BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

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CUSTOMER Doc. No.				NAME	RS/RKP	SKS	RS
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	400/230/110kV Solid Core Insulator			DATE	01/11/13	01/11/13	2/11/13
				GROUP	TBEM		
				W.O. No	83003		

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

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Rev.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	CUSTOMER	TBMM	O/C	
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SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1. SCOPE

This specification covers requirements of design, manufacture, assembly and testing at the Manufacturer's premises/works and packing and supply of 400kV, 230kV & 110kV Solid Core Insulators to site complete in all respects and including all fittings and accessories required for efficient and trouble-free operation.

This section covers the scope and quantities of 400kV, 230kV & 110kV Solid Core Insulators. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification. For environmental conditions, refer Section-3 carefully.

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.
Section-2: Equipment specifications
Section-3: General technical requirements for all equipments under the project.
Section-4: Guaranteed Technical Particulars (to be filled at contract stage)
Section-5: Checklist (to be filled during tender stage.)

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

The equipment is required for the following projects:

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

2. SPECIFIC TECHNICAL REQUIREMENTS

SN	Technical Particulars	Unit	400kV	230kV	110kV
1.	Type		Solid core Porcelain	Solid core Porcelain	Solid core Porcelain
2.	Voltage Class	kV	400	230	110
3.	Lighting Impulse withstand test voltage	kVp	±1425	±1050	±650
4.	Switching impulse withstand test voltage	kVp	±1050	-	-

5.	One minute power frequency dry and wet withstand voltage	kV_{rms}	680	460	275
6.	Pollution level as per IEC-815		Heavy (III)	Heavy (III)	Heavy (III)
7.	Total creepage distance	mm	10500	6125	3165
8.	Minimum cantilever strength	kN	8	8	6
9.	Max radio Interference Voltage At voltage of 305 kV (rms) and 156 kV(rms) for 400 kV & 220 kV respectively between phase to ground	µV	500	500	500
10.	Corona extinction Voltage(min)	kVrms	320	156	105
11.	Minimum torsional moment		As per IEC		
12.	Total height of insulator	mm	3650	2300	1050
13.	P.C.D.				
	a) Top	mm	127	127	127
	b) Bottom	mm	300	254	210
14.	No. of bolts				
	a) Top		4	4	4
	b) Bottom		8	4	4
15.	Diameter of bolt/holes(mm)				
	a) Top dia	mm	M16	M16	M16
	b) Bottom dia	mm	M18	M18	M18

3. BILL OF QUANTITIES

As per Annexure-1.

4. TYPE TESTING

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

The above type test should have been conducted not earlier than five (05) years as on the date of technical bid opening, which is 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations.

The Copies of type test certificates shall be furnished for verification at contract stage.

In Case the type test reports are more than 5 years old (from the date of Technical bid opening or the reports are found to be technically unacceptable, type tests shall be conducted by the vendor without cost & delivery implication to BHEL.

5. TECHNICAL REQUIREMENT

The qualified manufacturer should have manufactured, Type tested and supplied at least 50% of the required quantity (for each project) of the Solid Core Insulator (of the same voltage level as offered) to Electricity Boards/Power Utilities in India in any one year during the last five years as on 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations. The same should have been in satisfactory operation for a minimum period of two years as on date 05/4/13 for Anikadavu & 10/4/13 for Thappagundu substations.

Further the qualified manufacturer should have type tested the Solid Core Insulator from Government / Government recognized laboratories confirming to IS/IEC only.

6. INSPECTION & TESTING

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

Annexure-1

Bill of Quantities

A. 400/110kV Thappagundu Substation

A.1 400kV Solid Core Insulator

S. No.	Description	Unit	Quantity
1	400 KV Solid core insulator with corona ring(8kN)	Set	134
2	400 KV Solid core insulator without corona ring(8kN, for isolator & Bus Earth switch)	Set	180

A.2 110kV Solid Core Insulator

S. No.	Description	Unit	Quantity
1	110 KV solid core Insulators(6kN)	Set	155
2	110 KV solid core Insulators (6kN) [9No. Insulators for each Isolators + 3 No. Insulators for each Wave trap]	Set	582

B. 400/230-110kV Anikadavu Substation

B.1 400kV Solid Core Insulator

S. No.	Description	Unit	Quantity
1	400 KV Solid core insulator with corona ring(8kN)	Set	167
2	400 KV Solid core insulator without corona ring(8kN, for isolator & Bus Earth switch)	Set	234

B.2 230kV Solid Core Insulator

S. No.	Description	Unit	Quantity
1	230 KV solid core Insulators (8kN)	Set	157
2	230KV solid core Insulators (8kN) [9No. Insulators for each Isolators +3No. Insulators for each Wave trap]	Set	459

B.3 110kV Solid Core Insulator

S. No.	Description	Unit	Quantity
1	110 KV solid core Insulators(6kN)	Set	83
2	110 KV solid core Insulators(6kN) [9No. Insulators for each Isolators + 3 No. Insulators for each Wave trap]	Set	300

Accessories Required

Nut, Bolts & Spring Washers for following must be supplied with each BPI.

(1) For interconnecting insulator units.

(2) For fixing BPI on support structure

Note:-

1. The Quantities indicated above is subject to change by ±25% at contract stage.

SECTION – 2

EQUIPMENT SPECIFICATIONS

The post type insulators shall conform in general to latest IS: 2544, IEC-168 and IEC – 815

Sl. No.	IS/IEC of latest issue	Description
1	ISS 9921(Part I to V)	Specification for alternating current disconnectors (Isolators)and earthing switches for voltages above 1000V
2	IS: 7608	Phosphor bronze wires(for general engineering purpose)
3	IS:2108	Black hard malleable iron castings
4	IS:1570(Part II)	Carbon Steel (Un alloyed Steel)
5	IS:2071(Part I&II)	General definitions and test requirements and test procedures
6	IEC:129	Alternating Current disconnectors (Isolators)and earthing switches
7	IS:7906	Helical Compression Springs
8	IS:5561	Electric Power Connectors
9	IS:5358&IS 2629	Galvanising of ferrous parts
10	IS:2633	Method of testing conformity of coating of zinc coated articles
11	IS:3202	Climate proofing
12	IS:4759	Hot Dip Galvanization of coating on structural steel
13	IS3033	Spring Washers
14	IS:2016	Plain washers
15	IS:1573	Electro plate coating of Zinc on Iron& Steel

1.0 Constructional Features

1.1 Post type insulators shall consist of a porcelain part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators will be acceptable.

1.2 Porcelain used shall be homogeneous, free from lamination, cavities and Other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

1.3 Glazing of the porcelain shall be of uniform brown in colour, free from blisters, burrs and other similar defects.

1.4 The insulator shall have alternate long and short sheds with aerodynamic profile. The shed profile shall also meet the requirements of IEC-815 for the specified pollution level.

1.5 When operating at normal rated voltage there shall be electric discharge between conductor and insulator which would cause corrosion or injury to conductors or insulators by the formation of substance produced by chemical action.

1.6 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

1.7 All ferrous parts shall be hot dip galvanized in accordance with the latest edition of IS: 2633, & IS: 2629. the zinc used for galvanizing shall be grade zn99.95 as per IS: 209. the zinc coating shall be uniform adherent, smooth, reasonably bright, continuous and free from imperfections such as flux ash, rust stains, bulky white deposits and blisters. The metal pars shall not produce any noise generating corona under the operating conditions.

1.8 a) Every bolt shall be provided with a steel washer under the nut so that part of the threaded portion of the bolts is within the thickness of the parts bolted together.

b) Flat washer shall be circular of a diameter 2.5 times that of bolt and of suitable thickness. Where bolt-heads/nuts bear upon the beveled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.

c) All bolts and nuts shall be of steel with well formed hexagonal heads forged from the solid and shall be hot dip galvanized. The nuts shall be good fit on the bolts and two clear threads shall show through the nut when it has been finally tightened up.

1.9 Bidder shall make available data on all the essential features of design Including the method of assembly of shells and metals parts, number of shells per insulator, the manner in which mechanical stresses are transmitted through shells to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

2.0 Tests

In accordance with the stipulations of the specification, the post insulators shall be subject to type, acceptance, sample and routine tests as per IS: 2544 and IEC 168.

In accordance with the requirements stipulated under section 3, the Post Insulator should have been type tested as per IEC/IS and shall be subjected to routine and acceptance tests in accordance with IS/IEC document. Type test reports of the tests conducted earlier on similar equipment shall be submitted at contract stage

Type Tests

1. Visual examination
2. Verification of dimensions
3. Visible discharge test
4. Impulse voltage withstand test[Switching impulse test (wet) for 400kV *class* Insulator only]
5. Dry power –frequency voltage withstand test
6. Wet power –frequency voltage withstand test
7. Temperature cycle test
8. Test for mechanical strength
9. Puncture test (for insulators Type B only)
10. Porosity test
11. Galvanizing test
12. Switching impulse test
13. Measurement of R.I.V (Dry)
14. Corona extinction voltage test (Dry)
15. Test for deflection under load

Acceptance test

1. Verification of dimensions
2. Temperature cycle test
3. Test for mechanical strength
4. Puncture test
5. Porosity test
6. Galvanizing test
7. Bending load test in four directions at 50% minimum bending load guaranteed on all insulators
8. Bending load test in four directions at 100% minimum bending load as a sample test on each lot
9. Torsional test on sample insulators of a lot
10. Ultrasonic test as an acceptance test
11. Soundness test, metallurgical tests and magnetic test on MCI caps and pedestal tests

as acceptance test

12. All hot dip galvanised components shall be subject to check for uniformity of thickness and weight of zinc coating on sample test

Routine Test

1. Visual examination
2. Routine electrical test
3. Routine mechanical test
4. Bending load test in four directions at 50% minimum bending load guaranteed on all insulators, as a routine test
5. Ultrasonic test as a routine test
6. Torsional test on sample insulators of a lot
7. Bending load test in four directions at 100% minimum bending load

Acceptance norms for visual defects allowed at site and also at works shall be agreed in the Quality plan.

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3.0 If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the supplier.

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SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 Foreword

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

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

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

The following system parameters shall prevail:

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

SITE CONDITIONS

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

3.1.2 Max. humidity : 100% Max.

3.1.3 Average thunder storm days per annum : 50

3.1.4 Average rainy days per annum : 90

3.1.5 Average Annual rainfall : 1000 mm

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

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

AUXILIARY POWER SUPPLY

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

3.2 GENERAL REQUIREMENT

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

3.2.1 The supplier shall also furnish drawings for the following:

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

3.2.1 GENERAL:

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

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

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

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

3.3 SPECIFIC REQUIREMENT

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

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

3.4 SPECIFIC TECHNICAL REQUIREMENTS: / Drawing submission

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

3.5 STANDARD:

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

3.6 TEST CERTIFICATE:

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

3.7 Inspection clause :

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

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

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

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

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

3.8 GUARANTEE:

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

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

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

3.9 PRE COMMISSIONING TESTING :(if applicable)

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

3.10 PACKING:

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

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

3.11 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The supplier shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.
Finishing colour of various auxiliary system equipment including piping

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

3.12 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

3.13 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

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

3.14 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.15 GALVANIZING

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

3.16 DEGREE OF PROTECTION

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed outdoor: IP-55

b) Installed indoor in air conditioned area: IP-42
c) Installed in covered area IP:52
d) For LT switchgear (AC & DC distribution Boards): IP-54

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

3.17 RATING PLATES, NAME PLATES AND LABELS

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

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

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

3.18 EARTHING

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

3.19 TERMINAL BLOCKS AND WIRING

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

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

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

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

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

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

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

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

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

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

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

TBs should be suitable for cable sizes all cable sizes.

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

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

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel. Sheet steel used shall be at least 3.0 mm thick cold rolled or 3 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

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

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

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

3.21 SPACE HEATERS

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

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment.

3.22 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

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

3.23 INCIDENTAL SERVICES:

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

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

3.24 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

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

3.25 APPROVAL PROCEDURE

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

i.	First Submission	7 days after LOI/PO
ii.	Approval/comments/by employer on Initial submission	Reasonable time
iii.	Resubmission	Within 7 days (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 2 weeks of receipt of resubmission.
v.	Furnishing of distribution copies	2 weeks from the date of last approval.

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

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

3.26 TITLE BLOCK

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

For Thappagundu

Customer	M/s Tamil Nadu Transmission Corporation Limited

Project:	400/110 KV Substation at Thappagundu
Contractor	BHEL

For Anikadavu

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

3.27 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

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

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

3.28 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

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

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

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

APPENDIX-A

SCHEDULE OF TECHNICAL DEVIATION

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

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

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

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

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

Place

Date

Signature of the authorized representative of

Bidder's name …….

Designation …….

Company seal …….

APPENDIX-B

BIDDER'S UNDERTAKING FOR TYPE TEST REPORTS

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

Place Signature of the authorized representative of

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

Date

Designation----------

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

SECTION - 4

GUARANTEED TECHNICAL PARTICULARS FOR SOLID CORE INSULATOR

Sl. No.	Parameters	400kV	230kV	110kV
1.	Type			
2.	Voltage class (kV)			
3.	Dry and wet one minute power frequency withstand voltage (kVp)			
4.	Dry lightning impulse withstand voltage (kVp)			
5.	Wet switching surge withstand voltage (kVp)			
6.	Max. RIV (in μV) at specified 50-Hz phase to ground voltage in kV			
7.	Min. Corona extinction voltage (kV rms)			
8.	Total min. cantilever strength (kN)			
9.	Minimum torsional moment			
10.	Total height of insulator (mm)			
11.	P.C.D			
	a. Top (mm)			
	b. Bottom (mm)			
12.	No. of bolts			
	a. Top			
	b. Bottom			
13.	Diameter of bolt holes			
	a. Top (mm)			
	b. Bottom (mm)			
14.	Pollution level as per IEC-815			
15.	Min. total creepage distance (mm)			
16.	Hardware (Inter unit)			

17.	Hardware (for fixing to structure)			
18.	Applicable standard			

----------X-X----------

SECTION – 5

Check List

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

1. TECHNICAL REQUIREMENTS (FOR SURGE ARRESTER)

Sno.	Technical Particulars	Unit	400kV	YES/NO	230kV	YES/NO	110kV	YES/NO	Remarks
1	Type		Solid core Porcelain		Solid core Porcelain		Solid core Porcelain		
2	Voltage Class	kV	400		230		110		
3	Lighting Impulse withstand test voltage	kVp	1425		1050		650		
4	Switching impulse withstand test voltage	kVp	1050		-		-		
5	One minute power frequency dry and wet withstand voltage	kV_{rms}	680		460		275		
6	Total Creepage distance	mm	10500		6125		3165		
7	Minimum cantilever strength	kN	8		8		6		
8	Max radio Interference Voltage At voltage of 305 kV (rms) and 156 (rms) for 400 kV & 220 kV respectively between phase to ground	µV	500		500		500		
9	Corona extinction Voltage(min)	kVrms	320		156		105		
11	Minimum torsional moment		As per IEC		As per IEC		As per IEC		

12(a)	Pollution level as per IEC-815		Heavy (III)		Heavy (III)		Heavy (III)		
12(b)	Total height of insulator	mm	3650		2300		1050		
13	P.C.D.								
13.1	Top	mm	127		127		127		
13.2	Bottom	mm	300		254		210		
14	No.of bolts								
14.1	Top		4		4		4		
14.2	Bottom		8		4		4		
15	Diameter of bolt/hotes(mm)								
15.1	Top dia	mm	M16		M16		M16		
15.2	Bottom dia	mm	M18		M18		M18		
16	Hardware (Inter unit)		Included		Included		Included		
17	Hardware (for fixing to structure)		Included		Included		Included		

2. TYPE TESTS

a) Whether Type test reports of the tests conducted earlier (not more than 5 years earlier as per clause no.4 of section-1) submitted. **YES/NO**

b) Whether Type test reports are as per mentioned IS & IEC and Clause No. 2 of section-2 attached. **YES/NO**

c) If type test report submitted, make a table indicate report number and date. **YES/NO**

d) In Case the type test reports are more than 5 years old (from the date of Technical bid opening or the reports are found to be technically unacceptable, type tests shall be conducted by the vendor without cost & delivery implication to BHEL. **YES/NO**

3. Technical Requirement

a) Whether bidder is fulfilling Technical requirements as per Clause no. 5 of section-1 **YES/NO**

b) If Technical requirements are fulfilled attach supporting documents **YES/NO**