



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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DOCUMENT No.	TB-399-316-015	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	JG	SS	SKS
TITLE CLMAPS & CONNECTORS				SIGN			
				DATE	11.10.22	11.10.22	11.10.22
				GROUP	TBEM		
CUSTOMER	TAMILNADU TRANSMISSION CORPORATION LIMITED (TANTRANSCO)						
PROJECTS	400/230-110 KV SUBSTATION AT VELLAVIDUTHI						

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
				Distribution	TBMM	TBQM	TBCM	TBTS
				Copies	1	-	-	-

SECTION - 1

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Clamps & Connectors to site.

The specification comprise of following sections:

- Section-1 : Scope, Bill of Quantities & Project specific technical requirements.
- Section-2 : Equipment Specification.
- Section-3 : General technical requirements for all equipment's under the Project.
- Section-4 : Equipment Data Sheet
- Section-5 : Check-list

In case of any discrepancies between the requirements mentioned under different Sections, order of precedence shall be in the same order as listed above.

No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer.

The equipment is required for the following project:

- Name of the Customer : TAMIL NADU TRANSMISSION CORPORATION LIMITED
(TANTRANSCO)
- Name of the Project : 400/230-110 kV Substation at Vellalaviduthi

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

Specific technical requirements like rated voltage, rated current, conductor details, tube details and type of connectors etc are given in enclosed Annexure-1 (Bill of Quantities). Other technical requirements for the connectors shall be as follows:

Sl No	Technical Particulars	420kV	245 kV	145 kV	11kV
1	Nominal system voltage	400kV	230 kV	110 kV	11kV
2	Highest system voltage	420kV	245 kV	145 kV	12kV
3	Current Rating	Shall be as per BOQ			
4	Short circuit current rating	63kA for 1sec	40 kA for 3sec	40kA for 3sec	25kA for 1sec
5	Frequency	50 Hz \pm 5%			
6	Full wave impulse withstand voltage (1.2/50 microsecond wave)	1425 kVp	1050 kVp	650 kVp	75 kVp
7	Switching impulse withstand voltage ((250/2500 micro sec.) dry & wet	1050 kVp	---	---	---

8	One minute power frequency dry withstand voltage (rms)	630 kV	---	---	---
9	One minute power frequency dry & wet withstand voltage (rms)	---	460 kV	275 kV	28 kV
10	Corona extinction voltage	320 kV	156 kV	105 kV	---
11	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	1000 microvolt at 320kV rms	1000 microvolt at 156kV rms	500 microvolt at 92kV rms	---
12	System Earthing	--- Effectively earthed ---			
13	Rated ambient temp. for design	50 deg C			
14	Spacing between sub-conductors of the bus	450mm	225mm	225mm	---
15	Maximum working tension a) Twin Conductor (Kg) b) Quad Conductor (Kg):	2000 4000	2000 4000	2000 4000	400 800
16	Applicable IS	IS 5561 with latest amendment			
17	Minimum thickness of any part of clamps and connector	12mm			
18	Minimum thickness of current carrying parts of clamps and connector	16mm			
19	Material				
A	Terminal Connector	A6 Aluminum Alloy and by pressure / gravity die cast only. Sand casted terminal connectors are not acceptable			
B	For connecting equipment terminals made of copper or brass with ACSR Conductor/Aluminium tube	Copper alloy liner of min 2mm thickness shall be cast intergral with aluminum body			
C	For connecting GI	Galvanised mild steel shield wire			
d	Bolts, nuts and plain washers	All nuts, bolts & washers shall be of Hot Dip Galvanised mild steel			
e	Spring washers for items 'a' to 'c'	Electro-galvanised mild steel suitable for at least service condition-3 as per IS:1573			

Conductor/Aluminium Tube Details -

1) 4" IPS Al Tube (Outer Dia. = 114.2 mm, Thickness = 8.51 mm, Tolerance in OD = +2.2/-0.0 mm, Tolerance in Thickness = +2.2/-0.0 mm)
2) 3" IPS Al Tube (Outer Dia. = 88.9 mm, Thickness = 7.62 mm, Tolerance in OD = +2.2/-0.0 mm, Tolerance in Thickness = +2.2/-0.0 mm)
3) ACSR Moose Conductor (Overall Dia. = 31.77 mm)
4) Spacing between sub conductors of the 400kV bus = 450 mm
5) Spacing between sub conductors of the 220kV bus = 225 mm
6) Bimetallic connectors shall be offered wherever dissimilar materials are coming into contact as detailed above.
7) Rigid/Expansion = Expansion type on one side and Rigid type on other side (with Tube break, continuity should be made by suitable arrangement and same shall be part of connector.

Note-1 - The equipment connectors suitable for Aluminium tube shall be of such design that projected part of Aluminium tube should be fully covered to avoid entry of birds inside Aluminium tube.

Note-2 - The exact terminal detail of equipment's (terminal type, material, fixing details) will be furnished during detailed engineering. Tentative details of equipment's terminal type are mentioned in Annexure-2.

Note-3 - Procedure of Corona & RIV Test (if conducted) shall be as per enclosed Annexure-A.

Note-4 - For Auto transformer, Reactor, Current transformer, Potential Transformer and Isolator, clamps and connectors shall be supplied in line with requirements of Section-1 and Annexure-3.

1.3 BILL OF QUANTITIES

The estimated quantities in the scope of supply are as per enclosed Annexure.

- 1) Annexure-1 - 400kV, 245kV & 145 kV Clamps & Connectors BOQ.
- 2) Annexure-2 - Terminal details (exact terminal details will be furnished after placement of order)

The scope of supply shall also include:

- i) All connector hardware along with bimetallic washers / strip/ liners as required.
- ii) All hardware required for connecting to the respective equipment terminals.
- iii) Minimum 5 % extra hardware and bimetallic washers/ strip/ liners of each type.
- iv) Anti - oxidation grease-as required.

Note: Quantities mentioned in enclosed Annexure are subject to $\pm 30\%$ variation.


1.4 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for approval. The type test reports submitted shall be of tests conducted within last 10 years prior to the date of technical bid opening i.e. 21.08.2017. The bidder should have conducted type test on identical or similar equipment/ components to those offered. If these tests have been conducted more than 10 years prior from the date of technical bid opening or type test reports are found to be technically unacceptable to BHEL/TANTRANSCO, the type test shall be conducted without cost and delivery implication to BHEL.

1.5 QUALITY PLAN

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

1.6 PROJECT TITLE BLOCK

CUSTOMER	TAMIL NADU TRANSMISSION CORPORATION LIMITED (TANTRANSCO)		
PROJECT	400/230-110 kV Substation at Vellalaviduthi		
CONTRACT NO	LOA No. CE/TR/SE/TR IV/EE3/AEE1/F.T-2004/LOA2966/D080/2018, dt. 28.06.2018		
BHEL P.O. No.	PROJ. DOC. No.		REV. No.
CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED		
<i>VENDOR'S STANDARD TITLE BLOCK</i>			

-- X X --

ANNEXURE-1

BOQ:

SL NO	ITEM DESCRIPTION	UNIT	QTY
1	CLAMP & CONNECTORS FOR CURRENT TRANSFORMER 420KV : Suitable for 4" (EH) IPS AL Tube rigid type(3150A)	NO	8
2	CLAMP & CONNECTORS FOR CURRENT TRANSFORMER 420KV : Suitable for 4" (EH) IPS AL Tube expansion type(3150A)	NO	8

Annexure-2

Terminal Pad Details for Equipments

Project: TANTRANSCO's 400/230-110 kV Substation at Vellalaviduthi

Sl.No.	Equipment Details	Make	Terminal pad material *	Terminal pad type
1	420 kV Circuit Breakers	-	Aluminium Alloy	Palm type
2	420 kV Isolator	-	Copper	Stud/Palm type
3	420 kV Bus Post Insulators	-	Hot dip galvanised cast iron	Cap type (4x127PCD)
4	420 kV CVT	BHEL	Tinned MS rod	100mm long, 30dia stud
5	420 kV Current Transformer	BHEL	Copper Silver plated	100mm long, 49.5dia twin/single stud
6	HV Bushing (400/230kV ICT & 400/110kV ICT)	BHEL	Brass	125mm long, 60dia stud
7	LV Bushing (400/230kV ICT & 400/110kV ICT)	BHEL	Brass	125mm long, 60dia stud
8	HV Bushing (80 MVAR Reactor)	BHEL	Brass	125mm long, 60dia stud
9	245 kV Circuit Breakers	-	Aluminium Alloy	Palm type
10	245 kV Isolator	-	Copper	Stud/Palm type
11	245 kV Bus Post Insulators	-	Hot dip galvanised cast iron	Cap type (4x127PCD)
12	245 kV PT	-	Copper Nickel plated	80mm long, 30dia stud
13	245 kV Current Transformer	BHEL	Tinned Copper	80mm long, 30dia stud
14	145 kV Circuit Breakers	-	Aluminium Alloy	Palm type
15	145 kV Isolator	-	Copper	Stud/Palm type
16	145 kV Bus Post Insulators	-	Hot dip galvanised cast iron	Cap type (4x127PCD)
17	145 kV PT	-	Brass Nickel plated	80mm long, 30dia stud
18	145 kV Current Transformer	BHEL	Tinned Copper	80mm long, 30dia stud

- Note:**
1. Terminal Pad Drawings and balance details for the equipments shall be furnished at Contract stage.
 2. The above details are tentative and are subject to variation depending upon finalisation of respective equipment supplier.

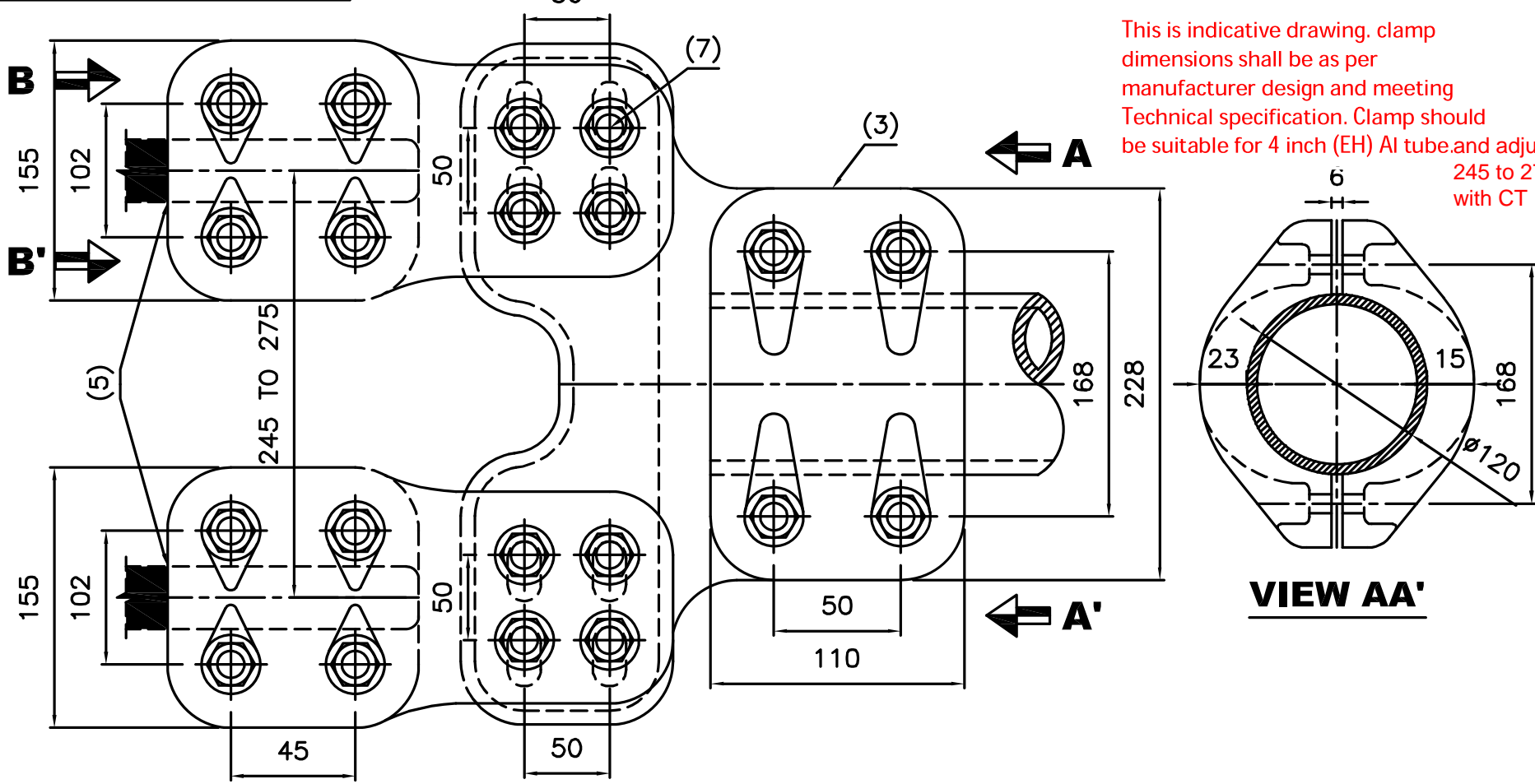
420KV CURRENT TRANSFORMER:

4.14. TERMINAL CONNECTOR:

The Terminal Connectors (TC) required for connection of the Current Transformer 4" Aluminium bus bar.

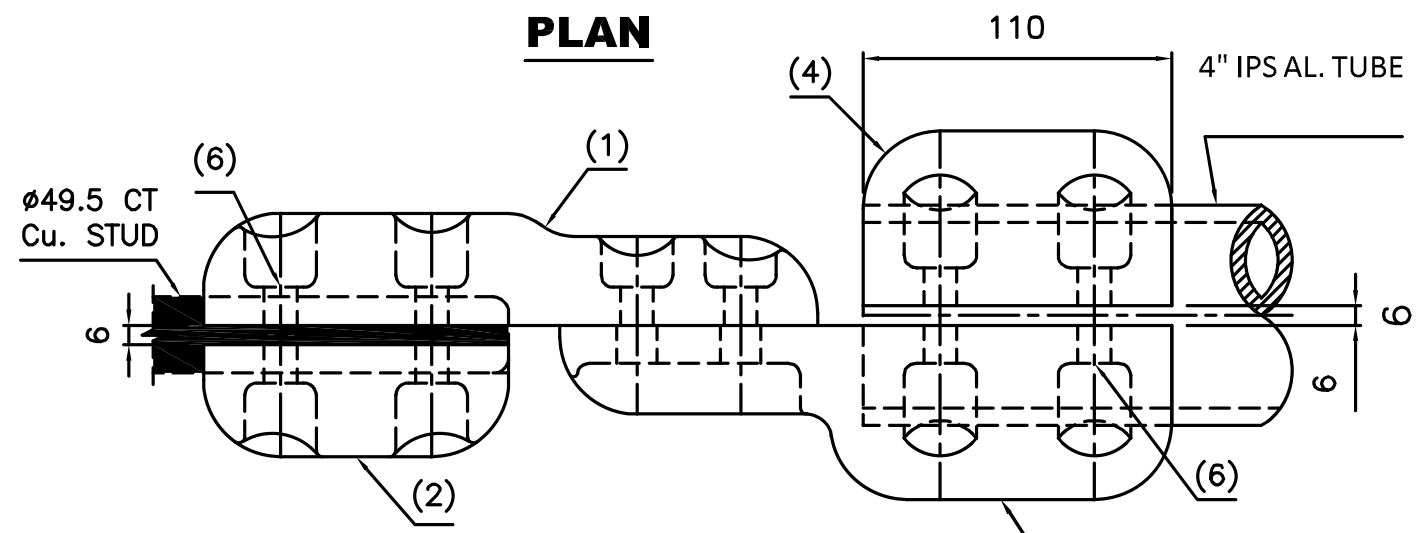
4.14.1 The Terminal Connectors shall meet the following requirements

- (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 off.



This is indicative drawing. clamp dimensions shall be as per manufacturer design and meeting Technical specification. Clamp should be suitable for 4 inch (EH) Al tube and adjustable between 245 to 275mm to match with CT

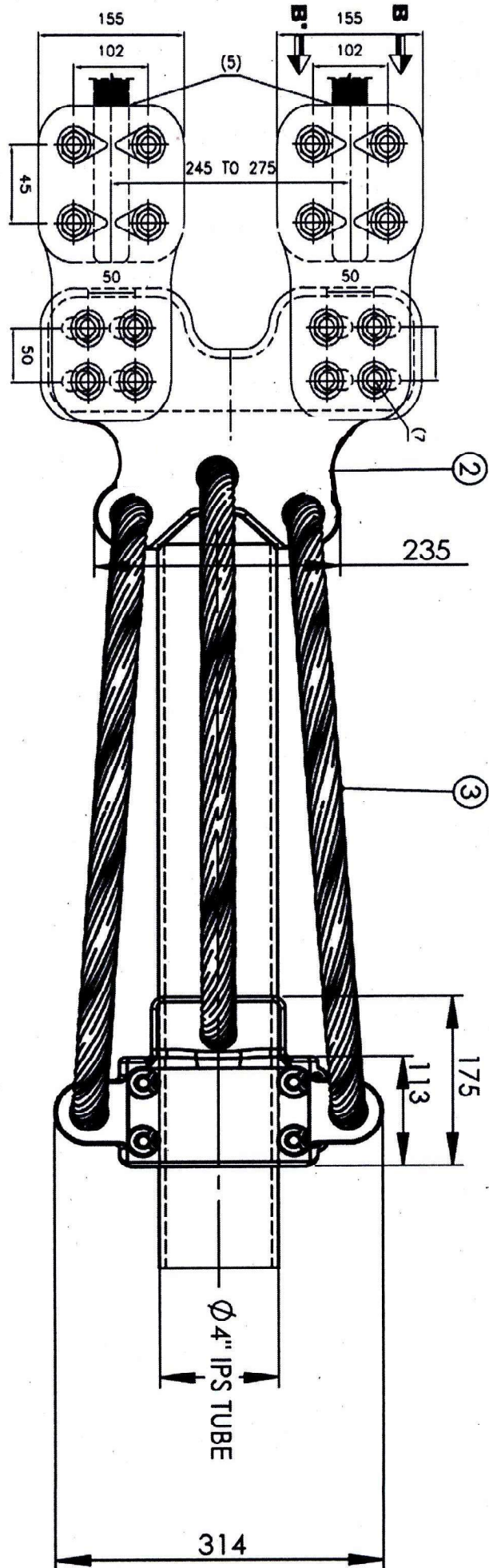
PLAN



ELEVATION

VIEW BB'

This is indicative drawing. Clamp dimensions shall be as per manufacturer design and meeting technical specification. clamp should be suitable for 4 inch (EH) al tube with adjustable between 245 to 275mm to match with CT stud.



420 kv,3150A CT CONNECTOR SUITABLE FOR 4 INCH AL TUBE,EXPANSION TYPE

SECTION - 2

POWER / TERMINAL CONNECTORS

1.0. SCOPE :

The Power Connectors are for use in outdoor sub-stations in TAMILNADU.

2.0. CODES AND STANDARDS :

2.1. The power connectors should conform to IS 5561-1970 for the latest issue.

2.2. All materials used shall conform to the relevant Indian Standards.

2.3. The Aluminium alloys used in the manufacture of the connectors shall conform to designation A6 of IS 617-1975.

2.4. Conductor the bimetallic connector made from Aluminium Alloy Wherever for connecting equipment terminal made of copper or brass to ACSR casting shall be provided with bimetallic Strip.

2.5.1. All bolts and nuts shall have hexagonal heads.

2.5.2. All Bolts and Nuts shall be of stainless steel conforming to ISS 1570-304 quality.

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

- (a) The terminal connector should be made of A6 Aluminum Alloy and by pressure / gravity die cast only. Sand casted terminal connectors are not acceptable.
- (b) All castings shall be free from blow holes, surface blisters, cracks and Cavities. All sharp edges should be rounded off.
- (c) No part of clamp shall be less than 12 mm thick.
- (d) The bimetallic strips / sleeve shall be 2 mm thick.
- (e) All nuts, bolts & washers shall be of Hot Dip Galvanised mild steel.
- (f) The conductor should be tightened by six bolts. Conductor hold length must not be less than 100 mm.
- (g) The surface of clamps to be tightened by six bolts should be flat in shape so that it may be possible to open the nuts and bolts by normal flat spanners. Therefore, any type of groove in the clamp body for fixing of nuts should be avoided.
- (h) The portion of clamp to hold the conductor should be flat and straight and not zig-zag in construction, at both the sides, so that holding of clamp by throttling action of current may be avoided.
- (i) Space of at least 50% of diameter of nuts should be available after the hole at both the sides of conductor holding portion for better mechanical strength.
- (j) All current carrying parts shall be designed and manufactured to have minimum contacts resistance.
- (k) The clamp for Twin Moose ACSR Conductor shall be in three pieces so

that each conductor may be tightened separately.

- (i) Size of terminal connector for which the clamp is designed and also rated current under site conditions shall be embossed / punched on each part of clamps except hardware
- (j) All the power connectors should be corona free and type tested for RIV irrespective of voltage level.**

3.0. RATING :

- 3.1. The rated current of Power Connectors shall be generally 800 A and for switch end clamps 1600 A.
- 3.2. The rated frequency of Power Connectors shall be 50 Hz.
- 3.3. The rated short time current shall be 63 KA (rms)/ 1 sec for 400KV system and 40.0. KA (rms) for 3 Seconds for 230 Kv & 110 KV system.
The rated Peak short circuit current shall be 2.5 times that of rated S.T.C.

4.0. REQUIREMENTS :

- 4.1. The power connectors surface shall be smooth and free from cavities, blow holes and such other defects which would be likely to cause them to be unsatisfactory in service also capable of preventing the built up of non conducting oxide.
- 4.2. The power connectors shall be so designed and proportioned that they are capable for safety withstanding stresses to which
- 4.3. They may be subjected during erection, normal service, under short circuit and climate conditions and that the effects of vibration both on the conductor and the connector itself are minimized. They shall be designed, manufactured, and finished so as to avoid sharp radius of curvature, ridges and excrescences which might lead to localized pressure on or damage to the conductor in service.
- 4.4. Sufficient contact pressure should be maintained at the joint by the provision of required number of bolts or other fixing arrangements. But the contact pressure should not be so great so as to cause relaxation of the joint by cold flow. The joint should be such that the pressure is maintained within this range under all conditions of service. To avoid excessive local pressure, the contact pressure should be evenly distributed by the use of pressure plates, wharewashers or suitable saddles of adequate area and thickness.
- 4.5. The Power Connectors shall be so designed that the joints runs cooler than the associated Bus Bar.
- 4.6. The Power Connectors shall have short and as far as possible direct current paths.
- 4.7. The Power Connectors shall avoid crevices where moisture can accumulate or through which corrosive atmospheres can penetrate.
- 4.8. All the current carrying parts shall be designed and manufactured to have minimum contact resistance.

- 4.9. The thickness of any current carrying parts shall not be less than 16 mm.
- 4.10. The clamps and fitting shall be so designed that the post Insulators shall not be subjected to any abnormal stresses due to thermal change in conductor.
- 4.11. All the clamps and fittings shall be as short as possible.
- 4.12. Wherever possible there shall be two halves and no U Bolts shall be used.

5.0. LIMITS OF TEMPERATURE RISE :

5.1. The limits of temperature rise specified are based on the following reference ambient temperatures :

- a) Maximum ambient air temperature : 45 Degree C
- b) Maximum daily average ambient temp. : 35 Degree C
- c) Maximum yearly ambient temperature : 30 Degree C

5.2 The temperature rise of Power Connectors above a reference ambient temperature 40 Degree C when carrying rated current shall not exceed 45 Degree C.

6.0. PROTECTION AGAINST CORROSION :

All parts of Power Connectors shall either be inherently resistant to atmospheric corrosion or be suitably protected against corrosion, both during storage and in service.

7.0. TESTS AND TEST CERTIFICATES :

TYPE TESTS :

- 7.1. Tenderers are requested to furnish copy of type test certificates for the material/equipment of their make in full shape as conforming to relevant IS/IEC Standards of latest issue obtained from a Government/ Government recognised Laboratory . The above type test certificates should accompany the drawings of the material/equipments, duly signed under seal by the Institution who have issued the type test certificate.
- 7.2. The above type test certificates shall be furnished and get them approved before offering of the inspection of first lot of materials/equipments at no extra cost to TANTRANSCO and no relaxation to TANTRANSCO's Delivery Clause will be given on this account.
- 7.3. The above type test should have been conducted not earlier than TEN years (10 years) as on the date of submission. Non submission of above type test certificates within the stipulated time will entail cancellation of Purchase Order without any further reference to the supplier.
- 7.4. The original type test certificates shall be furnished for verification on request Type Test conducted:
 - a) Tensile Test

- b) Resistance Tests
- c) Temperature Rise Test
- d) Short Time Current Test
- e) Dimensions Check
- f) RIV Test & Corona Test for all power connectors in respective of voltage rating.

7.6 Acceptance Tests :

- a) Tensile Test
- b) Resistance Tests
- c) Dimensions check
- d) Galvanising Test wherever applicable

7.7 Routine Tests :

- a) Visual Inspection and
- b) Dimensional check.

8.0 INSPECTION :

The accredited representatives of the Purchaser shall have access to the contractor's works at any time during the working hours for the purpose of inspecting the manufacturing of materials and for testing and may select samples from the materials. The contractors shall provide facilities for the above.

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1 General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).

2 Test Levels:

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3 Test Methods for RIC:

3.1 RIV tests shall be made according to measuring circuit as per International Special – Committee on Radio Interference (CISPR) Publication 16-1 (1993) part-1.

The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard publication No. 107-1964, except otherwise noted herein.

3.3 In measurement of RIC, temporary additional external corona shielding may be provided. In measurements of RIC only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no Variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, 115% and 130% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 400 kV listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noise meter.

4.0 Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. the test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 130% of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 130%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e 85%, 100%, 115% and 130%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using panchromatic film with an ASA daylight equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energized connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

In case corona inception does not take place at 130%, voltage shall not be increased further and corona extinction voltage shall be considered adequate.

4.1 The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up location shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by purchasers inspection after determining the best camera location.

4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of purchaser's inspector if, in his opinion, it will not prejudice other test.

5.0 Test Records:

In addition to the information previously mentioned and the requirements specified as per CISR or NEMA 107-1964 the following data shall be included in test report:

- a) Background noise before and after test.
- b) Detailed procedure of application of test voltage.
- c) Measurements of RIV levels expressed in micro volts at each level.
- d) Results and observations with regard to location and type of interference sources detected at each step.
- e) Test voltage shall be recorded when measured RIV passes through 100 micro volts in each direction.
- f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

SECTION – 3

PROEJCT DETAILS & GENERAL TECHNICAL REQUIREMENT

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 : 400/230-110 kV Substation at Vellalaviduthi
- c) Transport facilities : Road/Rail

Physical and other parameters:

- 3.1.1 Location of the substation : Vellala viduthi, Pudukottai district
- 3.1.2 Nearest Railway station : Pudukottai
Railway : Southern Railway
- 3.1.3 Meteorological data
- | | |
|--|----------------|
| (i) Maximum ambient temperature | : 50°C |
| (ii) Minimum ambient temperature | : 20°C |
| (iii) Maximum daily average ambient air temperature | : 45° C |
| (iv) Maximum yearly average ambient air temperature | : 32° C |
| (v) Maximum Humidity (%) | : 100% |
| (vi) Average thunder storm days per annum | : 50 |
| (vii) Average rainy days per annum | : 90 |
| (viii) Average annual rainfall (mm) | : 1000 mm |
| (ix) No. of months during which tropical monsoon condition prevail | : 5 |
| (x) Maximum wind pressure | : 150 Kgf/Sqmm |
| (xi) Altitude above MSL | : 1000M |

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

MAIN ELECTRICAL PARAMETRS:		
a)	Fault Levels	400kV: 63kA for 1 sec. 230kV: 40kA for 3 sec. 110kV: 40kA for 3 sec.
a)	Creepage Distance	25mm/kV

3.1.4 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 -10% to +10%, Frequency +/- 5%,
DC supply	220V, 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.

3.0.1 The bidder shall also furnish drawings for the following:

All EQUIPMENTS and type of clamps, fittings hardwares, 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-1 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 the specification.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

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 TEST CERTIFICATE:

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

3.6 TESTS :

All the tests as per relevant IS/IEC shall be carried out.

3.7 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 IS/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 equipments should operate without undue vibration and with the least practicable amount

of noise.

3.8 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 from 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.

3.9 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.

3.10 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/ BHEL and the bidder 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.

3.11 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.

3.12 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.

3.13 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.

3.14 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.

3.15 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.

3.16 DEGREE OF PROTECTION

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes, panels etc to be installed shall provide 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-60947 (Part-1)/ IS 12063 / IEC-60529. Type test report for degree of protection test on each type of the box shall be submitted for approval.

3.17 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation,

shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

3.18 RATING PLATES, NAME PLATES AND LABELS :-

The equipments shall be provided with a rating plate or plates marked with but not limited to following data whatever needs to that particular equipments (as applicable).

- (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.

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the BHEL/TANTRANSCO. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipments shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided. During approvals drawings of Rating/name plates/labels shall also be submitted.

3.19 TERMINAL CONNECTORS :

The terminal connectors shall meet the following requirements.

- a. Terminal connectors shall be manufactured and tested as per IS : 5561.
 - b. All castings shall be free from blow holes, surface blisters, cracks and cavities.
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- c. All sharp edges and corners shall be blurred and rounded off.
 - d. No part of a clamp shall be less than 10mm thick.
 - e. All ferrous parts shall be hot dip galvanized conforming to IS: 2633.
 - f. For bimetallic connectors, copper alloy liner of minimum thickness of 2mm shall be cast integral with Aluminium body. Flexible connectors shall be made from tinned copper.
 - g. All current carrying parts shall be designed and manufactured to have a minimum contact resistance.
 - h. Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS : 5561.
 - i. Terminal connectors shall be for Twin Moose Conductor with a spacing of 450mm between the conductor.

3.20 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.

3.21 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.

3.22 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.

3.23 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.

3.24 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.

3.25 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.

3.26 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.

3.27 LIST OF DRAWINGS AND DOCUMENTS :

The drawings for the equipments provided by the TANTRANSCO/BHEL 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/BHEL.

The bidder shall furnish one set of relevant descriptive and illustrative published literature pamphlets and the following drawings/documents for preliminary study along with the Offer (as applicable). (Drawings, GTP, type test reports, list of past supplies etc. Drawings & documents submitted at the time of offer shall be subject to review at contract stage)

- (i) General outline drawings showing dimensions and shipping weights, quantity of insulating media, etc.
- (ii) Sectional views showing the general constructional features of the equipment (eg. Breaker drg includes operating mechanism, arcing chambers, contacts with lifting dimensions for maintenance).
- (iii) Schematic diagrams of equipment (eg. Breaker drg includes 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 week of placement of order submit six sets of final version of all the above drawings for TANTRANSCO/BHEL approval. The TANTRANSCO/BHEL shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit six copies of the modified drawings for TANTRANSCO/ BHEL approval within one week from the date of comments. After receipt of TANTRANSCO/BHEL approval, the supplier shall, within two weeks, submit 8 prints and two good quality reproducible of the approved drawings for TANTRANSCO/BHEL use. 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 equipments 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 equipments.
- 4) It should be noted that if the above conditions are not fulfilled the initial payment will not be released.

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

Following Documentation schedule to be followed

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	Prints CDs
1	Drawings and Data Sheets	1	6	10	5
2	Drawings "As Built "	-	-	10	

3	Type Test Reports	1	6	10	
4	Erection Manuals	-	6	10	
5	Operation and Maintenance Manuals	-	6	10	
6	Manufacturing Quality Plan	-	6	10	
7	Field Quality Plan	-	6	10	
8	Inspection Test Reports	-	6	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.

3.28 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 equipments 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/BHEL.

- 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/BHEL inspection. The quality assurance plan and hold points shall be discussed between the TANTRANSCO/BHEL and supplier before the QAP is finalized.
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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 equipment.

3.29 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(/25) deg. C over an ambient of 45(/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.

3.30 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.

3.31 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.

3.32 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)

AFTER AGEING

1. Change in weight should not be more than 10% and change in Hardness should not be more than Shore A ± 10 after 7 days aging in transformer oil.
 2. There should not be any visible damages after accelerated aging of 24 hours in transformer oil of temperature 110° C.
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POWER CONNECTORS

01	Manufacturer's Name	
02	Applicable Standards	IS 5561
03	Type	BOLTED TYPE
04	Material (State % Composition of constituents impurities present) a) Clamp Body b) Bolts and Nuts ISS conforming to IS 1570 304 Grade c) Washers (Plain & Spring) d) Rated terminal Load (Kg) (Slip Strength) e) Factor of Safety	Aluminium Alloy-A6 as per IS-617 Stainless steel G.I
05	Bimetallic Liner, if any, and its thickness Bimetallic Strip	.---
06	Current Rating	
07	Minimum thickness of any current carrying part	
08	Weight of Clamp complete with hardware (Kg)	
09	Dimensions	
10	Tolerance for Bus Bar Groove	
11	Tolerance for other dimensions	
12	Recommended tightening torque for the offered clamps	
13	Short time rating	
14	Temperature rise	
15	Rated voltage	
16	Maximum design voltage	

**GUARANTEED TECHNICAL PARTICULARS FOR CLAMPS AND CONNECTORS
(To be submitted by the supplier at the contract execution stage)**

1. Tenderers Name and address.
 2. Manufacturer's Name and address.
 3. Applicable Technical Standards.
 4. Application.
 5. Manufacturer's type
 6. For connection to-
 - 6.1 Conductor size and arrangement
 - 6.2 Equipment terminal size and terminal.
 7. Material of clamps/fittings (state percentage composition of constituents and impurities present).
 - 7.1 Clamp body.
 - 7.2 Bolts, nuts & plain washers.
 - 7.3 Spring washers.
 - 7.4 Liners if any.
 8. Maximum contact resistance (ohms)
Continuous current rating of the clamps/fittings
 9. Maximum temp. rise of the clamps/fittings over ambient temp (50°C) when carrying full load current (°C)
 10. Maximum temp. rise of the clamps/fittings over ambient temp. (50°C) when carrying an estimated fault current of 40KA for 1 sec. (°C)
 - i) Rated terminal load
 - ii) Minimum failing load.
 11. Factor of safety
-

12. Minimum thickness of any part.
13. Weight of each type of clamp complete with hardware fittings (KG)
14. Machining accuracy of matching surface.
15. Service Indoor/outdoor.
16. Major dimensions of the clamps/fittings (with accompanied drawings).
17. Mechanical test.
 - i) Heat run test
 - ii) Material Composition tests.
 - iii) Tests for checking blow, holes cracks etc.
18. List of routine test to be carried out.
19. Whether the type tests are already carried out if Yes, enclose the type test certificates.
20. Details of the type tests to be carried out if not carried out earlier.
21. List of testing facilities available at your works for carrying out above type tests & routine tests & mechanical tests. If facilities not available at your works, please indicate the name and address of the firm/institute where these shall be carried out.

Name of the firm:-----

Signature of the Tenderer:-----

Designation:-----

Place :-----

Date :

2. TYPE TESTS

Whether Type test reports of the tests conducted earlier (not more than ten years earlier from date of technical bid opening i.e. 21.08.17) on similar material submitted.

YES/NO

If type test report submitted, indicate report number.

If the valid type test reports are not available with the bidder then the following tests shall be conducted by the bidder free of cost

YES/NO

FOR CLAMPS & CONNECTORS

Sl. No.	TESTS	REPORT NO.	YES/NO
A	Type tests		
1.	Temperature rise test (maximum temperature rise allowed is 35°C over 50°C ambient)		
2.	Short time current test		
3.	Resistance test		
4.	Tensile test		
5.	Galvanization test		
6.	Corona (dry) and RIV (dry) test (for 220 kV and above voltage level clamps)		

SECTION - 6
SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

<u>S.No.</u>	<u>Page No.</u>	<u>Clause No.</u>	<u>Deviation</u>	<u>Reason / Justification</u>
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Tenderer's Stamp & Signature
