BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	RD	VK	VK
TITLE				SIGN	Sd/-	Sd/-	Sd/-
765kV CURRENT TRANSFORMER				DATE	19-05-17	19-05-17	19-05-17
				GROUP	TBEM	W.O. No	86009
CUSTOMER	Tamilnadu Transmission Corporation Limited (TANTRANSCO)						
PROJECTS	765/400kV AIS S/S Ariyalur						

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
01	05-06-17	RD	VK	VK	Section-3 and Technical Requirements and BOQ (Section-1) Revised

Distribution	TBMM	TBQM	TBCM	TBTS
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SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Current Transformers complete with accessories as listed in clause 5.0 below. This section covers the specific technical requirements of 765kV CT.

The specification comprises of following sections:

Section-1:	Scope, Specific Technical Requirements & Quantities
Section-2:	Equipment Specification
Section-3:	Project Details & General Technical Requirements
Section-4:	Guaranteed Technical Particulars
Section-5:	Checklist

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

Note: The terms used in this specification namely, "Employer/Purchaser" refers to TANTRANSCO & "Sub-contractor/manufacturer" refers to successful bidder.

1.1 The equipment is required for the following Project:

Name of Customer: Tamilnadu Transmission Corporation Limited (TANTRANSCO)

Name of the Projects: 765/400kV AIS S/S Ariyalur

Refer Section - 3 for Project Details and General Specifications.

2.0 SPECIFIC TECHNICAL PARTICULARS

a. Technical Parameters of 765kV CT:

S.No.	Description of parameters	Data
1.	Max. System Voltage	800kV
2.	Rated frequency	50 Hz
3.	System Fault Level	50kA for 1 Sec
4.	Min. Creepage Distance	25mm/kV

b. 765kV CT Parameters:

Refer Section-2, Clause 3.1A) and Clause 3.2A).

For detailed Technical requirements refer Section-2 of the Technical Specification.

3.0 TECHNICAL REQUIREMENTS:

3.1 The manufacturer(s) whose 765kV Current Transformer(s) are offered, should have designed, manufactured, type tested (as per IEC/IS) for 40kA or above fault level and supplied 715kV or above class Current Transformers, which are in satisfactory operation for at least two (2) years as on 31.03.2017.

Further, a legally enforceable undertaking by the manufacturer shall be furnished before placement of PO to guarantee quality, timely supply, and performance of the 765 kV Current Transformer.

The manufacturer for 765kV class Current Transformers should have repair and maintenance facilities for these equipments in India. The repair and maintenance facilities shall be such that the equipment can be repaired and maintained without necessitating it to be taken outside the country. In case the manufacturer is not having these facilities and the offered Current Transformers are from outside India, the manufacturer should have Repair & Maintenance facilities in India as on 31.03.2017, otherwise he shall be required to supply 5% of total quantity, rounded off to the next higher integer, subject to a minimum of 3 Nos. of each type and rating of Current Transformers as additional spares (excluding mandatory spares) in lieu of repair and maintenance facilities for 765 kV Current Transformers.

OR

3.2 765kV Current Transformers may also be offered from the manufacturer, who have established production line in India and have manufactured & type tested (as per IEC/IS) for 40kA or above fault level 715kV or above Voltage Class Current Transformers, manufactured in their Indian works, which are in satisfactory operation as on 31.03.2017. In case the above Current Transformers are not in satisfactory operation for two (2) years as on 31.03.2017, the manufacturer shall furnish performance guarantee for an amount of 10% of the ex-works cost of the Current Transformers. This performance guarantee shall be in addition to the contract performance guarantee to be submitted by the manufacturer. And wherever the specified fault level of the Current transformers is more than 40 kA, in addition to the above, the offered Current transformers should have been designed, manufactured and type tested to the specified fault level as on 30.09.2016.

Further, a legally enforceable undertaking by the manufacturer shall be furnished before placement of PO to guarantee quality, timely supply, and performance of the 765 kV Current Transformer.

The manufacturer for 765kV class Current Transformers should have repair and maintenance facilities for these equipments in India. The repair and maintenance facilities shall be such that the equipment can be repaired and maintained without necessitating it to be taken outside the country. In case the manufacturer is not having these facilities and the offered Current Transformers are from outside India, the manufacturer should have Repair & Maintenance facilities in India as on 31.03.2017, otherwise he shall be required to supply 5% of total quantity, rounded off to the next higher integer, subject to a minimum of 3 Nos. of each type and rating of Current Transformers as additional spares (excluding mandatory spares) in lieu of repair and maintenance facilities for 765 kV Current Transformers.

4.0 PRE-COMMISSIONING AND COMMISSIONING

All pre-commissioning tests as per approved field Q.P and Instructions of equipment supplier shall also be performed without any extra cost to BHEL / Customer. The bidder shall arrange all special instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments for approval. "Commissioning checks", "installation checks","Site tests" wherever mentioned in the Specification shall be considered as pre-commissioning checks.

Note: The respective dates of commencement of erection, pre-commissioning and commissioning activity by BHEL will be intimated to the equipment manufacturer from time to time, so that arrangements for supervising the activity can be made accordingly by the manufacturer (However, the travel, lodging and boarding expenses for each visit of the bidder's engineers shall be borne by the bidder).

5.0 BILL OF QUANTITY:

765/400kV AIS S/S Ariyalur

Sl. No.	Description	Unit	Quantity
1.	765kV, 3000A, 50kA/1 sec, 6 Core, 1-ph Current Transformer **(LOT-I)**	No.	60
2.	765kV, 3000A, 50kA/1 sec, 6 Core, 1-ph Current Transformer **(LOT-II)**	No.	6
3.	Supervision of Erection for Sl. No. 1 above **(LOT-I)**	Lot	1
4.	Supervision of Erection for Sl. No. 2 above **(LOT-II)**	Lot	1
5.	Supervision of Testing (or Pre-commissioning) for Sl. No. 1 above **(LOT-I)**	Lot	1
6.	Supervision of Testing (or Pre-commissioning) for Sl. No. 2 above **(LOT-II)**	Lot	1
7.	Supervision of Commissioning for Sl. No. 1 above **(LOT-I)**	Lot	1
8.	Supervision of Commissioning for Sl. No. 2 above **(LOT-II)**	Lot	1

Note:

1. The Quantity is subject to change by ±20%.
2. Hardware (Nut, Bolts and Washers) for Mounting CT on structure – 1 set for each CT to be included by bidder in their offer.
3. BHEL shall procure support structure, terminal clamps & connectors and Junction Box separately.
4. Multiple visits are envisaged for each lot against Sl. No. 2, 3 and 4 above.
5. Items under Lot-II may not be ordered at all at contract stage.

6.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

a. All equipment being supplied shall conform to type tests and special tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under Clause 12.1 to 12.5 of section-2.

b. The reports for all type tests as per technical specification shall be furnished by the bidder along with equipment / material drawings. However, type test reports of similar equipments/ material already accepted in TANTRANSCO shall be applicable for all project with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO/IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by TANTRANSCO or representative authorized by TANTRANSCO or Utility or representative of accredited test lab or reputed consultant.

The test reports submitted shall be of the tests conducted within last 5 (five) years prior to 30.09.2016. In case the test reports are of the test conducted earlier than 5 (five) years prior to 30.09.2016, the bidder shall repeat these test(s) at no extra cost to BHEL. In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser. The supplier shall intimate BHEL/TANTRANSCO the detailed program about the tests at least two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

In case type tests are to be conducted /repeated and deputation of Inspectors/Purchasers representative is required, then all expenses shall be borne by Bidder.

7.0 SPECIAL TOOLS AND TACKLES:

The bidder shall include in his proposal the deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of the equipment. The **Special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature.** A list of all such devices shall be furnished. In addition to this the bidder shall also furnish a list of special tools and tackles required to be used during the operation of the equipment.

8.0 DEVIATIONS:

The bidder shall list out all the deviations from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

9.0 A legally enforceable undertaking shall be furnished by the L-1 Bidder to guarantee quality, timely supply and performance of the 765 kV Current Transformers and that Erection, testing and commissioning of 765kV class Current Transformers shall be carried out under the supervision of 765kV Current Transformers manufacturer.

SECTION - 2

OUT DOOR CURRENT TRANSFORMERS

1.0 SCOPE: EQUIPMENT SPECIFICATION

1.1 This scope covers for design, manufacture, inspection, testing before dispatch, packing and delivery F.O.R (Destination) of 800 KV ~~and 420KV~~ Outdoor Current 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~~.

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 judgement, is not in full accordance therewith.

2.0 STANDARDS:

2.1 Unless otherwise specified elsewhere in this specifications, 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 above.
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.	IEC:60185	Current Transformers
09.	IEC:60060	High Voltage testing techniques
10.	IEC :60071	Insulation co-ordination
11.	IEC:60044(4)	Instrument transformer measurement of P.Ds
12.	IEC:60270	Partial discharge measurement
13.	IEC:8263	Method for RIV test on high voltage insulators.
14.	IEC:60044-1	Current Transformers
15.	IEC-61869	Instrument Transformers.

Besides the above, the standard minimum safety clearances stipulated in IE Rules 1956 shall also be complied with and the relevant latest 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 800 KV CURRENT TRANSFORMERS:

Sl. No	Item	800 KV CT
01	Type of CT/Installation	Single Phase, Dead/Live tank, oil filled/ SF6 gas 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	800 KV (rms)
	Number of CT secondary	6 Nos.
	Number of cores per CT	6 Nos.
05	Current ratio A/A	(a) Core 1 & 2 – 3000-2000-1000/1A (b)Core3& 4 – 3000-2000-1000-500/1A (c) Core 5&6- 3000-2000-1000/1A
06	Ratio Taps	On Secondary side.
07	Method of Earthing system where the Current Transformer will be installed.	Solidly earthed.
08	Rated continuous thermal Current (A).	120% for higher two ratio taps and 200% for lower ratio taps.
09.	Acceptable limit of temperature rise above the specified ambient temperature for continuous operation at rated Current.	As per IS- 2705.
10.	Acceptable partial discharge level at 1.2 Um /root 3	Less than 5 pico coulombs.
11.	Max. Radio interference voltage at 1.1 times the maximum rated Voltage/Root 3	2500 micro Volts.

12.	1.2/50 micro second Lightning Impulse withstand Voltage (KV peak) Dry.	2100
13	Switching impulse withstand voltage(250/2500 micro second)KV	1550
14.	1 minute power frequency withstand voltage on primary (Dry) KV(rms)	970
15.	Power frequency over voltage withstand requirement for secondary winding(KV rms) for 1 min.	5
16.	Min. creepage distance of porcelain housing (mm).	20000
17.	Rated short time withstand Current for 1 second duration(KA rms).	50
18.	Rated dynamic withstand Current (KA peak)	125
19.	Visual corona extinction voltage (KV RMS)	508
20.	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.
21.	Seismic acceleration(Horizontal)	0.3g.
22.	Maximum dielectric dissipation factor at Um/root3	~~0.002~~ AS PER RELEVANT IS/IEC
23.	Primary to earth insulation resistance at 30^0 C	Min 20,000 M ohms
24.	Cantilever strength Kg	500

B) 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	420 KV (rms)
	Number of CT secondary	6 Nos.

	Number of cores per CT	6
05	Current ratio A/A	(b) Core 1 & 2 – 3000-2000-1000/1A (b)Core3 &4– 3000-2000-1000–500/1A (c) Core 5 & 6 - 3000-2000-1000/1A
06	Ratio Taps	On Secondary side.
07	Method of Earthing system where the Current Transformer will be installed.	Solidly earthed.
08	Rated continuous thermal Current (A).	120% for higher two ratio taps and 200% for lower ratio taps.
09.	Acceptable limit of temperature rise above the specified ambient temperature for continuous operation at rated Current.	As per IS- 2705.
10.	Acceptable partial discharge level at 1.2 Um /root 3	Less than 5 pico coulombs.
11.	Max. Radio interference voltage at 1.1 times the maximum rated Voltage/Root 3	2500 micro Volts.
12.	1.2/50 micro second Lightning Impulse withstand Voltage (KV peak) Dry.	1425
13.	Switching impulse withstand voltage(250/2500 micro second)KV	1050
14.	1 minute power frequency withstand voltage on primary (Dry) KV(rms)	630
15.	Power frequency over voltage withstand requirement for secondary winding(KV rms) for 1 min.	3
16.	Min. creepage distance of porcelain housing (mm).	10500
17.	Rated short time withstand Current for 1 second duration(KA rms).	63
18.	Rated dynamic withstand Current (KA peak)	157.5
19.	Visual corona extinction voltage (KV RMS)	320
20.	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.

21.	Seismic acceleration(Horizontal)	0.3g.
22.	Maximum dielectric dissipation factor at Um/root3	0.002
23.	Primary to earth insulation resistance at 30^0 C	Min 20,000 M ohms
24.	Cantilever strength Kg	500

B. **PRINCIPAL TECHNICAL PARAMETERS OF 800 KV C T**

3.2 CORE WISE DETAILS OF CURRENT TRANSFORMERS:

(A) REQUIREMENT FOR 800 KV CTs (3000-2000-1000-500/1-1-1-1-1-1A)

No. of cores	core No	Application	Current Ratio	Output Burden (VA)	Accuracy class as per IEC-60044-1	Min. Knee point voltage (VK) (Volts)	Max. CT.sec. winding resistance (ohms)	Max. Exciting current @ Knee point voltage Vk (mA)	Remarks
6	1	Main-I Protection /Transformer Backup protection	3000/ 2000/ 1000/ 1A	---	PS	3000/ 2000/ 1000	15/ 10/ 5	20mA on 3000/1 Tap 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 3 cores shall be fixed on the other side/ ALL 6 CORES TO BE PLACED ON ONE SIDE
	2	Main-II Protection / Transformer Differential 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	
	3	Metering Main	3000/ 2000/ 1000/ 500/1A	20 20 20 20	0.2S 0.2S 0.2S 0.2S	N.A		N.A.	
	4	Metering Main	3000/ 2000/ 1000/ 500/1A	20 20 20 20	0.2S 0.2S 0.2S 0.2S	N.A		N.A.	
	5	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 1000/1 Tap	
	6	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.

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

No. of Cores	Core No.	Application	Current Ratio	Output Burden (VA)	Accuracy class as per IEC-60044-1	Min. Knee point voltage (VK) (Volts)	Max. CT.sec. winding resistance (ohms)	Max. Exciting current @ Kneepoint voltage Vk (mA)	Remarks

6	1	Main-I Protection /Transformer Backup 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 / Transformer Differential 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	
	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	Metering Main	3000/ 2000/ 1000/ 500/1A	20 20 20 20	0.2 0.2 0.2 0.2	N.A		N.A.	
	5	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 1000/1 Tap	
	6	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:

4.1 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 equipotential 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.

(c) 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.

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

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

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

(g) For 765/~~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

(h) For 765/~~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.

(i) 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.

(j) For 765 kV CTs the instrument security factor at all ratios shall be less than ten (10) for metering cores ~~and 420 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core~~.

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

(l) Suitable for mounting lattice support structure ~~to be supplied along with the Current Transformers~~

(m) 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.

(n) 765/~~420~~ kV Current Transformers shall be suitable for high speed auto reclosing.

4.2. 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.

4.3. 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,

* POLYMER INSULATOR IS ALSO ACCEPTED.

glazing of porcelain shall be of uniform brown or dark brown colour 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 .

4.4. 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.

4.5. 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 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.

4.6. 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.

4.7. CORE:

(a) 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.

4.8. INSULATING MEDIUM (OIL/ SF6 Gas)

A) Insulating oil/SF6 gas required for first filling of the CT shall be covered in Bidder's scope of supply. The oil/ SF6 gas shall meet the requirements of latest edition of IS/IEC.

4.9 PREVENTION OF OIL LEAKAGES AND ENTRY OF MOISTURE:

4.9.1 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.

4.9.2 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.

4.9.3 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.

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

4.10 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.

4.11. 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.

4.12. 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.

4.13. 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.

4.14. TERMINAL CONNECTOR (NOT IN BIDDER'S SCOPE OF SUPPLY)

The Terminal Connectors (TC) required for connection of the Current Transformer is 4.5" Aluminium bus bar for 800KV CT ~~and 4" Aluminium bus bar for 420 KV CT.~~

4.14.1 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 16mm 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 provided.

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

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

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

4.15. 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.

4.16. 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 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	 90 100 120 100 130	 40 50 70 50 80

	Class-B: In Air	100	50
	In oil		
		155	105
	Class-F: In Air	100	50
	In oil	100	50
	Enamel : oil base	120	70
	Synthetic, in air	100	50
	Synthetic, in oil		
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 shallbeused, rubberdiaphragms 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 multicore 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 designations on the relevant wiring diagram. The terminals shall be rated for not less than 10 amps.

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.

5.4. 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.

5.5. The C.T. shall be provided with a rating plate with dimensions and markings as per I.S : 2705. The markings shall be punched and not painted.

5.6. 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 despatching 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 $\frac{10}{5}$. 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 $\frac{10}{5}$ 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 aluminium 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.

* ALUMINIUM PRIMARY WINDING IS ALSO ACCEPTED.

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 60 milli amps at lowest tap. 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 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 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:

12.1The 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.

In case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to ~~the originally schcduled date of bid opening~~ 30/09/2016 :

i) Lightning Impulse Test
ii) Switching Impulse Test
iii) Multiple Chopped Impulse Test (For CT)
~~iv) Chopped Impulse Test (For CVT)~~

The above type test should have been conducted within 5 years as on ~~the~~ 30/09/16 ~~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.

(i) 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 programme 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 800/~~420~~ KV Current Transformers shall be as follows :-

(1) Short time current test.
(2) Temperature rise test.
(3) Lightning Impulse Voltage Test.
(4) Wet Test for outdoor type Current Transformers (as per clause 7.4 of IEC 44.1).
(5) 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 submiited along with offer.

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

(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) Interturn voltage test as per clause 8.4 of (IEC 44-1).

(vi) Determination of errors.

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 despatched 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.

(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.

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.

(a) General outline and assembly drawings of the equipment.

(b) Graphs showing other performance of equipments in regard to magnetization characteristics.

(c) 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.,

(d) Schematic drawing.

(e) Type test reports.

(f) 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.

16.0. 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.

17.0. JUNCTION BOXES (NOT IN BIDDER'S SCOPE OF SUPPLY) !

Absolutely vermin proof fabricated from MS sheet of thickness 3mm minimum Junction boxes with IP 55 Degree of protection are to be supplied one each along with a set of 3(three) numbers Current Transformers. Boxes have to be provided with belt / rubber beadings and doors opening with wing nuts for lockings.

It should be Hot dip galvanized. It should be provided with stud type terminal blocks with lock nuts and washers. Boxes should have necessary provision with cable glands for connecting 20 Nos. 4 Sq. mm, 4 core cables 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 spaces for easy wiring and using testing instruments such as tong test milli ammeters. Provision to be made for double earthing arrangement by through bolts from inside to outside.

** ** **

winding of singlephase spare shunt reactors can be disconnected or connected to either of the three phase banks unless approved otherwise. All material like Bus post insulator, Aluminium tube, conductor, clamps & connectors, earthing materials, support structure, hardware etc required for neutral formation and connection with neutral CT and earthing of neutral shall be provided by contractor.

2.Reactor Oil

The insulating oil, to be used and supplied with the Reactor, shall be of EHV grade conforming to IS:335 of latest issue. No inhibitors shall be used in the oil.

V.~~SECTION 05~~(CURRENT TRANSFORMER):

1. Placement of secondary Core in one side in the design of CT: accepted for 765KV only provided the type test reports shall be submitted for the same design.

2. CT insulator: In respect of 765KV,Polymer insulator can also be accepted only on submission of relevant type test certificates and successful performance certificate from the end user.

3.Aluminium/copper primary winding accepted for 765KV CT only provided the type test results are submitted for the same design.

~~VI.SECTION 06(SURGE ARRESTORS)~~:

1. LA insulator: In respect of 765KV,Polymer insulator can also be accepted only on submission of relevant type test certificates and successful performance certificate from the end user.

VII.SECTION 08(ISOLATORS):

1.Isolater Terminal Pads

a)As per specification for 400 KV isolators.

b)For 765KV isolators all current carrying parts shall be made from high conductivity electrolytic copper/aluminium.

2. For 800 & 420 KV AB Switches each phase shall be suitable for both manual & Electrical operation. Manual operation by individually and ganged electrically.

3.Isolater Blade/Arm: Shall be made from high conductivity electrolytic copper/ aluminium.

SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 FOREWORD

The provisions under this section are intended to supplement general requirements for the materials, equipment's 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 : 765/400KV AIS SUB STATION AT ARIYALUR

c) Transport facilities : Road/Rail

Physical and other parameters:

3.1.1 Location of the substation

3.1.2 Nearest Railway station : Tindivanam
Railway : Southern Railway

3.1.3 Meteorological data

(i)	Atmosphere	: Polluted
(ii)	Maximum ambient temperature	: 50°C
(iii)	Minimum ambient temperature	: 20°C
(iv)	Maximum daily average ambient air temperature	: 45° C
(v)	Maximum yearly average ambient air temperature	: 32° C
(vi)	Maximum Humidity (%)	: 100%
(vii)	Average thunder storm days per annum	: 50
(viii)	Average rainy days per annum	: 65
(ix)	Average annual rainfall (mm)	: 750 mm
(x)	No. of months during which tropical monsoon condition prevail	: 3
(xi)	Maximum wind pressure	: 150 Kgf/Sqmm
(xii)	Altitude above MSL	: <1000M

(xiii) Basic Wind Speed : **47 m/s (Zone -4)**

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

3.1.4 System Parameter

SL No	Description of parameters	765kV System	400 kV System
1.	System operating Voltage	765kV	400k V
2.	Maximum operating voltage of the system(rms)	800kV	420k V
3.	Rated Frequency	50HZ	50H
4.	Number of Phases	3	3
5.	Rated Insulation Levels (i)Full wave impulse withstand voltage.(1.2 to 50 micro sec) (ii)Switching impulse withstand voltage(250/2500 micro sec) dry and wet. (iii) One minute power frequency dry withstand voltage (rms)frequency dry withstand voltage (rms)	 2100kVp 1550kVp 830kV	 1550kVp 1050kVp 630kV
6.	Corona extinction voltage	508kV	320kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV,and 266kV rms for 400kV system	2500 microvolts	1000 microvolts
8.	Minimum creepage distance (25mm/kV)	20000 mm	10500 mm
9.	Rated short circuit current for 1 sec. Duration	50kA	63kA
10.	System neutral earthing	Effectively earthed	Effectively earthed
11.	Seismic acceleration	0.3g horizontal	0.3g horizontal
12.	Plinth level of switchyard	500mm above FGL	500mm above FGL

3.1.5 AUXILIARY POWER SUPPLY :

Auxiliary electrical equipment's maintenance equipment's etc., shall be suitable for operation on the following supply system.

3 phase AC Supply	415V, 3 phase 4 wire 50 Hz, neutral grounded AC supply -10% to +10%, frequency +/- 5%
1 phase AC supply	240V, single phase, 50 Hz neutral grounded AC supply
DC supply	220, 2 wire DC supply + 10% to –15%, Ungrounded 48V, 2 wire DC supply , Positively earthed

3.2 GENERAL REQUIREMENT

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

3.2.1 The bidder shall also furnish drawings for the following:

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

3.2.2 **GENERAL**:

The bidder 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.

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

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/equipment is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

The bidders are requested to procure the equipment's/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

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

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

3.4 STANDARD:

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

The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the date of bid opening) of standards specified in each section.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other.
The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the Specification shall take precedence.

3.5 TYPE TEST:

The Type Test for all the 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 Ten years, subject to no change in design as on the originally scheduled date of technical bid opening i.e. **30.09.2016**

In case the type tests were conducted earlier than 10 (ten) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test (s) at no extra cost to the purchaser.

However, in case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to the originally scheduled date of bid opening.
i) Lightning Impulse Test
ii) Switching Impulse Test
iii) Multiple Chopped Impulse Test (For CT)
iv) Chopped Impulse Test (For CVT)
In case the test reports are of these tests (for instrument transformers) asmentioned above are conducted earlier than 5 (five) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test(s) at no extra cost to the BHEL. The original type test certificates shall be furnished for verification on request.
TANTRANSCO/BHEL reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative at no extra cost.
Non furnishing of type test certificates by the tenderers, will be liable for rejection.

3.6 MATERIALS AND WORKMANSHIP:

All the materials shall be of the best class and capable of satisfactory operation in the tropics with humid atmosphere conditions. Unless otherwise specified, they shall conform to the requirements of the appropriate ISS/IEC. The workmanship shall be of the best grade and the entire construction in accordance with the best modern practice.

The equipment shall be designed to facilitate inspection and repairs and to ensure satisfactory operation under atmosphere condition prevailing at site and under such sudden variation of load and voltage as may be met with under working conditions in the system including those due to faulty synchronizing and short circuit within the rating of the apparatus.

The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment.

All the equipment's should operate without undue vibration and with the least practicable amount of noise.

3.7 INSPECTION:

The inspection may be carried out by the TANTRANSCO/BHEL at any stage of manufacture. The supplier shall grant free access to TANTRANSCO's/BHEL representative at a reasonable time when the work is in progress. The TANTRANSCO/BHEL shall have access at all times to the works and all other places of manufacture/fabrication, where the equipments are being manufactured/fabricated and the bidder shall provide TANTRANSCO's/BHEL representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

Inspection and acceptance of any equipment under this specification by the TANTRANSCO/BHEL shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the TANTRANSCO/BHEL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The TANTRANSCO/BHEL, reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

The correct grade and quality of steel shall be used by the supplier. To ascertain quality of steel, the TANTRANSCO/BHEL may at his discretion get the material tested at an approved laboratory.

The bidder shall take an account the fabrication wastage while quoting the rates. The Employer will not accept any liability in connection with the wastage of steel during fabrication or otherwise. Steel shall be procured exclusively from the main producers. However, sections not rolled by main produces can be procured from reroller, provided rerolling of structural steel section is done rom billets/ingots of tested quality. Rerolled sections are duly tested as per relevant standards. Supplier should obtain approval of list of primary producers of Steel and Zinc before Proto assembly.

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.

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:

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.

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.

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 equipment's and before charging each item of equipment's 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 equipment's in the presence of BHEL/ TANTRANSCO. Necessary tools, testing kits to be arranged by the Supplier.

3.10 DOCUMENTATION : 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.I. units.

3.11 PAINTING, GALVANISING:

All interiors and exteriors of all metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter and the surfaces treated by phosphating (e.g. seven tank phosphating sequences).

All metal surfaces exposed to atmosphere shall be given, in addition to the treatment, 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 limits specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external paintings shall be as per shade **No.697/631 of IS-5**.

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 several service conditions.

All ferrous parts including all sizes of nuts, bolts, support channel structures, etc. as also the mechanism housing shall be hot dip galvanized conforming to latest version of IS : 2629 or epoxy painted. Spring washers shall be electro-galvanised.

All members of the structure members shall be hot dipped galvanised with a zinc coating of **610 gms. per square metre** . Galvanising shall be done after a work is completed, except that the nuts may be tapped or rerun after galvanization. The zinc coating shall be smooth, clean, of uniform thickness and free from defects. The preparation for galvanising itself shall not adversely affect the mechanical properties of the coated materials. The employer shall be at liberty to have the samples of zinc used, test checked in any laboratory at his own cost and reject the particular supply if it is below standard.

All galvanised material shall withstand test as per IS 2633-1972 or any other equivalent standard.The zinc used for galvanising fabricated material shall be of high grade Electrolytic zinc of 99.99% purity.

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 610gm of zinc per square meter of surface. The zinc coating shall be smooth, of uniform thickness and free from defects.

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 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-I). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.16 RATING PLATES, NAME PLATES AND LABELS:-

The equipment's shall be provided with a rating plate or plates marked with but not limited to following data whatever needs to that particular equipment's.

(a) Manufacturer's name or trade mark.
(b) Serial number and type design making it possible to get all relevant information from the manufacturer.
(c) Year of manufacture.
(d) Rated voltage
(e) Rated insulation level.
(f) Rated frequency
(g) Rated Normal current.
(h) Rated short circuit breaking current
(i) First pole to clear factor
(j) Rated duration of short circuit
(k) Rated auxiliary D.C. supply voltage of closing and opening devices.
(l) Rated pressure of SF6 gas for operation and interruption.
(m) Rated out of phase breaking current.
(n) Rated supply voltage of auxiliary circuit.
(o) Rated supply frequency of auxiliary circuits.
(p) Purchase Order Number and Date.

The rating plate shall be visible in position of normal service and installation.
The rating plate shall be weather proof and corrosion proof.

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/labels shall also be submitted.

3.17 EARTHING:

The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate earthing terminals suitable for bolted connection to 50x8mm mild steel flat to be provided for connection to station earth mat.

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat of Size 75X12 mm. 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.

3.18 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 drawing approval stage.

3.19 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 2.0 mm thick cold rolled or 2.5 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 /EPDM 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 at least 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.20 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.

3.21 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.

3.22 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.

3.23 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.

3.24 LIST OF DRAWINGS AND DOCUMENTS :

The drawings for the equipments provided by the TANTRANSCO shall be followed strictly by the bidder while designing. For the rest of the equipments, the design is in the scope of the bidder and the same got approved by the TANTRANSCO.

The bidder shall furnish One sets of relevant descriptive and illustrative published literature pamphlets and the following drawings/documents for preliminary study along with the offer.

(i) General outline drawings showing dimensions and shipping weights, quantity of insulating media, etc.

(ii) Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts with lifting dimensions for maintenance.
(iii) Schematic diagrams of breaker offered for control supervision and re- closing.
(iv) Structural drawing, design calculations and loading data for support structures.
(v) Foundation drilling plan and loading data for foundation design.
(vi) The Type Test Reports
(vii) Bill of materials shall be furnished along with drawings.

The supplier shall, within 1 weeks of placement of order submit six sets of final version of all the above drawings for BHEL/TANTRANSCO's approval. The TANTRANSCO shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for TANTRANSCO's approval within two weeks from the date of comments.. However the drawing approval does not absolve the supplier from complying with the terms of the specification.

The following should be supplied to each consignee circle along with the initial supply of equipment's ordered.

1) Five copies of printed and bound volumes of operation, maintenance and erection manual in English along with the copies of approved drawings and type test reports etc.
2) Three sets of manuals detailed in item (1) shall be supplied to the TANTRANSCO/BHEL within one week from the date of approval of drawings.
3) The spares for the Equipment's ordered under the scope of the Contract should also be supplied to the consignee circle along with initial supply of the breakers.
4) It should be noted that if the above conditions are not fulfilled the initial payment will not be released.

3.25 **QUALITY ASSURANCE PLAN:**

The bidder shall invariably furnish following information along with his offer. (i) Statement giving list of important raw materials including but not limited to:

(a) Contact material
(b) Insulation
(c) Porcelain
(d) Sealing material
(e) Contactor, limit switches, etc. in control cabinet.

Name of sub-supplier for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative, copies of test certificates.

(ii) Information and copies of test certificates as in
(i) above in respect of bought out accessories.
(iii) List of areas in manufacturing
process, where such inspections are normally carried out for quality control and details of such tests and inspections.
(iv) Special features provided in the equipment to make it maintenance free.
(v) List of testing equipment available with the Bidder for final testing of breakers vis-à-vis, the type, special, acceptance and routine tests specified in
the relevant standards. These limitations shall be very clearly brought out in the relevant schedule i.e. schedule of deviations from specified test requirements.

The supplier shall submit following information to the TANTRANSCO.

1) List of raw materials as well bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
2) Type test certificates of the raw material and bought out accessories.
3) Quality assurance plan (QAP) withhold points for TANTRANSCO inspection. The quality assurance plan and hold point shall be discussed between the employer and supplier before the QAP is finalized.
The supplier shall submit the routine test certificates of bought out items and raw material, at the time of routine testing of the fully assembled breaker.

3.26 **TEMPERATURE RISE :**

The maximum temperature attained by any part of the equipment when in service at site under continuous full load conditions and exposed to the direct rays of the sun shall not exceed 30 deg. Cover an ambient of 50 deg. C limits specified in relevant IEC. When the standard specify the limit of temperature rise these shall be exceeded when corrected for the difference between ambient temperature at site and that specified in the approved specifications. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

3.27 **FITTINGS AND ACCESSORIES :**

Following is a partial list of some of the major fittings and accessories to be furnished by contractor as an integral part of the equipment.
Operation mechanism housing complete with:
(a)Locking arrangement.
(b)Heaters equipped with automatic thermostatic control and control switch. (c) Cable glands.
(d) Local/Remote change over switch.
(e) Operation Counter.
(f) Terminal Blocks.
(g) Control switches to cut off control power supply.
(h) MCCBs/MCBs are required with permanent identification marks for protection of D.C. circuits and A.C. circuits.
(i)Two earthing terminals.

3.28 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.

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.

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.

3.29 SPECIFICATION FOR NITRYL BUTYL RUBBER

The gaskets are to be used in tanks exposed to Transformer mineral oil/SF6 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)

3.30 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 BHEL/TANTRANSCO. 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 BHEL/TANTRANSCO 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 below mention Title block for Submission of Documents.

Title Block

Customer	**M/s Tamil Nadu Transmission Corporation Limited**
Project:	**765/400KV Air Insulated substation Ariyalur**
Contractor	**BHEL**

3.31 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER
Drawings, GTP, Type Test Reports and List of Past Supplies. Drawings & Documents

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

3.31 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.

SECTION-4

GUARANTEED TECHNICAL PARTICULARS

CURRENT TRANSFORMER

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

SECTION-4

GUARANTEED TECHNICAL PARTICULARS

18.	Secondary data	18.	
a)	Secondary resistance at different taps.	a)	
b)	Oversize factor and transient error under CO-t-CO duty condition of fault (100 ms)	b)	
19.	Maximum exciting current	19.	
a)	100% Kpv (mA)		
b)	25% kpv (mA)		
c)	20% kpv (mA)		
d)	10% kpv (mA)		
20.	Instrument security factor at different ratios	20.	
21.	Radio interference voltage at 1.1 Ur/(SQRT 3) at 1.0 MHz (micro volts)	21.	
22.	Whether auxiliary CT/reactors provided for metering winding.	22.	
23.	Conona extinction voltage (KV rms)	23.	
24.	Partial discharge level (pico coulumbs)	24.	
25.	Total creepage distance (mm)	25.	
26.	Primary	26.	
a)	No. of primary turms	a)	
b)	Material and cross section of primary (cm^2)	b)	
c)	Whther bar type or ring type primary	c)	
27.	Whether CT is suitable for transportation horizontally	27.	

SECTION-4

GUARANTEED TECHNICAL PARTICULARS

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

SECTION-4

GUARANTEED TECHNICAL PARTICULARS

37.	Dimensional details	37.	
	I) Overall height from mounting plane		I)
	ii) Height up to terminals from mounting plane		ii)
	iii) Mounting dimensions & diameter of mounting holes		
	iv) Terminal pad diameter and length		iv)
	v) Material of terminal pad		v)
	vi) Diameter of insulator at		vi)
	a) Top end		a)
	b) Bottom end		b)
38.	Temperature rise over an ambient temp. of 50° C (°C)	38.	
39.	Transient over voltage withstand for	39.	
	a) 30 seconds (KV peak)		a)
	b) 1 minute (KV peak)		b)
40.	Whether CT chartercteristic curves enclosed		40.
41.	Details of recommended support structure enclosed		41.
42.	Drawing showing clearance from earthed objects enclosed		42.
43.	Type test reports as per IEC enclosed		43.
44.	OGA drawing enclosed		44.
45.	Details of spark gap provided at the primary or secondary enclosed		45.

SECTION – 5

CHECK LIST FOR 765kV CURRENT TRANSFORMER

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

Sl. No.	Parameters	Data	YES/NO	Remarks
1	Manufacturer's type designation	Bidder to furnish in Remarks Col.		
2	Type of CT			
	a) Insulation (As per clause 4.8 of section-2)	i. SF6	YES/NO	
		ii. Oil	YES/NO	
	b) Installation	Outdoor	YES/NO	
	c) Mounting	Upright	YES/NO	
	d) Tank design	i. Live tank	YES/NO	
		ii. Dead tank	YES/NO	
3	Standards Applicable	IEC 61869, IEC 60044-1, IEC-60044-4, IS-2705-(P1 to P4), ANSI-C5713	YES/NO	
4	Rated Voltage (kV rms)	765kV	YES/NO	
5	Rated Primary Current	3000A	YES/NO	
6	Rated short time withstand current	50kA rms/1sec	YES/NO	
7	Rated dynamic withstand current	125kA peak	YES/NO	
8	Max. Temperature rise over design ambient temperature	As per Clause 4.16 of Section-2	YES/NO	
9	One minute power frequency withstand voltage - Secondary Terminal and Earth	5kV	YES/NO	
10	Cantilever Strength	Not less than 500 Kg	YES/NO	

Sl. No.	Parameters	Data	YES/NO	Remarks
11	Class of Insulation	A	YES/NO	
12	Core parameters	As per clause 3.2 A) of Section-2	YES/NO	
13	**External Surface**			
	Steel	i) Hot dip galvanized As per Section-3	YES/NO	
		ii) Painted As per Section-3	YES/NO	
14	**Insulator /Bushing**			
	a. Material			
	i. Shedded Polymer insulator		YES/NO	
	ii. Shedded Porcelain insulator	CT conforms to the internal arc fault test (internal fault protection class-2), as a special test as per IEC-61869, with at least 40 kA internal arc fault current	YES/NO	
	b. One piece construction without any metallic flange joint		YES/NO	
15	**Specific requirements for Oil/SF6 CT's**			
	a. Oil filled CT's:			
	i. Grade of oil	EHV grade	YES/NO	
	ii. Standard to which oil conforms	IS-335 / IEC-60296	YES/NO	
	iii. Oil filling and drain plug provided.		YES/NO	
	iv. Oil sight glass provided		YES/NO	

Sl. No.	Parameters	Data	YES/NO	Remarks
15	b. SF6 filled CT's:			
	i. Standard to which gas conforms	IEC-60376/60376A/60376B	YES/NO	
	ii. Suitable SF6 gas density monitoring device		YES/NO	
	iii. NO/NC contacts available in SF6 gas density monitoring device for remote annunciation and tripping in case of SF_6 leakage		YES/NO	
	iv. Provision for online gas filling		YES/NO	
	v. Suitable rupture disc provided to prevent explosion.		YES/NO	
16	**Hermetic Sealing**			
	a. Hermetically Sealed		YES/NO	
	b. Details of arrangement made for Hermetical sealing of the CT's are available and shall be furnished for approval at contract stage.		YES/NO	
	c. Details of Site test to check the effectiveness of the hermetic Sealing are available and shall be furnished for approval at contract stage.		YES/NO	
17	Polarity of CT permanently marked		YES/NO	
18	**Impregnation details along with Test/Checks** : to ensure successful completion of impregnation cycle are available and shall be furnished for approval at contract stage		YES/NO	

Sl. No.	Parameters	Data	YES/NO	Remarks
19	Name Plate			
	As per IEC standards, and shall clearly indicate Year of manufacture, Rated current, Extended current rating & rated thermal current		YES/NO	
20	Terminal Box - Ingress Protection	IP 55	YES/NO	
21	In case of "Bar primary" inverted type CT	The CT conforms to the additional requirements specified under 4.1 a) of Section-2, Clauses .i), ii), iii), iv), v)	YES/NO	
22	Rated extended current	As per 4.1 g) of Section-2	YES/NO	
23	Packing & Transportation			
	a. CT suitable for horizontal transportation.		YES/NO	
	b. Details of packing design shall be furnished for review at contract stage.		YES/NO	
24	CT suitable for mounting on lattice support structure		YES/NO	
25	CT suitable for High speed auto-reclosing		YES/NO	
26	Details of measures taken to achieve minimum risk of explosion of the CT in service is **attached along with this offer.**		YES/NO	
27	The CT manufacturer meets the **Qualifying Requirements** specified in Section-1, 3.0 of this Technical Specification.		YES/NO	
28	Valid Type test reports as per Section-2, Clause 12.0 shall be submitted at contract stage.		YES/NO	
29	The list of equipments required for conducting pre-commissioning test shall be submitted for approval during contract stage		YES/NO	

Sl. No.	Parameters	Data	YES/NO	Remarks
30	Confirmation to clause 6.0 of Section-1 pertaining to TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE		YES/NO	
31	List of Deviations if any, is attached along with offer		YES/NO	
32	List of all special tools and tackles as per Clause 7.0 of Section-1 of this technical Specification shall be furnished during Contract stage		YES/NO	
33	**Following Documents are attached along with the offer :**			
	a. Filled Checklist		YES/NO	
	b. Documents to support the qualifying requirements of the Equipment manufacturer as per clause 3.0 of Section-1 of this Technical Specification.		YES/NO	
34	Bidder to confirm if TANTRANSCO standard approved drawings/ Previous TANTRANSCO approval for the offered CTs are available	If Yes, bidder shall submit the TANTRANSCO approval letters along with offer	YES/NO	