BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

					Prepared	Checked	Approved
DOCUMENT No.	TB-363-510-032	Rev	00				
CUSTOMER Doc. No.				NAME	BA	VK	VK
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	POTENTIAL TRANSFORMER (230kV & 110kV)			DATE	31.07.14	31.07.14	31.07.14
				GROUP	TBEM		
				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 **230kV & 110kV Potential Transformers (Oil 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 230kV & 110kV Potential 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.	**110 KV single phase 3 core Potential Transformer with all accessories excluding support structure, terminal connectors and common Junction box**	Nos.	**6**

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

S. No.	DETAILS	Unit	Quantity
1.	**230 KV single phase 3 core Potential Transformer with all accessories excluding support structure, terminal connectors and common Junction box**	Nos.	**6**
2.	**110 KV single phase 3 core Potential Transformer with all accessories excluding support structure, terminal connectors and common Junction box**	Nos.	**6**

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 230kV & 110kV Potential Transformers to any of the 230/110 KV 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

As per customer specification attached herewith

SECTION - 8
POTENTIAL TRANSFORMER

1.0 SCOPE:

This scope covers for design, manufacture, inspection, testing before dispatch, packing and delivery F.O.R (Destination) of 230KV/110KV Potential Transformers along with all accessories with its terminal box and a common junction box, terminal connector specified herein for Protection and Metering services with suitable mounting structure.

2.0. STANDARDS:

Unless otherwise specified elsewhere in the specification, the Electro Magnetic Voltage Transformers shall conform to the latest revisions and amendments thereof the IS:3156 and IEC Standards.

Besides the above the standard minimum safety clearances stipulated in IE Rules 1956 shall also be complied with.

3.0 CLEARANCE:

All clearance of live parts between phases and to earthed metal parts of equipments shall be adequate for maximum service voltage or normal plus 10% and shall conform to IS:3156 of the latest issue unless specified otherwise.

4.0. CAPACITY:

All the equipments detailed in this specification shall be capable of Operating continuously under the severest operating conditions in the tropies with humid atmospheric conditions without deterioration or damage. The entire equipment shall also be suitable for continuous operation of voltage 10% above the normal and frequency variation of plus or minus 5%.

5.0. TECHNICAL SPECIFICATION

5.1.1. FOR 230 KV POTENTIAL TRANSFORMERS

5.1	Type	230 KV Potential Transformer, (Electromagnetic type) Outdoor oil filled, self cooled, Nitrogen filled, sealed type suitable for effectively earthed system.
5.2	Normal system voltage	230 KV
5.3	Highest system voltage	245 KV (rms)
5.4	Frequency	50 c/s
5.5	Voltage ratio (a) rated primary voltage (KV RMS)	 230KV/√3

	(b) secondary voltage(v)	wdg – I : 110/√3 Wdg - II : 110/√3 Wdg – III : 110/√3
5.6.	Method of earthing system where the EMVT will be installed.	Solidly earthed
5.7.	1.2/50 microsecond lightning impulse withstand voltage (KVP)	1050
5.8.	1 minute dry power frequency on the porcelain bushing withstand voltage (KV rms)	460
5.9.	Min.creepage distance of porcelain (mm)	6125 mm
5.10.	Rated voltage factor	(a) 1.5 for 30 seconds (b) 1.2 for continuous rating
5.11.	1 minute power frequency withstand voltage for secondary winding (KV) rms	3 KV rms.
5.12	Maximum dieelectric dissipation factor at Um/Root3	0.005
5.13.	Partial discharge level at rated voltage (picco coulombs)	Less than 10
5.14.	Maximum temperature rise over ambient of 50 degree C	As per IEC-186
5.15	Rated total thermal burden	Wdg - I 200 VA Total Wdg - II 200 VA 550 VA Wdg-III 150 VA
5.16.	Seismic acceleration (Horizontal)	0.3g.
5.17.	Type of mounting Structure TANTRANSCO scope	Pedestal/structure mounting type.

5.1.2. FOR 110 KV POTENTIAL TRANSFORMERS

5.1	Type	110 KV voltage transformer (Electromagnetic type) outdoor oil filled, self cooled, nitrogen filled, sealed type suitable for effectively earthed system.
5.2	Type of mounting structure TANTRANSCO scope	Pedestal/structure mounting type
5.3	Normal system voltage	110 KV
5.4	Highest system voltage	132 KV (rms)
5.5	Frequency	50 c/s
5.6	Voltage ratio (a) rated primary voltage (KV RMS)	110KV/√3

	(b)secondary voltage(V)	wdg – I : 110/√3 Wdg-II : 110/√3 Wdg-III : 110/√3
5.7.	Method of earthing system where the EMVT will be installed.	Effectively earthed
5.8.	1.2/50 microsecond lightning impulse withstand voltage (KVP)	550
5.9.	1 minute dry power frequency on the porcelain bushing withstand voltage (KV rms)	230
5.10.	Min.creepage distance of porcelain (mm)	3400
5.11.	Rated voltage factor	1.5 for 30 seconds 1.2 for continuous
5.12.	Maximum dielectric dissipation factor at Um/√3	0.005
5.13.	1 minute power frequency withstand voltage for secondary winding (KV) rms	3 KV rms for all winding
5.14.	Partial discharge level at 1.2 Um / root 3 (pico coulombs)	Less than 5
5.15.	Maximum temperature rise over ambient of 50 degree C	As per IEC-186
5.16	Rated total thermal burden	Wdg - I 200 VA Total Wdg - II 100 VA 500 VA Wdg - III 200 VA
5.17.	Seismic acceleration (Horizontal)	0.3g.

5.1.3. COREWISE REQUIREMENT FOR 230KV PT

Sl.No.	Particulars	Requirements		
01.	Rated primary voltage	230/√3 KV		
02.	Type	Single phase electro magnetic type VT		
03.	No. of secondary windings	Three		
04.	Rated voltage factor	1.5 for 30 seconds. 1.2 for continuous.		
05.	Phase angle error for metering core only	+/- 10 minutes (As per IS-3156)		
06.	Rated secondary voltage (v)	Secondary-I 110/√3	Secondary-II 110/√3	Secondary-III 110/√3
07.	Application	Metering	Protection	Protection

08.	Accuracy	0.2	3p	3p
09.	Output burden (VA)	200	200	150

NOTE : The accuracy of 0.2 on winding I (Metering) should be maintained upto and including total burden of 550 VA on all the three windings.

5.2.1. COREWISE REQUIREMENT FOR 110KV PT.

Sl.No.	Particulars	Requirements		
01.	Rated primary voltage	110/√3 KV		
02.	Type	Single phase electro magnetic type VT		
03.	No. of secondary windings	Three		
04.	Rated voltage factor	1.2 continuous 1.5 - 30 seconds		
05.	Phase angle error for metering core only	± 10 minutes		
06.	Rated secondary voltage (V)	Secondary-I 110/√3	Secondary-II 110/√3	Secondary-III 110/√3
07.	Application	Protection	Protection	Metering
08.	Accuracy	3P	3P	0.2
09.	Output burden (VA)	200	100	200

NOTE : The accuracy of 0.2 on winding III should be maintained upto and including total burden of 500 VA on all the three windings.

6.0 GENERAL TECHNICAL REQUIREMENTS:

The insulation of the Potential 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 Potential Transformers.

6.1. 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 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 IEC-815.

Details of attachment of metallic flanges to the porcelain shall be brought in the offer

6.1.1 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/ aluminium alloy, depending on the requirement. Welding in horizontal plane is to be avoided as welding at his 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.

6.2. PAINTING, GALVANISING AND CLIMATE PROOFING :

All interiors and exteriors of enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surfaces treated by phosphating (e.g seven tank phospating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable stoving and air drying before final painting. Colour of the final paints shall be shade No.697 of IS-5. The finally painted cubicle shall present aesthetically pleasing appearance and shall be free from any dent or uneven surface. Complete details of painting, galvanizing and climate proofing of the equipment shall be furnished in the offer.

Paint inside the metallic housing shall be of anti condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

All components shall be given adequate treatment of climate proofing as per IS-3202 so as to withstand corrosive and severe service conditions.

All metal parts not suitable for painting such as structural steel, pipes levers, linkages nuts and bolts used in other than current path etc. shall be hot dip galvanized as per IS-2629.

6.3. INSULATING OIL:

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

6.4. PREVENTION OF OIL LEAKAGES AND ENTRY OF MOISTURE:

6.4.1.The supplier shall ensure that the sealing of Potential Transformer is properly achieved. In this connection the 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.

6.4.2.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.

6.4.3.For gasketed joints, wherever used nitryl butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove/ plane surface with adequate space for accommodating the gasket under compression. Rubber`O' rings shall be used for sealing. Aging test shall be conducted on the gaskets as detailed in Annexure – IA and the test certificates produced for verification.

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

6.5. OIL LEVEL INDICATORS:

Potential 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 to an observer standing at ground level. If metal bellow is used for the above purpose a ground glass window /bellow level indicator shall be provided to monitor the position of metal bellow. Oil minimum and maximum level may be engraved and painted.

6.6. EARTHING:

Metal tank of Potential Transformer shall be provided with separate earthing terminals for bolted connection to 50 x 8 mm MS flat to be provided by the Board for connection to station earth-mat.

6.7. LIFTING ARRANGEMENTS:

Potential 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 shall be supplied which shall be of removable type.

6.8. NAME PLATE:

The Potential Transformer shall be provided with, non-corrosive, legible name plate with the information specified in relevant standards, duly engraved/punched on it. The EMVT shall be provided with a rating plate with

dimensions and markings as per IS:3156. The markings shall be punched and not painted.

The following data may be duly engraved / punched on the name plate.

(a) Manufacturer's Name.
(b) Manufacturer's Serial No. and type designation.
(c) Year of manufacture.
(d) Rated Primary and secondary voltage.
(e) Rated frequency, out put per phase and accuracy class.
(f) Highest system voltage.
(g) Rated insulation level.
(h) Rated voltage factor.
(i) Over voltage factor.
(j) Number of cores.
(k) Transformer ratio.
(l) Rated burden.
(m) Weight.
(n) LOA No. and date.

6.9. TERMINAL CONNECTOR:

The Terminal Connectors (TC) suitable for single Moose Conductor to be supplied along with potential transformer. The TC shall be suitable for vertical and horizontal take off.

The Terminal Connectors shall meet the following requirements.

(i) Terminal connectors shall be manufactured and tested as per IS-5561.

(ii) All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

(iii) No part of a clamp shall be less than 10mm thick

(iv) All Ferrous parts shall be galvanized conforming to IS-2633

(v) For bimetallic connectors, copper alloy liner of minimum thickness of 2mm shall be cast integral with aluminium body.

(vi) Flexible connectors shall be made from tinned copper.

(vii) All current carrying parts shall be designed and manufactured to have minimum contact resistance.

(viii) Connectors shall be designed to be Corona free in accordance with the requirements stipulated in IS:5561. The sharp edges shall be rounded off.

6.10. GENERAL FEATURES :

I) 230KV PT

(a) The 230KV Outdoor Potential Transformers shall be oil immersed, self cooled, hermetically sealed type suitable for the services indicated conforming to the modern practice of design and manufacture. Dry nitrogen gas slightly above the normal atmosphere will be filled in above the surface of oil.

(b) The core shall be of high grade grain oriented non-ageing electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy.

(c) Generally, Potential Transformers offered, shall not require any maintenance apart from occasional cleaning of the insulators.

(d) The bushings used should conform to IS-5621 and should be suitable for use in heavily polluted atmosphere.

(e) A suitable oil level indicator and pressure releasing arrangements will be provided on each potential transformer.

(f) The secondary terminal will be brought out in a compartment on one side of the potential transformer for easy access. Suitable HRC fuses shall also be provided. Cable entry with glands shall be provided on the bottom of the secondary box for entry of 3 Nos. 2 core 4 sq.mm cable. Suitable electrolytic copper wire should be used for windings.

(g) All ferrous parts of the Potential transformers shall be hot dip galvanized.

(h) For providing supervision against failure of fuse provided in the potential transformer secondary terminal box, additional 2 Nos. secondary terminals may be provided across the winding-I terminal.

(i) All sharp corners in the potential transformer are to be rounded off suitably. The encapsulated potential transformer is impervious to Snow, Ice and significant temperature changes.

II) 110KV PT

The potential transformer is required for protection and metering purposes. 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.

Primary winding shall be made out of high conductivity copper. Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. Type of insulation used shall be described in the offer. Each core of secondary winding shall be protected by two sets of HRC fuses, in parallel.

The HRC fuses meant for protection of secondary windings shall also be located in the terminal box. 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 Secondary terminals shall be brought out in a weather proof terminal box. The HRC fuses meant for protection of secondary windings shall also be located in the terminal box. The terminal box shall be provided with removable gland plate and glands suitable for 1100V grade, PVC insulated, PVC sheathed multicore 2.5 sq.mm to 6 sq.mm. stranded copper conductor cable. The dimensions of the sufficient working space for use of normal tools. The terminal blocks shall be stud type and provided with ferrules indelibly marked or numbered and their in sensifications shall correspond to the design on the relevant wiring diagram.

Secondary winding terminal studs shall be provided with atleast three nuts, plain and spring washers. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6mm. The length of atleast 1.5mm shall be available on the studs for inserting the leads.

6.11. WINDING :

6.12. PRIMARY WINDING :

All primaries of potential transformers will be connected in phase to neutral with the neutral point solidly earthed. The neutral of the system is also solidly earthed. Suitable link may be provided in between the neutral and earth.

6.13. SECONDARY WINDING :

I) 230KV PT

All Potential Transformers for phase to ground connection shall be provided with winding rated for 110V/√3 for winding – I,II and III.

II) 110KV PT

All Potential Transformers for phase to ground connection shall be provided with winding rated for 110V/√3 for winding – I ,II and III.

6.14. Electrolytic copper shall be used for both primary and secondary windings.

6.15. PRIMARY TERMINALS :

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

6.16. 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 Junction box size 750mm Height, 600mm Width, 325mm Depth 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 PT.

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 milliammeters. 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 6 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.

6.17. MEASUREMENT OF CAPACITANCE AND TAN DELTA.

The 230KV and 110KV Potential 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 caption, 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 Potential Transformers.

6.18. TEMPERATURE RISE :

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	Temper-ature	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 75	55 25

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 90	55 40
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 Enamel : oil base Synthetic, in air Synthetic, in oil	 90 100 120 100 130 100 155 100 100 120 100	 40 50 70 50 80 50 105 50 50 70 50
06.	Any part of metal or of insulating material in contact with oil except contacts	100	50
07.	Oil	50	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.

6.19. 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 minimise partial discharges. Suitable transformer oil should be filled up under vacuum immediately after drying is over. Oil filling and drain plugs may be provided.

6.20. JUNCTION BOXES :

Absolutely vermin proof fabricated from M.S. sheet of thickness 3mm minimum junction boxes are to be supplied one each along with for a set of 3 Nos. Potential Transformers. Junction Boxes shall be of size 750mm Height, 600mm width and 325mm depth. Boxes have to be provided with belt/rubber beedings and doors opening with wing nuts for locking.

For 110 KV PT

Necessary fuse provision to facilitate broken delta connection through 3rd or 2nd core may be given.

It should be painted with aluminium paint outside and grey paint inside. It should be provided with stud type terminal blocks with lock nuts and washers. Boxes should have necessary provision with cable glands for connecting 6 Nos. 4 Sq.mm 6 core cable and 2 Nos. 4 Sq.mm 8 Core cables. All sharp corners should be rounded off. Boxes should have sufficient working spaces for easy working and spares for each wiring. A spare terminal block with 24 terminals may be provided in the Junction Boxes.

Junction Box shall be manufactured as per the drawing available at this office/enclosed.

6.21. FITTINGS AND ACCESSORIES :

The Potential Transformer shall be provided with the following list of fittings.

(a) Name plate with rating and connection diagram.
(b) Lifting lugs.
(c) Earthing terminal.
(d) Oil filling hole with cap.

(e) Oil level gauge / bellow level indicator
(f) HV terminal connectors.
(g) Cable gland.
(h) Protective fuses in the LV side.
(i) Any other fittings as per the manufacturer's practice.
(j) Nitrogen filling valve with cap.
(k) Pressure relief valve.
(l) Secondary terminal box with removable undrilled gland plate.

6.22. PACKING AND FORWARDING:

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.

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.

The supplier shall ensure that the bill of material is approved by the Board before dispatch.

6.23. 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. The Bidder shall furnish the following drawings along with his offer.

(g) General outline and assembly drawings of the equipment.
(h) Graphs showing other performance of equipments in regard to magnetization characteristics.
(i) 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.,

(j) Schematic drawing.

(k) Test reports, literature, pamphlets of the bought out items and raw materials.

The supplier shall within 2 weeks of placement of order, submit four sets of final versions of all the above drawings for Board's approval. The Board shall communicate its comments/approval on the drawings to the supplier within reasonable time. The Supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Board's approval within two weeks from the date of Board's comments. After receipt of Board's approval, the supplier shall within three weeks, submit 6 prints and two good quality reproducible of the approved drawings for Board's use.

Six sets of the type test reports, duly approved by the Board shall be submitted by the supplier for distribution, before commencement of supply. Adequate copies of acceptance and routine test certificates, duly approved by the Board shall accompany the dispatched consignment.

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

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

(b) Five 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/TR -I within one week from the date of approval of drawings.

(iii) It should be noted that if the above conditions are not fulfilled, the initial payment will not be released.

6.25. INSPECTION:

The Board 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 Board's representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

The supplier shall keep the Board 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.

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

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.

7.0. TESTS:

7.1. TYPE TEST :

Before offering inspection of Potential Transformers, the successful tenderer should submit copies of type test certificates for materials of their make in full shape, as conforming to relevant ISS/IEC of latest issue, obtained from a Govt/Govt. recognized laboratory. The above type test certificates should accompany the drawings for the materials duly signed under seal by the institution who has issued the type test certificate.

The details of type tests should also be given as per schedule - G. The above type test should have been conducted within 5 years on the date of tender opening. Original type test reports shall be produced for verification on request.

7.2. ACCEPTANCE AND ROUTINE TESTS:

All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of Board's representative.

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

(i) Verification of terminal marking and polarity.
(ii) High Voltage power frequency tests on primary windings.
(iii) High Voltage power frequency tests on secondary windings.
(iv) Partial discharge measurement.
(v) Determination of errors according to the requirement of appropriate accuracy class.
(vi) Tan delta measurement.

Immediately after finalisation of the programme of acceptance/ routine testing, the supplier shall give sufficient advance intimation atleast 15 days in advance to the Board, to enable to depute its representative for witnessing the tests.

SPECIFICATION FOR NITRYL BUTYL RUBBER

The gaskets are to be used in tanks exposed to Transformer mineral oil at about 110 C.

1. Hardness should be Shore A 70 + 5.

2. Tensile Strength should be min. 10.8N/sq.mm(Minimum)

3. Elongation strength should be 270% (Minimum)

AFTER AGING

1. Change in weight should not be more than 10% and change in Hardness should not be more than Shore A +10 after 7 days aging in transformer oil.

2. There should not be any visible damages after accelerated aging of 24 hours in transformer oil of temperature 110 C.

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
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) <u>230kV PT</u>

S. No.	*Parameters*	*Data*	*Yes / No*	*Remarks*
1.	*Applicable Standard*	*IS-3156*		
2.	*Type*	*Outdoor, oil filled, self cooled sealed by nitrogen cushion*		
3.1	*Earthing Conditions*	*Solidly Earthed*		
3.2	*Rated Frequency*	*50 Hz*		
3.3	*System Voltage*	*230kV*		
3.4	*Highest System Voltage*	*245kV*		
3.5	*Voltage Ratio* *a) Rated Primary Voltage (kV rms)* *b) Secondary Voltage (Volts)*	*230kV/√3* *Wdg-1: 110/√3* *Wdg-2: 110/√3* *Wdg-3: 110/√3*		
3.6	*One min. dry Power frequency withstand voltage on porcelain bushing*	*460kV rms*		
3.8	*One min. Power frequency withstand voltage for Secondary winding (kV rms)*	*3 kV rms*		
3.9	*Creepage Distance*	*6125mm*		
3.10	*Lightning Impulse(Peak Value)*	*1050kV p*		
3.11	*Rated Voltage Factor*	*a) 1.5 for 30 seconds* *b) 1.2 for continuous rating*		
3.12	*Maximum electric dissipation factor at Vm/√3*	*0.005*		
3.13	*Partial discharge level at rated Voltage (in pico-Coulombs)*	*<10*		

4	*Max. Temperature rise over design ambient temperature of 50°C*	*As per IEC - 186*		
5	*Seismic Acceleration (horizontal)*	*0.3g*		
6	*Type of Mounting structure*	*Pedestal/ Structure mounted*		
7	*Max. Temperature rise over design ambient temperature of 50°C*	*As per IEC - 186*		
8	*External Surface if steel*	*Hot Dip Galvanized*		
9	*Measurement of Capacitance and Tan Delta*	*Test tap provided in PT for measurement of Capacitance, tan delta & partial discharges (Refer cl.6.17 of section-2)*		
10	*Core-wise requirement of PT*	*(Refer cl.5.1.3 of section-2)*		

B) TYPE TESTS

i) Whether type test reports of the tests as per relevant IS-3156 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, 05/04/2013 for Anikadavu and 10/04/2013 for Thapagundu substations).
(YES)

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

Date: **Signature of the authorized representative of Bidder**

Company Seal

B) <u>110kV PT</u>

S. No.	*Parameters*	*Data*	*Yes / No*	*Remarks*
1.	*Applicable Standard*	*IS-3156*		
2.	*Type*	*Outdoor, oil filled, self cooled sealed by nitrogen cushion*		
3.1	*Earthing Conditions*	*Solidly Earthed*		
3.2	*Rated Frequency*	*50 Hz*		
3.3	*System Voltage*	*110kV*		
3.4	*Highest System Voltage*	*132kV*		
3.5	*Voltage Ratio* *c) Rated Primary Voltage (kV rms)* *d) Secondary Voltage (Volts)*	*110kV/√3* *Wdg-1: 110/√3* *Wdg-2: 110/√3* *Wdg-3: 110/√3*		
3.6	*One min. dry Power frequency withstand voltage on porcelain bushing*	*230kV rms*		
3.8	*One min. Power frequency withstand voltage for Secondary winding (kV rms)*	*3 kV rms*		
3.9	*Creepage Distance*	*3400mm*		
3.10	*Lightning Impulse(Peak Value)*	*550kV p*		
3.11	*Rated Voltage Factor*	*c) 1.5 for 30 seconds* *d) 1.2 for continuous rating*		
3.12	*Maximum electric dissipation factor at Vm/√3*	*0.005*		
3.13	*Partial discharge level at 1.2 Vm/√3 (in pico-Coulombs)*	*<5*		
4	*Max. Temperature rise over design ambient temperature of 50°C*	*As per IEC - 186*		
5	*Seismic Acceleration (horizontal)*	*0.3g*		
6	*Type of Mounting structure*	*Pedestal/ Structure mounted*		

7	*Max. Temperature rise over design ambient temperature of 50°C*	*As per IEC - 186*		
8	*External Surface if steel*	*Hot Dip Galvanized*		
9	*Measurement of Capacitance and Tan Delta*	*Test tap provided in PT for measurement of Capacitance, tan delta & partial discharges (Refer cl.6.17 of section-2)*		
10	*Core-wise requirement of PT*	*(Refer cl.5.2.1 of section-2)*		

B) TYPE TESTS

i) Whether type test reports of the tests as per relevant IS-3156 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, 05/04/2013 for Anikadavu and 10/04/2013 for Thapagundu substations).
(YES)

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

Date: **Signature of the authorized representative of Bidder**

Company Seal