding(KV rms) for 1 min.	3
17.	Min. creepage distance of porcelain housing (mm).	10500
18.	Rated short time withstand Current for 1 second duration (KA rms).	63
19.	Rated dynamic withstand Current (KA peak)	157.5
20.	Visual corona extinction voltage (KV RMS)	176
21.	Number of terminals in control cabinet.	All contacts and control circuit to be wired up to control cabinet plus 20% extra terminals exclusively for purchaser's use.
22.	Seismic acceleration (Horizontal)	0.3g.
23.	Maximum dielectric dissipation factor at Um/root3	0.005
24.	Primary to earth insulation resistance at 30^0 C	Min 20,000 M ohms

3.2 CORE WISE DETAILS OF CURRENT TRANSFORMERS:

(A) REQUIREMENT FOR 420 KV CTs (3000-2000-1000-500/1-1-1-1-1A)

No. of	Core No.	Application	Current Ratio	Output Burden (VA)	Accuracy class per 60044-1	Min. Knee point voltage (VK) (Volts)	Max. CT.sec. winding resistance (ohms)	Max. Exciting current @ Knee point voltage Vk (mA)	Remarks
5	1	Main-I Protection	3000/ 2000/ 1000/ 1A	---	PS	3000/ 2000/ 1000	15/ 10/ 5	20mA on 3000/1 30mA on 2000/1 Tap 60mA on 1000/1 Tap	In case of dead tank CTs, 3 cores shall be fixed on one side and remaining two cores shall be fixed on the other side.
	2	Main-II Protection	3000/ 2000/ 1000/ 1A	---	PS	3000/ 2000/ 1000	15/ 10/ 5	20mA on 3000/1 30mA on 2000/1 Tap 60mA on 1000/1	N.A
	3	Metering Main	3000/ 2000/ 1000/ 500/1A	20 20 20 20	0.2 0.2 0.2 0.2	N.A		N.A.	

	4	Bus Diff. Main	3000/ 2000/ 1000/ 1A	----	PS	3000 2000 1000	15 10 5	20 mA on 3000/1 Tap 30 mA on 2000/1 Tap 60mA on	
	5	Bus Diff. Check	3000/ 2000/ 1000/ 1A	----	PS	3000 2000 1000	15 10 5		

NOTE: (i) The parameters like Vk, RCT, Im specified shall be proportional to ratios.

(ii) All the ratios shall be made available with secondary tapping only so that the same can be adopted simultaneously in different cores.

4.0 GENERAL TECHNICAL REQUIREMENTS:

Current Transformers should have the following requirements:

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. The primary winding should be housed in rigid metallic shell. The winding assembly should be held firmly and for this purpose suitable clamping arrangement at the bottom shall be provided and explained through a sketch.

Firm clamping arrangement is a must and holding of winding using nylon rope etc. shall not be acceptable. In case "Bar primary" inverted type current transformers are offered the manufacturer will meet the following additional requirements.

(i) The Secondaries shall be totally encased in metallic shielding providing a uniform equi-potential surface and ensure even electric field distribution.

(ii) The lowest part of the insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.

(iii) The upper part of insulation assembly resting on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.

(iv) Nitrogen if used for hermetic sealing (in case of live tank design) should not come in direct contact with oil.

(v) Bidder/Manufacturer shall recommend whether any special storage facility is required for CT.

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

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

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

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

Marshalling Box shall be in BHEL Scope.

Current Transformer's guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

c. For 420 kV Class CTs, the rated extended primary current shall be 200 % of rated primary on all except 3000/1A tap ration. On 3000/1A tap ratio the extended primary current shall be 120% . However at 3000/1A ratio the CT shall be thermally rated for 200% for 15 minutes and 120% continuous. For 230/110 KV class CTs, the rated extended primary current shall be 120 % (or 150% if applicable) on all cores of the CTs as specified.

d. For 420 kV 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 10% to 100% of rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs.

e. 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. The contractor shall submit the details of packing design to the purchaser for review.

f. For 420 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core.

g. The wiring diagram plate for the interconnections of the three single phase CTs shall be provided inside the marshalling / junction box.

h. Suitable for mounting lattice support structure to be supplied along with the Current Transformers

i. The CT shall be designed as to achieve the minimum risks of explosion in service. Bidder/Manufacturer shall bring out in his offer, the measures taken to achieve this.

j. 420 kV Current Transformers shall be suitable for high speed auto re closing.

k.. The insulation of the current transformer shall be designed such 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 the specification are meant for the fully assembled Current Transformers.

4.1 PORCELAIN HOUSING:

The details of location and type of joint, if provided on the porcelain shall be furnished by the Bidder along with the offer. The housing shall be made of homogeneous, vitreous, porcelain of high mechanical and dielectric strength, glazing of porcelain shall be of uniform brown or dark brown color with smooth surface arranged to shed away rain water or condensed water particles (fog). The profile of porcelain shall be aerodynamic type as per IEC-815. Details of attachment of metallic flanges to the porcelain shall be brought in the offer.

The bushings shall have ample insulation, mechanical strength and rigidity for the condition under which they shall be used and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove the internal heat. Cast metal end caps for the bushings shall be of high strength, hot dip galvanized malleable iron. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionization. The insulation of bushings shall be coordinated with that of the Current Transformer such that the flashover, if any will occur only external to the Current Transformer. End shields should be provided for distribution of stresses. Corona shields for bushings, if required should be provided.

TANK: The metal tanks shall have a bare minimum number of welded joints so as to minimize possible locations of oil leakage. The metal tank shall be made out of mild steel/stainless steel/ aluminum alloy, depending on the requirement. Welding in horizontal plane is to be avoided as welding at this location may give way due to vibrations during transport resulting in oil leakage. Supplier has to obtain specific approval from purchaser for any horizontal welding used in the bottom tank.

4.2. HOT DIP GALVANISING AND WEATHER PROOFING:

All exposed Ferrous parts including Tank of the Current Transformer. Structural steel, pipes, rods, levers, linkages, nuts & bolts used etc shall be hot dip galvanized as per IS: 2629 and IS 2633.

4.3. CORE:

The grade M4 toroidal core shall be of high-grade non-ageing electrical silicon laminated steel of low hysterisis loss and high permeability to ensure high accuracy. The instrument transformer core to be used for metering shall be of accuracy class specified or appropriate class suitable for commercial and industrial metering.

4.4. INSULATING MEDIUM (OIL)

Insulating oil required for first filling of the CT shall be covered in Bidder's scope of supply. The oil shall meet the requirements of latest edition of IS: 335.

SF6 filled Current Transformers are also acceptable.

The SF6 gas shall comply with IEC-60376, 60376A and 60376B and shall be suitable in all respects for use in the switchgear under operating conditions.

4.5 PREVENTION OF OIL LEAKAGES AND ENTRY OF MOISTURE:

The supplier shall ensure that the sealing of current Transformer is properly achieved. In this connection the sealing arrangement provided by the supplier at various locations including the following ones shall be described, supported by the sectional drawings.

(i) Locations of emergence of primary and secondary terminals.

(ii) Interface between porcelain housing and metal tanks.

(iii) Cover of the secondary terminal box.

Nuts and bolts or screws for fixation of the interfacing porcelain bushings for taking out terminals, shall be provided on flanges cemented to the bushings and on the porcelain.
For gasketed joints, wherever used, Nitryl Butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression. Ageing -tests shall be conducted on the gaskets and the test certificates produced for verification.

During inspection each CTs will be subjected to a pressure test at 0.7 kg/sq. cm for 8hrs.

In case of SF6 filled CTs/Inductive VTs, it shall be provided with a suitable SF6 gas density monitoring device, with NO/NC contacts to facilitate the remote annunciation and tripping in case of SF6 leakage. Provisions shall be made for online gas filling. Suitable rupture disc shall be provided to prevent explosion.

4.6 OIL LEVEL INDICATORS:

Current Transformers supplied with Nitrogen cushion for compensation of oil volume variation shall be provided with prismatic type oil sight window at suitable location so that the oil level is clearly visible to naked eye for an observer standing at ground level. If metal bellow is used for the above purpose a ground glass window shall be provided to monitor the position of metal bellow.

4.7. EARTHING:

Metal tank of Current Transformer shall be provided with 2 Nos. separate earthing terminals for bolted connection to 65 x 10 mm MS flat for connection to station earth-mat.

4.8. LIFTING ARRANGEMENTS:

Current Transformers shall be provided with suitable lifting arrangement to 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 so as to avoid any damage to the porcelain housing or the tanks during lifting for installation/transport. Necessary string guides supplied shall be of removable type.

4.9 NAME PLATE:

The Current Transformer shall be provided with, legible name plate with the information specified in relevant standards, duly engraved/punched on it, including the capacitance and tan delta value.

4.10. Enamel, if used for conductor insulation shall be either polyvinyl acetate type or amide type and shall meet the requirement of IS: 4800. Polyester enamel shall not be used.

4.11. The temperature rise on any part of equipment shall not exceed the maximum temperature rise specified below under the conditions specified in test clauses. The permissible temperature rise indicated is for a maximum ambient temperature of 50°C.

Sl. No	Nature of the part or of the Liquid	Temperature	Maximum value of Temp. rise at a max. ambient air temp. not exceeding 50°C
01	Contacts in air, silver-faced copper, copper alloy or aluminium alloy (see Notes (i) & (ii) Bare copper or Tinned aluminium alloy	105	55
02.	Contacts in oil. Silver –faced copper, copper alloy or aluminium alloy (see Note –ii) Bare copper or tinned aluminium alloy.	90 80	40 30

03.	Terminals to be connected to external conductors by screws or bolts silver-faced(see note-iii). Bare copper or Tinned aluminium alloy.	105	55
04.	Metal parts acting as springs	See note-iv	See note-iv
05.	Metal parts in contact with insulation of the following classes. Class-Y : (For Non-impregnated materials) Class-A: (For materials immersed in oil or impregnated) Class-E: In Air In oil Class-B: In Air In oil Class-F: In Air In oil	90 100 120 100 130 100 155 100	40 50 70 50 80 50 105 50
	Enamel : oil base Synthetic, in air Synthetic, in oil	100 120 100	50 70 50
06.	Any part of metal or of insulating material in contact with oil except contacts	100	50
07.	Oil	90	40

NOTES:

(i) When applying the temperature rise of 55°C care should be taken to ensure that no damage is caused to the surrounding insulating materials.

(ii) The quality of the silver facing shall be such that a layer of silver remains at the point of contact after the mechanical endurance test. Otherwise, the contacts shall be regarded as “bare”.

(iii) The values of temperature and temperature rise are valid whether or not the conductor connected to the terminals is Silver-faced.

(iv) The temperature shall not reach a value where the elasticity of the material is impaired. For pure copper, this implies a temperature limit of 80°C.

5.0 CURRENT TRANSFORMER:

5.1 The CT shall be of Dead/ 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 precautions if any, for horizontal transportation may be indicated in the name plate itself.

5.2 For compensation of variation in the oil volume due to ambient variation, Nitrogen cushion or metal bellows shall be used, rubber diaphragms shall not be permitted for this purpose.

5.3 The CT secondary terminals shall be brought out in a weather proof terminal box. The terminal box shall be provided with removable gland plate and glands suitable for 1100 Volts grade, PVC insulated, PVC sheathed multi-core 4 sq.mm or 6 sq mm stranded copper conductor cable. The terminal blocks shall be stud type and provided with ferrules indelibly marked or numbered and these identifications shall correspond to the designation on the relevant wiring diagram. The terminals shall be rated for not less than 10 amps.

5.4 The terminal box shall be dust and vermin proof. Suitable arrangement shall be made for drying of air inside the secondary terminal box. The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with use of normal tools and measuring instruments such as tong type milli-ammeter.

5.5 Polarity shall be indelibly marked on each primary and secondary terminal. Facility shall be provided for short circuiting and grounding of the C.T. secondary terminals inside the terminal box.

5.6 The C.T. shall be provided with a rating plate with dimensions and markings as per IS: 2705. The markings shall be punched and not painted. The Current Transformer shall be vacuum dried and filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture from entering the tanks. Oil filling and/or oil sampling cocks, if provided to facilitate factory processing should be permanently sealed before dispatching the C.T.

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

5.8. 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 IEC-60044-1 or IS: 2705. In case the instrument security factor of 5 or less is not possible to be achieved on higher ratios, auxiliary CTs of ratio 1/1 & 5/5 and 0.2 accuracy class shall be deemed to be included in the supplier's scope of supply. This shall also be specifically brought out by the supplier in the offer.

6.0. PRIMARY WINDING:

Primary winding shall be made out of suitably insulated copper conductor of 99.9% conductivity. Conductors used for the primary winding shall be rigid or housed in rigid aluminum shell. Unavoidable joints in the primary winding shall be welded type. The details of such welded joints shall be indicated in the drawings submitted with the offer. For primary winding current density shall not exceed 1.5A/ Sq.mm for copper primary winding. The design density for short circuit current as well as conductivity of the metal used for primary winding shall meet the requirement of IS: 2705.

7.0. SECONDARY WINDINGS:

Suitably insulated Copper wire of electrolytic grade shall be used for secondary windings. Type of insulation design, suitable for tappings shall be provided on the secondary winding.

8.0. The maximum excitation current of the CT at Vk shall not exceed 30 milli amps. The Bidder shall furnish along with his offer the magnetization curve/s for all the core/s.

9.0 PRIMARY TERMINALS:

The primary terminals shall be of heavily tinned electrolytic copper of 99.9% conductivity. The minimum thickness of tinning shall be 15 microns. The primary terminal on either side of the tank shall be not less than 80mm length and 30mm dia copper.

10.0. SECONDARY TERMINALS:

The secondary terminals shall be brought out in a weather proof terminal box. Firstly the connections will be terminated in an internal board and then the same shall be brought out in a secondary terminal box. The terminal box shall be provided with removable gland plate and glands suitable for 1100 volts grade PVC insulated PVC sheathed multi core 4 or 6 sq.mm for CT.

The terminal box shall be dust and vermin proof. Suitable arrangement shall be made for drying of air inside the secondary terminal box. The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with use of normal tools and measuring instruments such as tong type milli-ammeters. 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 the above arrangement may please be furnished along with the offer.

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 8 mm. The length of at least 15mm shall be available on the studs for inserting the leads. The horizontal spacing between centers of the adjacent studs shall be at least 1.5 times the outside circum dia. of the nuts.

11.0 MEASUREMENT OF CAPACITANCE AND TAN DELTA:

The Current Transformer shall be provided with suitable test tap for measurement of capacitance, tan delta as well as partial discharges, in factory as well as at site. Provision shall be made of a screw on cap for solid and secured earthing of the test tap connection, when not in use. A suitable caution plate shall be provided duly fixed on the cover of the secondary terminal box indicating the purpose of the test tap and necessity of its solid earthing as per prescribed method before energizing the Current Transformers.

12.0 TYPE TEST:

12.1 The successful tenderer should furnish before the offering of inspection of the first lot of equipments commencement of supply, copies of type test certificates of the offered technology CTs obtained from a Government /Government recognized Lab. The above type test certificates should accompany the drawings for the CTs duly signed under seal by the institution who has issued the type test certificate. The type tests should have been conducted as per IEC 60044-1 of latest version.

The above type test should have been conducted within 5 years as on the date of tender opening. Original type test report shall be furnished for verification on request.

12.2. Special Tests:

The following special tests as per IEC 60044-1 of latest version should be conducted and test reports submitted from a Government / Government recognized lab before offering of inspection of the first lot of equipments.

(a) Chopped Impulse Test on primary winding (Cl. 9.1).
(ii) Measurement of capacitance and dielectric dissipation factor (Cl.9.2.)
(iii) Mechanical tests (Cl. 9.3) (excluded for SF6 Gas filled CTs).

(iv) Multiple Chopped Impulse tests on primary (as per Annexure – B of IEC 44-1)

12.3. ACCEPTANCE AND ROUTINE TESTS:

All acceptance and routine tests as stipulated in the IEC 60044-1 of latest version shall be carried out by the supplier in presence of TANTRANSCO's representative. In addition the capacitance and tan delta tests should also be conducted. The measured values shall be engraved in the name plate.

12.4. Immediately after finalization of the program of acceptance / routine testing, the supplier shall give at least fifteen days advance intimation to the TANTRANSCO, to enable to depute its representative for witnessing the tests.

12.5. The type test reports to be submitted for 400 KV Current Transformers shall be as follows:-

(1) Short time current test.
Temperature rise test.
Lightning ImpulseVoltageTest
Wet Test for outdoor type Current Transformers (as per clause 7.4 of IEC 44.1).
Determination of errors.
In addition to the above reports following special tests as per IEC 60044-1

on the Current Transformers should also be submitted along with techno-commercial bid.

(i) Chopped lightning Impulse Test as per clause 9.l of (IEC 44-1).

(ii) Measurement of capacitance and Die electric dissipation (as per clause 9.2 of IEC 44-1) (excluded for SF6 Gas filled CTs).

(iii) Mechanical tests (as per clause 9.3 of IEC 44-1).

(iv) Multiple chopped Impulse tests on primary (as per Annexure-B of IEC 44-1)

It may please be noted that the above test reports should be submitted along with offer.

Routine Test: Following routine tests shall be carried out in the presence of TANTRANSCO's officer.

For oil filled CTs:

(i) Verification of terminal markings.

(ii) Power Frequency with stand test on primary and secondary windings.

(iii) Partial discharge measurement (as per clause 8.2.2 of IEC 44-1).

(iv) Power frequency withstand test between section (as per clause 8.3 of IEC 44-1).

(v) Inter-turn voltage test as per clause 8.4 of (IEC 44-1).

(vi) Determination of errors.

For SF6 filled CTs:

i) Dew point measurement
ii) SF6 alarm/ lockout check.
iii) SF6 leakage test. Gas leakage rate shall be maintained within 0.2% per annum.

12.6 TESTING FACILITIES:

The bidder should have all the facilities available in house to carry out high voltage power frequency tests, tan delta and capacitance measurement as per specifications for these parameters narrated in various clauses and stipulated in IEC 44-1 and 44.2. The bidder must have partial discharge measurement facility suitable for measurement as per IEC 44-1 class 8.22. The instrument used for PD measurement should be calibrated from Government Lab/Govt. approved lab and calibration reports must be furnished with the offer. The bidder should furnish a statement clearly indicating the particulars of testing equipments, their make, year of manufacture, rating etc. Please note that offers not complying these requirements are liable for rejection.

13.0. INSPECTION:

(I) The TANTRANSCO shall have access at all times to the works and all other places of manufacture, where the Instrument Transformers are being manufactured and the supplier shall provide TANTRANSCO's representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

(II) The supplier shall keep the TANTRANSCO 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) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

(IV) The acceptance of any quantity of the equipment shall in no way relieve the supplier of his responsibility for meeting all the requirement of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.

14.0. PACKING AND FORWARDING:

14.1. The equipment shall be packed in crates suitable for vertical/horizontal Transport, as the case may be and suitable to withstand handling transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment 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. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

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

Name of the consignee.

Details of consignment.

Destination.

Total weight of consignment.

Handling and unpacking instructions.

Bill of material indicating contents of each package.

15.0. LIST OF DRAWINGS AND DOCUMENTS:

All drawings shall conform to relevant international standards organization (ISO) specification. All drawings shall be in ink and suitable for micro filming.

All dimensions and data shall be in S.S.I units.

15.1 . The Bidder shall furnish the following drawings along with his offer.
General outline and assembly drawings of the equipment.
Graphs showing other performance of equipments in regard to magnetization characteristics.
Sectional views showing.

. (i)General constructional features.

(ii) Materials/Gaskets/ sealings used. (iii) The insulation of the winding arrangements, Method of connection of the primary/secondary winding to the primary/secondary terminals etc.,

Schematic drawing.
Type test reports.
Test reports, literature, pamphlets of the bought out items and raw materials.

15.2. The supplier shall within 2 weeks of placement of order, submit four sets of all the above drawings for TANTRANSCO's approval. The TANTRANSCO shall communicate its comments/approval on the drawings to the supplier within reasonable time.

The Supplier shall, if necessary, modify the drawings for TANTRANSCO's approval within two weeks from the date of TANTRANSCO's comments. After receipt of TANTRANSCO's approval, the supplier shall within three weeks, submit 6 prints and two good quality reproducible of the approved drawings for TANTRANSCO's use.

15.3 Adequate copies of acceptance and routine test certificates, duly approved by the TANTRANSCO shall accompany the dispatched consignment.

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

15.5 The following shall be supplied to each consignee circle along with the initial supply of the equipments ordered.

i) Ten copies of printed and bound volumes of operation, maintenance and erection manuals in English along with the copies of approved drawings and type test reports etc.

ii) Three sets of the Manuals detailed in item (i) shall be supplied to the SE/Transmission – I within one week from the date of approval of drawings.

17.0. ASSEMBLY:

During manufacture strict quality control should be adopted. The equipment should be dried under vacuum in the hot chamber. Voids should be avoided to minimize partial discharges. Suitable Transformer oil should be filled up under vacuum immediately after drying is over. Oil filling and drain plugs may be provided.

SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 Foreword

The provision under this section is intended to supplement general requirements for the materials, equipment and services covered under other sections.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a) Customer : M/s Tamil Nadu Transmission Corporation Limited
b) Project Title : 400/110 KV Substation at Thappagundu & 400/230/110 KV Substation at Anikadavu
c) Transport facilities : Road/Rail
d) Site location : THAPPAGUNDU IN THENI DISTRICT, MADURAI REGION & ANIKADAVU IN TIRUPPUR DISTRICT, COIMBATORE REGION

The following system parameters shall prevail:

Nominal system voltage	**400 kV**	**230kV**	**110 kV**
Highest system voltage	420 kV	245kV	132 kV
Frequency	50 Hz	50 Hz	50 Hz
Minimum creepage	25mm/kV	25mm/kV	25mm/kV
System Earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed

SITE CONDITIONS

3.1.1 Ambient Temperature
a) Ambient air temp. (max.) : 50 deg C
B) Max Temp. for design : : 50 deg C
b) Ambient air temp. (min.) : 20 deg C
c) Max, Daily average ambient air temp. : 45 deg C
d) Max. yearly average ambient air temp. : 32 deg C

3.1.2 Max. humidity : 100% Max.

3.1.3 Average thunder storm days per annum : 50

3.1.4 Average rainy days per annum : 90

3.1.5 Average Annual rainfall : 1000 mm

3.1.6 No. of months during which tropical monsoon condition prevail: 5
3.1.7 Max, wind Pressure : 150kg/sqmm
3.1.8 Max wind speed : 39m/s
3.1.8 Altitude above MSL : 1000 m

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

AUXILIARY POWER SUPPLY

3 phase AC Supply	415V, 3 phase 4 wire 50 Hz, neutral grounded AC supply -15% to +10%
1 phase AC supply	240V, single phase, 50 Hz neutral grounded AC supply
DC supply	220, 2 wire DC supply + 10% to –15% 48V, 2 wire DC supply

3.2 GENERAL REQUIREMENT

3.2.0 ALL THE EQUIPMENTS /MATERIALS TO BE SUPPLIED SHOULD BE IN ACCORDANCE WITH RELEVANT LATEST / AMMENDED ISS /IEC, WHETHER IT HAS BEEN SPECIFICALLY MENTIONED IN THE SPECIFICATION OR NOT".

3.2.1 The supplier shall also furnish drawings for the following:

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

3.2.1 GENERAL:

3.2.1.1 The bidders shall be fully responsible for providing all equipment, materials system and services specified or otherwise which are required to complete the construction and successful commissioning of the substation in all respects.

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

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

3.2.1.4 The Tenderers are requested to procure the equipments/materials/component only from reputed /qualified manufacturer as per Technical requirement stipulated in Section - I of Technical specifications. Approval of make of item shall be taken up by vendor from TANTRANSCO himself.

3.3 SPECIFIC REQUIREMENT

3.3.1 The Supplier shall furnish make/manufacturer, catalogues, engineering data, and technical information, design documents, drawings etc., fully in conformity with the technical specification and get approval from competent authority before commencement of any work.

3.3.2 All steel materials, other than materials for earthing should be of galvanized if not specified.

3.4 SPECIFIC TECHNICAL REQUIREMENTS: / Drawing submission

The successful bidder shall submit all drawings and documents as per clause no. 3.29 along with the list of drawings within 7 days after placement of order to BHEL.

3.5 STANDARD:

The goods supplied under this contract shall conform to the standards mentioned in the Technical Specifications and when no applicable standard is mentioned, to the standard specified by the Institution of Central / State Government or internationally recognized Institutions shall be applicable and such standards shall be the latest issued by the concerned institution.

3.6 TEST CERTIFICATE:

Copies of all test certificates relating to material to be procured by the Supplier for the works shall be forwarded to BHEL.

3.7 Inspection clause :

3.7.1 The BHEL/TANTRANSCO or his representative shall have the right to inspect and/or test the goods /works to confirm their conformity to the supplier. BHEL/TANTRANSCO shall notify the supplier in writing of the identity of any representatives authorized for these purposes.

The inspections and tests may be conducted on the premises of the supplier or his Sub vendor at the point of delivery and /or at the goods' final destination. Where tests are conducted in the premises of Supplier, all reasonable facility and assistance including access to drawings and production data shall be furnished at no charge to the BHEL.

Should any inspected or tested goods fail to conform to specifications, the BHEL/TANTRANSCO may reject them and the supplier shall either replace the rejected goods or make all alterations necessary to meet specification requirements free of cost to the BHEL/TANTRANSCO within one week of intimation.

The BHEL/TANTRANSCO's right to inspect, test and where necessary reject the goods after the goods; arrival at the site, shall in no way be limited or waived by reason of the goods having been previously inspected. Tested and passed by the BHEL/TANTRANSCO or his representative prior to the goods dispatch.

3.7.2 Not less than 15 (Fifteen) days advance intimation shall be given about the quantity of materials that will be ready for inspection by the officers of TANTRANSCO/ BHEL/Third agency authorized by the Corporation. The materials should not be dispatched without instruction from the Corporation.

3.8 GUARANTEE:

3.8.1 The supplier shall guarantee that the goods under the Contract are new, unused of the most recent or current models and incorporated all recent improvements in design and materials unless provided otherwise in the Contract. The supplier shall further guarantee that the goods supplied under this Contract shall have no defects arising from design, materials or workmanship, installation and erection, if that may develop under normal use of the supplied goods. The supplier shall also guarantee the performance of the works executed by him including the performance of all the materials/goods supplied by him.

3.8.2 BHEL shall promptly notify supplier in writing of any claims arising under guarantee in respect of goods. Upon receipt of such notice, the supplier shall, with all reasonable speed, repair or replace the defective works or parts thereof, free of cost at site. All the expenses towards transportation of defective parts to supplier's works and of repaired/replaced parts to site shall be borne by the Supplier.

3.8.3 If the Supplier, having been notified, fails to remedy the defects within 14 days, the BHEL will proceed to take such remedial action as may be necessary, at the supplier's risk and expenses. All expenses in this regard will be recovered from Supplier.

3.9 PRE COMMISSIONING TESTING :(if applicable)

On completion of erection of equipments and before charging each item of equipments shall be thoroughly cleaned and inspected jointly by the TANTRANSCO and the BHEL for correctness and completeness of installation and acceptability for charging leading to initial pre commissioning test. The pre commissioning testing to be carried all equipments in the presence of Board Engineers. Necessary tools, testing kits are to be arranged by the Supplier.

3.10 PACKING:

3.10.1 The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit to their final destination as indicated in the Contract and exposure to extreme temperatures, salt and precipitation etc., during transport and open storage. Packing case size and weights shall be taken into consideration wherever appropriate, the remoteness of the 'goods' final destination and absence of heavy mechanized handling facilities, at all points in transit.

3.10.2 The packing, marking and documentation within and outside the package shall comply strictly with such special requirements as shall be expressly provided for in the Contract or in any subsequent instructions issued by BHEL.

3.11 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The supplier 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 BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO 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 the steel works shall be thoroughly cleaned of rust , scale , oil , grease, dirt and scarf by pickling , emulsion cleaning , etc. The sheet steel shall be phosphated /oven dried and then painted with two coats of zinc rich primer paints . After application of the primer, two coats of finished synthetic enamel paint shall be applied. The colour of the finished coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS 5 /RAL 7032 for all switchboard /MCC/distribution board , control panels etc.
Sufficient quantities of touch paint shall be furnished for application at site. All the indoor cubicles shall be the same as exterior surface and for other miscellaneous items, colour scheme will be approved by the BHEL/TANTRANSCO.

3.12 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly 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 painting 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 otherwise 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.

3.13 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.

3.14 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.

3.15 GALVANIZING

All nuts and pins shall be adequately locked. Nuts, bolts and pins used inside the transformer and tap-changer compartment where gaskets are not used shall be provided with spring washers or locknuts. Where galvanizing is specified, it shall be applied by the hot dipped process or by electro-galvanizing process and for all parts, other than steel wires, shall consist of a thickness of zinc coating equivalent to not less than 610 gm of zinc per square metre of surface.The zinc coating shall be smooth, of uniform thickness and free from defects.

3.16 DEGREE OF PROTECTION

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. 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 outdoor: IP-55

b) Installed indoor in air conditioned area: IP-42
c) Installed in covered area IP:52
d) 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.

3.17 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 be required by the BHEL/TANTRANSCO. The rating plate for each equipment shall be according to IEC requirements.

Alternately two separate plates one with Hindi and other with English inscriptions may be provided.

During approvals drawings of Rating/name plates/lables shall also be submitted.

3.18 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.

3.19 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 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 Publications, 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.

TB sizes for incoming power supply shall be informed/confirmed during drwawing approval stage.

TBs should be suitable for cable sizes all cable sizes.

3.20 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 sheet steel. Sheet steel used shall be at least 3.0 mm thick cold rolled or 3 mm hot rolled. 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 atleast 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

3.21 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.

3.22 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

Delivery of goods shall be made by the supplier in accordance with the terms specified by the BHEL in its schedule of requirements.

3.23 INCIDENTAL SERVICES:

The Supplier is required to provide any or all the services broadly outlined in the Technical specification. Any other minor incidental service related to the scope of work like providing necessary assistance whether specifically mentioned or not must be carried out by the

Supplier at his own cost. All tools, Tackles Plant etc., required for completion of above works shall be brought by the Supplier.

3.24 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

Should there be any discrepancy between the specifications and/or schedule of prices and/or drawings or any inconsistency, error or omission in either of them, reference must be made to the BHEL/TANTRANSCO for an explanation and the Supplier will be held responsible for any errors that may occur in the work through neglect of this precaution. The explanation of the BHEL/TANTRANSCO shall be final and binding on the Supplier.

3.25 APPROVAL PROCEDURE

The scheduled dates for the submission of drawings as well as for, any data/information to be furnished by the Employer would be as per the following schedule. 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.	First Submission	7 days after LOI/PO
ii.	Approval/comments/by employer on Initial submission	Reasonable time
iii.	Resubmission	Within 7 days (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 2 weeks of receipt of resubmission.
v.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The supplier 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.

3.26 TITLE BLOCK

Following Title Blocks to be used in drawings at the time of drawing approvals

For Thappagundu

Customer	M/s Tamil Nadu Transmission Corporation Limited

Project:	400/110 KV Substation at Thappagundu
Contractor	BHEL

For Anikadavu

Customer	M/s Tamil Nadu Transmission Corporation Limited
Project:	400/230-110 KV Substation at Anikadavu
Contractor	BHEL

3.27 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) List of Part Supplies with rating

Drawings & Documents submitted at the time of offer shall be subject to review at contract stage.

3.28 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	7	10	5
2	Drawings “As Built “	-	-	10	
3	Type Test Reports	1	7	10	
4	Erection Manuals	-	7	10	
5	Operation and Maintenance Manuals	-	7	10	
6	Manufacturing Quality Plan	-	7	10	
7	Field Quality Plan	-	7	10	
8	Inspection Test Reports	-	7	10	

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD-2004 or Later version or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with details of Customer & Project etc. written on top.

APPENDIX-A

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations/variations/exceptions from the specification:

SECTION	CLAUSE NO. / PAGE NO.	STATEMENT OF DEVIATION / VARIATIONS / EXCEPTIONS

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

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

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

Place

Date

Signature of the authorized representative of

Bidder's name …….

Designation …….

Company seal …….

APPENDIX-B

BIDDER'S UNDERTAKING FOR TYPE TEST REPORTS

Bidder shall take type test report, MQP, and drawing approval from TANTRANSCO without any commercial / delivery implication to BHEL. In case type test reports are not acceptable to customer due to any technical reason, the same shall be conducted free of cost.

Place Signature of the authorized representative of

Bidder 'name----------

Date

Designation----------

Company seal ----------

SECTION – 4

GUARANTEED TECHNICAL PARTICULARS

S. No.	Particulars	Guaranteed Value
1	Type	
2	Manufacturer s type designation	
3	Rated voltage	
4	Number of cores	
5	Frequency	
6	Ratio of Transformation for each core	
7	Rated burden (VA) for each core at different ratios	
8	Class of accuracy for each core at different ratios	
9	Knee point voltage (Vk)for each core at different ratios	
10	Maximum exciting current (mA) for cores 1, 2,3,4 at different ratios at Vk	
11	Maximum resistance of secondary winding at 75°c in Ohms for each core at different ratios	
12	Magnetization curves for current transformer cores (to be enclosed)	
13	Short time thermal current rating in KA(for 1 sec)	
14	Rated current dynamic in KA (peak value)	
15	Rated continuous thermal current	
16.a	One minute power frequency dry withstand test voltage at primary to earth KV(RMS)	
16.b	One minute power frequency dry withstand test voltage between each section of primary winding	
17	1.2/50 micro second positive and negative impulse wave with stand test voltage	
18	One minute power frequency dry withstand test voltage on Secondaries	
19	Whether the current transformer will carry 1.2 times the rated primary current	
20	Turns ratio error & phase angle error for cores 1, 2,3 & 4	
21	Ratio taps	

22	Ratio error at rated burden and at 120 and 200 percentage of rated current for core – 5 at different ratios.	
23	Phase angle error at rated burden and at 120 and 200 percentage of rated current for core – 5 at different ratios.	
24	Maximum value of tan delta	
25	Mounting details.	
26	Total creepage distance in mm.	
27	Weight of oil/SF6 gas pressure	
28	Total weight.	
29	Over all dimensions in mm.	
30	Details of drawings enclosed.	
31	Details of test certificates enclosed.	
32	Primary to earth insulation resistance at 30ºC.	
33	State the relevant IS followed for a) 400 KV Current Transformer offered. b) Bushing used. c) Transformer oil used. d) SF6 gas used.	

SECTION 5
CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER
RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

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

BHEL ENQUIRY NO:

BIDDER: OFFER REFERENCE:

A)

S. No.	Parameters	Data	Yes / No	Remarks
1.	Applicable Standard	IEC: 60044-1, IS-2705	Yes	
2.	Type	Outdoor	Yes	
3.	Whether Oil / SF6 filled	Oil filled / SF6 filled	Yes	Bidder to tick
4.	Rated Frequency	50 Hz	Yes	
5.	Highest System Voltage	420kV	Yes	
6.	Rated current	3000A	Yes	
7.	Rated short time withstand current for 1 sec	63 kA for 1 sec.	Yes	
8.	Rated extended current	120% for higher two ratio taps and 200% for lower ratio taps	Yes	
9.	Rated dynamic current	157.5 kAp	Yes	
10.	Rated Insulation Levels : a. Power Freq. Withstand Voltage b. Lightning Impulse withstand voltage	 630kV (rms) 1425kVp	Yes	
11.	Creepage Distance	10500 mm	Yes	
12.	The CT Core Parameters	As per Clause 3.2 of Section- 2	Yes	

13.	CT supplied Suitable for operation in the Climatic and High Altitude conditions.	Suitable for Climatic and Meteorological Data Specified in Section III	Yes	
14.	Max. Temperature rise over design ambient temperature	As per clause 3.1 of Section -2	Yes	
15.	External Surface if steel	Hot Dip Galvanized	Yes	
16.	Type Test report.	Copies of valid type test reports to be submitted along with offer.	Yes	
18.	Technical Requirement	Manufacturer qualifies the Technical Requirement as per clause 5.0 of Section-1 of the Technical Specification.	Yes	

B) TYPE TESTS

i)Whether type test reports of the tests as per relevant IS-2705 and IEC 60044 conducted earlier on identical or similar material are available(test reports are of the test conducted not earlier than 5 (five) years prior to the date of bid opening i.e. 05/04/13 for Anikadavu and 10/04/13 for Thapagundu.

(YES)

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

Date:

Signature of the authorized representative of Bidder

Company Seal