



**BHARAT HEAVY ELECTRICALS LIMITED**  
**TRANSMISSION BUSINESS ENGINEERING MANAGEMENT**  
**NEW DELHI**

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<b>TITLE</b>	<b>420/245/132 kV Isolators &amp; 420kV Bus Earth Switch</b>	<b>DATE</b>					
		<b>GROUP</b>	<b>TBEM</b>				
		<b>W.O. No</b>	<b>83003</b>				
<b>CUSTOMER</b>	<b>TAMIL NADU TRANSMISSION CORPORATION LIMITED</b>						
<b>PROJECT</b>	<b>400/110 KV Substation at Thappagundu &amp; 400/230-110 KV Substation at Anikadavu</b>						

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2	31.12.13	<i>Richa</i>	<i>SKS</i>	<i>Rakesh</i>	Revision is done to change the specification of 420kV Isolator
1	11.11.13	-SD-	-SD-	-SD-	Technical Qualifying requirement is revised.
<b>Rev.</b>	<b>Date</b>	<b>Altered</b>	<b>Checked</b>	<b>Approved</b>	<b>REVISION DETAILS</b>
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## **SECTION – 1**

### **SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES**

#### **1. SCOPE**

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 420kV 245kV & 132kV Isolators without support insulators, terminal connectors and structure to site.

This section covers the scope and quantities of 420kV 245kV & 132kV Isolators. 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**

As per Section-2.

#### **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 original type test certificates shall be furnished for verification at detailed Engineering stage.

## **5. TECHNICAL QUALIFYING REQUIREMENT**

The qualified manufacturer should have manufactured, Type tested and supplied at least 50% of the required quantity (for each project) of the Isolator (of the same voltage level as offered and short Circuit Rating of at least 40kA for 3s for 420kV and 40kA for 3s for 245kV & 132kV) 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 Isolator 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 420kV Isolator & 420kV Bus Earth Switch**

S. No.	Item Description	Added Description	Unit	Quantity
1	420 KV, 3150 A, 63KA for 1s Isolator with double earth Switch	3 phase, HCB(Al)/HCB(Cu)/HDB**(Al)/HDB**(Cu); Both Isolator & Earth Switch shall be Electrically ganged with accessories, complete in all respects	Set	7
2	420 KV, 3150 A, 63 KA for 1s Isolator with single earth Switch	3 phase, HCB(Al)/HCB(Cu)/HDB**(Al)/HDB**(Cu); Both Isolator & Earth Switch shall be Electrically ganged with accessories, complete in all respects	Set	22
3	420 KV Bus Earth Switch (Single phase)	63KA for 1s, with accessories, complete in all respects( 2 shall be master & 4 follower type)	Set	6
4	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 420kV Isolator	----	No#	1
5	Supervision charges for erection, testing and commissioning of 420kV Isolator (on man-day basis)	----	Day*	1

**A.2 132kV Isolators**

S. No.	Item Description	Added Description	Unit	Quantity
1	132 KV, 2000 A, 40 KA for 3s Isolator with single earth Switch	3 phase, Cu Double Break mechanically ganged Isolator with manual Earth Switch with accessories, complete in all respects	Set	8
2	132 KV, 2000 A, 40 KA for 3s Isolator without earth Switch	3 phase, Cu Double Break mechanically ganged Isolator with accessories, complete in all respects. Total quantity is bifurcated in following groups [42 No. Isolators are mounted on structure	Set	54

		+4 No. Isolators are gantry Mounted at a height of 10m + 8 No. Isolators are gantry mounted at a height of 8m]		
3	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 132kV Isolator	----	No.#	1
4	Supervision charges for erection, testing and commissioning of 132kV Isolator (on man-day basis)	----	Day*	1

## B. 400/230-110kV Anikadavu Substation

### B.1 420kV Isolators & 420kV Bus Earth Switch

S. No.	Item Description	Added Description	Unit	Quantity
1	420 KV, 3150 A, 63KA for 1s Isolator with double earth Switch	3 phase, HCB(Al)/HCB(Cu)/HDB**(Al)/HDB**(Cu); Both Isolator & Earth Switch shall be Electrically ganged with accessories, complete in all respects	Set	9
2	420 KV, 3150 A, 63 KA for 1s Isolator with single earth Switch,	3 phase, HCB(Al)/HCB(Cu)/HDB**(Al)/HDB**(Cu); Both Isolator & Earth Switch shall be Electrically ganged with accessories, complete in all respects	Set	28
3	420 KV Bus Earth Switch (Single phase)	63KA for 1s, with accessories, complete in all respects (2 shall be master & 4 follower type)	Set	6
4	Mandatory Spare: 420 KV, 3150 A, 63KA for 1s Isolator with double earth Switch	3 phase, HCB(Al)/HCB(Cu)/HDB**(Al)/HDB**(Cu); Both Isolator & Earth Switch shall be Electrically ganged with accessories, complete in all respects	Set	1
5	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 420kV Isolator	----	No.#	1
6	Supervision charges for erection, testing and commissioning of 420kV Isolator (on man-day basis)	----	Day*	1

**B.2 245kV Isolator**

S. No.	Item Description	Added Description	Unit	Quantity
1	245 KV, 2000A, 40 KA for 3s Isolator with single earth Switch	3 phase, Cu Double Break mechanically ganged Isolator with manual Earth Switch with accessories, complete in all respects	Set	6
2	245 KV, 2000A, 40 KA for 3s Isolator without earth Switch	3 phase, Cu Double Break mechanically ganged Isolator with accessories, complete in all respects. Total quantity is bifurcated in following groups [32 No. Isolators are mounted on structure +9 No. Isolators are gantry Mounted at a height of 9.5m]	Set	41
3	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 245kV Isolator	----	No.#	1
4	Supervision charges for erection, testing and commissioning of 245kV Isolator (on man-day basis)	----	Day*	1

**B.3 132kV Isolator**

S. No.	Item Description	Added Description	Unit	Quantity
1	132 KV, 2000 A, 40 KA for 3s Isolator with single earth Switch	3 phase, Cu Double Break mechanically ganged Isolator with manual Earth Switch with accessories, complete in all respects	Set	4
2	132 KV, 2000 A, 40 KA for 3s Isolator without earth Switch	3 phase, Cu Double Break mechanically ganged Isolator with accessories, complete in all respects. Total quantity is bifurcated in following groups [22 No. Isolators are mounted on structure +2 No. Isolators are gantry Mounted at a height of 10m +4 No. Isolators are gantry mounted at a height of 8m]	Set	28
3	Lump Sum Supervision Charges for Erection Testing & commissioning	----	No.#	1

	of one No. of 132kV Isolator			
4	Supervision charges for erection, testing and commissioning of 132kV Isolator (on man-day basis)	----	Day*	1

**Notes:**

1. '#' – Supervision charges shall be quoted on lump sum basis only. Bidder shall estimate required no. of man-days for supervision based on his own experience & shall submit a checklist for input wrt site readiness. It will be the sole responsibility of the bidder to obtain site readiness checklist before deputing any of his personnel at site.
2. '\*\*' - In case of any delay on account of BHEL, after deputing personnel at site, bidder shall also quote supervision charges for one man-day.
3. The insulators, terminal connectors and structure will be supplied by BHEL (refer Note 4). Equipment mounting hardware on structure shall be supplied by vendor. Inter pole cables and glands shall be supplied by BHEL.
4. '\*\*\*' In case of Bidder Quoting for 420kV HDB isolator, the bidder has to include 3 No. centre post rotating Insulators with each isolator in the scope of supply. The details of insulator (given in Annexure-2) should match with BHEL supplied insulator. Applicable only for 420kV Double Break Isolator & not for 245 & 132kV Isolators.

## Annexure-2

### BPI Details

SN	Technical Particulars	Unit	400kV
1.	Type		Solid core Porcelain
2.	Voltage Class	kV	400
3.	Lighting Impulse withstand test voltage	kVp	±1425
4.	Switching impulse withstand test voltage	kVp	±1050
5.	One minute power frequency dry and wet withstand voltage	kV <sub>rms</sub>	680
6.	Pollution level as per IEC-815		Heavy (III)
7.	Total creepage distance	mm	10500
8.	Minimum cantilever strength	kN	8
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
10.	Corona extinction Voltage(min)	kVrms	320
11.	Minimum torsional moment		As per IEC
12.	Total height of insulator(min)	mm	3650
13.	P.C.D.		
	a) Top	mm	127
	b) Bottom	mm	300
14.	No. of bolts		
	a) Top		4
	b) Bottom		8
15.	Diameter of bolt/holes(mm)		
	a) Top dia	mm	M16
	b) Bottom dia	mm	18

#### Notes:

- In Case of supply of BPI with 400kV HDB Isolator, bidder should ensure Technical Qualifying requirement of the BPI manufacturer; which is  
 "The qualified manufacturer should have manufactured, Type tested and supplied at least 265 No. 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

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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. "

2. "The Type Test for BPI 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."

3. Vendor approval of BPI to be obtained by Isolator Bidder only, from TANTRANSCO/BHEL.

**Section-2**  
**General Equipment Specifications**

**1.0 SCOPE:**

This scope covers for design, manufacture, inspection, testing before dispatch, packing and delivery of Isolators 420KV, 245KV&132KV along with all accessories

**2.0. STANDARDS:**

Unless otherwise specified elsewhere in the specification, the Isolators to the latest revisions and amendments thereof the IS and IEC Standards.

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

**ISOLATORS :-**

<b>SL. NO</b>	<b>SPECIFICATION NO.</b>	<b>DESCRIPTION</b>
1	IS : 9921 (Part I to V)	Specification for alternating current disconnects (Isolators) and earthing switches for voltages above 1000 V
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 steels)
5	IS:2071 (Part I & II)	General definitions and test requirements and test procedures.
6	IEC : 129	Alternating current disconnects (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 Galvanisation of coating on structural steel.
13	IS : 3033	Spring Washers
14	IS : 2016	Plain Washers
15	IS : 1573	Electro plate coating of zinc on Iron & Steel
16	IS:2544&5350(part II)	Insulators

**3.0** The 420/230/110 KV Outdoor Isolators offered shall be as detailed below:

3.01. 420 KV, 50 Cycles, 3150 Amps, upright mounted, HCB(Al)/HCB(Cu)/HDB(Al)/HDB(Cu), 3 pole motor operated switches with ground blade (Single or Double blade), phase spacing of poles 7000 mm. Steel base shall be supplied with switch. This switch shall be mounted on tubular/lattice steel structure. The live point of terminal will be at a height of 8200 mm above ground level. The Motor shall be suitable for operation at 3 phases 50 cycles.

3.02 Each phase of Isolators and earth switch to be electrically operated individually and suitable for gang operation electrically.

3.03 420KV 50 cycle 3150 Amps Isolators same as item 3.01 above but without earthing device (Wherever Applicable) with the switch terminals at a height 8000 mm above plinth level and manual operating handle at 1000 mm above ground level.

3.04. The above Isolators should conform to IEC 129 or IS 9921 of latest issue.

3.05. 230 KV, 50 Cycles, 2000A & 110 KV, 50Hz, 2000 Amps, horizontal upright mounted vertical 3 pole double break center rotating **motor operated switch** with turn & twist mechanism **with manual earthing device** Steel mounting frame required to be supplied along with switch. This will be mounted on concreted foundation at a height such that the terminal pad will be 5500 mm above ground level and manual operating handle at a height of 1000mm above ground level, phase to phase spacing shall be 4000 mm.

#### **4.0 DESIGN :**

4.01 The switches will be mounted upright on support steel structure to be provided by the BHEL. The steel structure shall be erected in the RCC foundation..

4.02 Horizontal break switches shall be capable of making/ breaking magnetizing current of 0.7A at 0.15 power factor and capacitive current of 0.7A at 0.15 power factor at rated voltage.

4.03 The short time current rating of the switch shall be 63 kA(rms) for 1 sec for 400 KV system and 40 KA (rms) for Three (3) seconds for 230/110KV system. The rated peak short circuit current shall be 2.5 times the rated short time withstand current.

4.04 The switches shall be capable of being operated by 220V D.C. with provision of manual operation. The operating mechanism shall be capable of closing and opening the switch for any value of supply voltage between 80% and 110% of the rated voltage.

4.05 The equipment offered should be entirely satisfactory for the operations under tropical conditions in humid atmosphere with maximum temperature of 50 Degree C in shade and at an altitude not exceeding 1000 meters above sea level.

4.06. Current Density to be adopted for all parts of the isolator shall not exceed the following limits:

- a) Hollow tube sections – Copper : 2.0 Amps/ Sq. mm | Aluminium : 1.0 Amps/Sq.mm  
(Except Earth Switch moving Contact)
- b) Other Sections – Copper : 2.0 Amps/ Sq.mm.
- c) Terminal Pad – Aluminium : 1.0 Amps/Sq.mm | Copper : 2.0 Amps/ Sq. mm

## **5.0 CONSTRUCTIONAL FEATURES :**

The constructional details of Isolators and Accessories shall be in accordance with the requirements stated hereunder:

### **5.1 BASE:**

Each single pole of the isolator shall be provided with a complete galvanized steel base with holes and designed for mounting on a supporting structure. The base shall be of heavy fabrication, hot dip galvanized drilled to accommodate the bearings and to suit the steel work on which the switches are mounted. All steel works required with galvanized bolts, washers, nuts, etc. for mounting the switch and for operation from ground shall be included. Rotating insulator base should be provided with tapered roller bearings of suitable capacity with suitable lubricating facility. The composite frame of the base shall be made of minimum size of 125 x 65 x 8 mm. Bottom PCD holes shall match

a) insulators PCD 300 mm. Top PCD of insulators is 127 mm for 400 KV.

b) Insulator Bottom PCD holes shall be slotted holes to match 254/210 mm. Top PCD of Insulators is 127 mm for both 230 & 110 KV..

Bidder should get confirmation from BHEL at the time of detailed Engineering.

**5.2 INSULATORS:** Insulator required for the switches is not included in the scope of supply of Bidder.( Refer Note 4 of Annexure-1)

#### **6.0 TERMINAL CONNECTORS : (Not In Bidder's Scope)**

Clamp type terminal connectors shall be supplied and bolted to the terminals of the switches. They shall be hot tinned to prevent corrosion when connected to Aluminum bus. The clamps should be made entirely of non-ferrous parts non-magnetic steel. The terminal connectors to be supplied shall conform to IS 5561 of latest issue and suitable to receive Twin Moose Conductor / 4" Aluminium Bus Bar Rigid/ expansion type as per site requirements for 400 KV & for 230 & 110 KV terminal connectors suitable to receive 3" Aluminium busbar & twin moose conductor as per site condition. All power connectors should be corona free irrespective of voltage level.

#### **7.0 TERMINAL PADS :**

The terminal pads shall be hard drawn electrolytic copper / Al flats. All electrical parts should be of adequate cross section to handle the designed rated current safely.

#### **8.0 OPERATING MECHANISM :**

8.01 For 230 & 110 KV Isolators the three single pole switches shall be joined by double inter phase connecting rods for group operation & also for electrical gang operations. The operation shaft shall be equipped with suitable grounding clamps.

8.02 For 400 KV AB Switches each phase shall be joined by connecting rods in such a way that suitable for both manual & Electrical operation individually and ganged electrically.

8.03 The switches shall be operated by means of hand wheel shaft supplied with couplers and supporting brackets.

8.04 Manual operating mechanism through crank and reduction gear shall be provided.

8.05 Motors rated 1 HP and above shall be suitable for operation only on a 415 V, 3 Phase, 50 Hz system.

8.06 The operating mechanism may be housed in a weather proof cabinet. The top of the cabinet should be suitably sloped to prevent collection of rain water. The thickness of MS sheet used should not be less than 3 mm. The operating motor shall be of A.C, 3 phase, 415 V, 1 H.P. or above capacity supplied with over load protection and single phase preventer. Gland plates with 6 Nos. three sizes of knockouts for cable entry as to be provided.

The operating mechanism shall consist of the following :

- b) Local remote transfer switch
- c) Control switch (for local closing and opening)
- d) Limit switches to prevent over-travel both in the closing and opening position.

- e) The interlock to cut off the supply to the operating motor when operated manually.
- f) Facility for the remote indication of failure of A.C. supply.
- g) Illumination for the mechanism box.
- h) Mechanical ON/OFF indication.
- i) Electrical Lamp ON/OFF indication on the operating pipe.
- j) Space heater.
- k) Auxiliary contacts

8.07 The operating mechanism shall provide quick, simple and effective operation. Motor operated type operating mechanism shall be suitable for remote operation of all three poles simultaneously as well as local manual operation through crank and reduction gear. The design of manual operation shall be such that one man shall be able to operate the isolator without undue effort with about 20 (TWENTY) revolutions of the crank. The operating mechanism shall be suitable to hold the isolator in CLOSE OR OPEN position and prevent operation by gravity, wind, short circuit forces, seismic forces, vibration, shock, accidental touching etc.

8.08 Limit switches for control shall be fitted on the isolator/earth switch shaft within the cabinet to sense the open and close positions of the isolators and earth switches.

8.09 It shall not be possible, after final adjustment has been made, for any part of the mechanism to be displaced at any point in the travel sufficient to cause improper functioning of the isolator when the isolator is opened or closed at any speed. All holes in cranks, linkage etc. having moving pins shall be drilled to fit accurately so as to maintain the minimum amount of slack and lost-motion in the entire mechanism.

8.10 A local/remote selector switch and a set of open/close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons.

8.11 Provision shall be made in the control cabinet to disconnect power supply when local manual operation is intended.

8.12 Motor operated mechanism shall be subjected to blocked rotor test.

8.13 Engraved electrical drawing of MOM shall be fixed inside the cubical.

### **9.0 EARTHING DEVICE (Wherever Applicable):**

One earthing switch per pole forming an integral part of the line disconnecting switch and manually operated shall be supplied.

The earthing switch shall match with main switch. A suitable flexible braided connection shall be provided on the hinge end of the earthing blade for connection to ground bus

The operation of earthing device will be manual for 230 KV & 110 KV without using any other supply or storage of energy and therefore is entirely dependent on the operator. The switches shall be provided with a blade for earthing the incoming supply side and the device shall be capable of operation at ground level. The operating rods of all switches shall be supplied with a clamp and 2 runs of copper flexible braid of each 25 x 3 mm totaling to number suitable for the rated capacity. This arrangement is for grounding the operating assembly and copper flexible should run through the connecting pipe between earth switch moving contact and fixed contact.

The shunt-earthing blade operating mechanism should be so mechanically linked with the operating mechanism of the series switch so that the earthing blade cannot be closed, when the series switch is closed and the series switch cannot be closed when the earthing switch is closed. In addition, key interlocks shall be provided, for the series switch to permit operation in the desired sequence only. Two numbers earthing terminals on the base channel shall also be supplied.

For 400 KV Isolators both Single Earth and Double Earth switch should be electrically operated. Necessary arrangement should be made for Manual operation also.

Two Numbers earthing terminals on the base channels shall also be supplied.

## **10.0 AUXILIARY SWITCHES :**

8.1 The earthing devices and air disconnecting switches shall be equipped with an auxiliary switch designed for both 220V DC. Operation. The auxiliary switch shall be equipped with 15 "normally open" and 15 "normally closed" and 2 "make before break" type wiping contacts. The auxiliary switches shall be of **reputed make** conforming to IS Standards. The make of auxiliary switches shall be indicated in the offer. Provision of adding of Auxiliary contacts may also be provided.

8.2 The above contacts shall be in addition to those required for interlocking schemes. The contacts shall be capable of carrying 10 amps at 220V DC or 230 V AC.

8.3 The auxiliary switches shall be actuated by a cam or similar arrangement directly mounted on the isolator and shall be without any intermediate levels, linkages etc. to ensure fool-proof operation.

8.4 The auxiliary switches and auxiliary circuit shall be capable of carrying a current of at least 10 amps continuously. Auxiliary switches shall be capable of breaking at least 2 A in a 220 V DC circuit with a time constant of not less than 20 milli seconds.

## **11.0 KEY INTERLOCKING :**

Electrical interlock for the main switch with the corresponding circuit breaker and mechanical interlock for the earth blade with the main switch.

## **12.0 INSULATION :**

12.01 The system voltage is 400/230/110 KV normal and system frequency is 50 cycles. The system is effectively earthed neutral system. The insulation of all high tension switches and outdoor accessories shall be capable of operating continuously at normal voltage plus 10% with a frequency variation of 5% and under temperature and humidity conditions mentioned in Section-3.

12.02 The rated insulation level of the switches and disconnectors shall be as follows :

a) Impulse withstand voltage (to earth and between poles of 420kV Switches and switch disconnectors).

1. To Earth and Between Poles - 1425 KV
2. Across Isolating Distance - 1425 KV (240kVp)

b) One minute power frequency withstand voltage (to earth and between poles of 245kV switches and switch disconnectors)

1. To Earth and Between Poles - 460 KV
2. Across Isolating Distance - 530 KV

## **13.0. CLEARANCES :**

13.01 All clearance of live parts between phase and earthed metal parts of switches shall be adequate for maximum service voltage plus 10% and shall conform to IS1992 of the latest issue.

13.02 The clearance and positions of equipment and apparatus and access facilities shall be such as to permit safe maintenance of any section of apparatus while the remaining section are alive.

## **14.0. TERMINAL BOXES :**

Suitable terminal boxes with knockout for standard type of cable glands of 3 different size shall be supplied/provided.

## **15.0. SHORT CIRCUIT REQUIREMENTS :**

15.01 The rated peak short circuit current or the rated short time current carried by an isolator or earthing switch for the rated maximum duration of short circuit as per Clause 4.03. shall not cause,

- a) Mechanical damage to any part of the isolators or earthing switch
- b) Separation of the contacts or contact welding and
- c) A temperature rise likely to damage insulation.

15.02 After the passage of these currents, the isolator shall be able to carry its rated current under specified conditions and the operation of the operating device shall not be impaired.

15.03 If earthing switch is combined with an isolator as a single unit, the rated peak short-circuits current and the rated short-time current, of the earthing switch shall be at least equal to those specified for the isolator. The earthing switch shall be capable of making on a dead short circuit without damage or endangering the operator.

## **16.0 FIXED AND MOVING CONTACTS :**

16.01 The isolator shall have heavy-duty self-aligning high-pressure contacts of modern design. The contact shall be made of high grade, high conductivity, and heat resisting material. The main contacts shall be made of hard drawn, electrolytic copper and the surface shall be silver plated. Arcing contacts wherever provided, shall close first and open last.

16.02 The isolator blades/arms shall be made from tubular section of hard drawn electrolytic copper/ Al ( for 420kV only) having suitable diameter and shell thickness, and the contact surface shall be heavily silver-plated.

16.03 The surface of the contacts shall be liberally designed to withstand safely the highest short circuit current.

16.04 The fixed contacts of hard drawn electrolytic copper flat shall be of the high pressure type with pressure relieving springs and have a wiping action during closing and opening. They shall be silver surfaced. Suitable insulators to prevent current flowing through the springs should be provided. Fixed arcing horns should be mounted on the fixed contacts.

16.05 All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper (As per ISS)/ Al ( for 420kV only) . Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts shall be made of copper silicon alloy or stainless steel or equivalent. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying

parts shall be made of malleable cast Iron or cast-steel. No grey iron shall be used i

**16.06 The movable and fixed contact assembly and blade shall ensure**

- i) Electro dynamic withstand ability during short circuit without any risk of repulsion of contacts.
  - ii) Thermal withstand ability during short-circuits.
  - iii) Constant contact pressure even when the live parts of the insulators stacks are subjected to tensile stresses due to linear expansion of connected bus-bars, flexible conductors either because of temperature variation or strong winds.
  - iv) Self-wiping action during closing and opening / operation to remove any film, oxide coating, etc. Wiping action shall not cause scouring or abrasion of surfaces.
  - v) Self-alignment ensuring smooth closing of the switch. The temperature rise of the contacts and other current carrying parts shall be as per relevant IS., while carrying the rated current continuously. The temperature rise due to passage of rated short-circuit current shall not cause any annealing or welding of contacts.
  - vi) Fixed guides shall be provided so that proper seating of contacts will be obtained by closing even when a blade is out of alignment by 2.5 mm or less.
  - vii) All movable parts, which may be in the current path, shall be shunted by flexible copper conductors to prevent breaking due to repeated bending.
- vii) Fabrication shall be made with suitable jig to avoid deviation during production.

Details of size and shape of contact, springs, back plate, fixing arrangements, design of contact pressure, life of contacts, limit of temperature rise etc., shall be furnished at the time of Detail Engineering

**16.07 Isolators and Earth Switches shall be capable of withstanding the dynamic and thermic effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.**

**16.08** The contacts shall rest on a Aluminium/Teflon block and with initial tension. Suitable device shall be provided to prevent dashing. Fabrication, welding etc., shall be done in suitable jig to avoid deviations during production.

16.09 The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals, i.e., after every 1000 operations or after 5 years whichever is earlier.

### **17.0. JAW AND FIST MECHANISM :**

17.01. For 400 KV Isolators with Centre break AB Switches (With Jaw and Fist mechanism) & For 400kV, 230kV & 110 KV (with turn and twist mechanism) shall be provided with adequate locking to avoid opening or loosening by wind, short circuit force etc., on moving blade. The springs shall be made out of stainless steel or phosphor bronze or any other superior quality material to have adequate strength and resilience and shall be encased with grease to avoid exposure to rain. The clamps and plates be made out of at least 16 mm thick M.S. Plate or flat. Fasteners with nylock nuts shall be used wherever necessary. Vulnerable parts shall be fabricated by tubular gas cutting and milling. The entire mechanism shall be fabricated in suitable jig and template to avoid deviations during production.

17.02. All live parts shall be designed to have smooth surfaces without any sharp points edges and other corona producing surfaces so as to eliminate corona at specified extinction voltage or 1.1 x rated voltage, if extinction voltage is not specified.

### **18.0 FASTENERS :**

Fasteners shall be hot dip galvanized conforming to relevant IS. Fasteners/ Bolts and Nuts of size less than 16 mm shall be Hot Dip Galvanised Electroplated as per Relevant IS.

### **19.0 BEARINGS :**

19.01 Tapered roller bearing for rotating insulator stacks and thrust ball bearing guides for operating handle shall be provided.

19.02 The design and construction of the various bearings should embody all the features required to withstand the climatic conditions specified to ensure dependable and effective operation, even after long period of inaction .

19.03 Rotating insulators shall be mounted on a housing with bearings. The housing for insulators shall be made of gravity die cast metal with smooth surfaces and suitably machined for seating the bearings. Two nos. of bearings with adequate shaft diameter and distance between the bearings shall be provided to avoid wobbling during operations. The bearings shall be of **reputed** make and lubricated for life. All other friction locations shall be provided with suitable bearings or stainless or brass bushes. The bearings

bushes, joints, springs, etc. shall be so designed that no lubrication shall be required during the service. Complete details of bearings, bushes, housing, greasing, etc., shall be furnished with tender.

**20.0. EARTHING :**

Flexible copper connections with a adequate area cross section shall be provided between rotating earth blades and the frame which shall have a cross section of at least 75 mm square and shall be tinned or suitably treated against corrosion.

The frame of each isolator and earthing switch shall be provided with two reliable earthing terminals for connection to the purchaser's earthing conductor/flat and also clamping screw suitable for carrying specified short time current. Flexible ground connectors shall be provided for connecting operating handle to the earthing flat. The diameter of clamping screw shall be at least 12 mm. The connection point shall be marked with earth symbol.

**21.0. ASSEMBLY :**

The Isolator shall be fully assembled at the works of the tenderer. Typical operation shall be carried out on each type of fully assembled disconnector to ascertain that all parts fit correctly and function satisfactorily.

**22.0. CONTROL CABINET :**

The control cabinet of the operating mechanism shall be made out of 3 mm thick sheet steel or 10 mm thick Aluminium plate or casting. Hinged door shall be provided with pad locking arrangement. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type of gasket shall be provided to ensure degree of protection of at least IP55 as per IS: 2147. The cabinet shall be suitable for mounting on support structure with adjustment for vertical, horizontal and longitudinal alignment. Details of these arrangements shall be furnished along with the offer.

**23.0. GEAR :**

The Isolators may be required to operate occasionally, with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet this requirement. The gears shall be made out of Aluminium bronze or any other better material and lubricated for life with graphite or better quality non draining and non hardening type grease. Wherever necessary automatic relieving mechanism shall be provided. Complete details of components, material, grade, self lubricating arrangement, grade of lubricants, details of jig, fixtures and devices used for quality check shall be furnished.

**24.0. GLAND PLATE AND GLANDS :**

Two removable gland plates with twelve (12) knockout of 3 different diameters shall be provided with each operating mechanism for terminating all cables.

#### **25.0. CONTROL CIRCUITS :**

25.01 Control device shall store OPEN and CLOSE command even if the corresponding switch is momentarily pressed until the command is fully executed and the components get de energized after execution.

25.02 Auxiliary switch shall not be used as limit switch. Details of make, rating and type of limit switch shall be furnished in the offer.

#### **26.0. SPACE HEATERS :**

Space heater suitable for 1 phase, 240 V AC supply shall be provided in the mechanism box to prevent condensation

#### **26.0. TERMINAL BLOCK AND WIRINGS :**

27.01. Operating mechanism shall be provided with 1100 V grade stud type terminal block. All auxiliary switches, interlocks and other terminals shall be wired up to terminal block. The terminal block shall have at least 20% extra terminals. All wiring shall be carried out with 1100 V grade insulated 2.5 Sq.mm copper wires as per IS 1554 of latest issue.

27.02. All wiring shall be provided with suitable identifying PVC or other plastic ferrules at the end. All the terminal marking shall be indelible preferably engraved. The ends of wires shall be provided with tinned terminal spade crimped on to the wires.

27.03. No joints shall be provided in the wiring. All spare contacts of relays, push buttons, auxiliary switches etc., shall be wired up to the terminal blocks in the mechanism box.

27.04. Insulating barriers shall be provided between adjacent connections.

27.05. All relays, contact and other electrical devices mounted in the panel shall have name plates with a rating data and manufacturer's name, etc. suitable identification Labels shall also be provided for control switches, push button, terminal block, auxiliary switches and fuses etc. including position indications of isolators/earthing switch.

#### **28.0. DUTY REQUIREMENTS.**

28.01 Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.

28.01 The earth switches wherever provided shall be constructionally interlocked so that the earth switches can be operated only when the Isolator is open and vice-versa. The constructional interlocks shall be built-in construction of isolator and shall be in addition to the electrical interlocks provided in the operating mechanism.

28.02 In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of fail safe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range stipulated in this specification.

28.03 The isolator shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminals of each pole of isolator on account of make/break operation.

28.04 Isolator and earth switches shall be able to bear on the terminals the total forces including wind loading and electrodynamic forces on the attached conductor without impairing reliability or current carrying capacity. A factor of safety of 2 shall be used in all design.

28.05 The isolator shall be capable of making/breaking magnetizing current of 0.7A at 0.15 power factor and capacitive current of 0.7A at 0.15 power factor at rated voltage.

#### **29.0. INTERIOR ILLUMINATION :**

A switch, HRC fuse and holder suitable for a 240 V lamp shall be provided in the mechanism box.

#### **30.0. POWER SOCKET :**

A 1 Phase 240 V 15 A power socket and switch shall be provided in the mechanism box.

#### **31.0. CONTROL AND AUXILIARY SUPPLY :**

A 3 Phase switch with MCB fuses for phases and link for neutral shall be provided for power supply and a 2 way switch MCB fuses shall be provided for control supply in the motor operated mechanism.

#### **31.0. ACCESSORIES:**

The following accessories, including but not limited to, shall be supplied.

#### **31.01 Position Indicator :**

A position indicating device shall be provided for each isolator/earthing switch, irrespective of whether the isolating distance is visible or not.

**31.02 Grounding Pads :**

Each pole of the isolator shall be provided with two grounding pads of non-corrodible material at opposite ends, braced to the channel base. Flexible copper ground connectors shall be provided for connecting operating handles of isolators and earthing switches to the grounding system.

**31.03 Pad locking device :**

The isolator and earthing switch shall be provided with padlocking device to permit locking of the isolator and earthing switch in both fully open and fully closed positions.

**31.04 Earthing switch or Grounding Blades :**

When specified, earthing switch or grounding blade shall form an integral part of each pole of isolator. Two independent ground terminations, with flexible blades and suitable connectors for the specified size of earth conductor leads, shall be provided at the hinged end of the switch.

**31.5 Counter balance :**

These shall be provided, where required, for counter balancing the isolators to prevent impact at the end of travel both on opening and closing of the isolator/earthing switch. The springs shall be of non-rusting alloy.

**32.0 INSPECTION OF BOUGHT OUT ITEMS:**

The BHEL reserves the right to insist for witnessing the acceptance/ routine testing of the bought out items as well as carrying out factory inspection of their sub-vendors .

Complete address with name of contact person, Phone No. etc., of their sub-vendors and items including MOM Boxes manufactured by their sub-vendor shall be furnished without fail. It is the responsibility of the Supplier to make available the bought out items and provide facility for inspection of the same at their sub-vendor's factory.

**33.0. SIZE AND DIMENSIONS :**

The sizes and dimensions of fixed, moving contacts, Base channel, Tandem and operating pipes etc. shall be as per the latest IS or IEC and based on the design of the manufacturer. The drawings giving the dimensional details shall be furnished during detailed engineering. The Successful tenderer has to submit the drawings for the approval of the purchaser within 15 days of receipt of the order.

**34.0. NAME PLATE:**

A weather proof and corrosion proof name plate shall be provided on isolators, earthing switches and operation devices. It shall be mounted in such a position that it is visible in the position of normal service and installation.

**35.0. PAINING , GALVANISING AND CLIMATE PROOFING :**

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

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

35.2 All ferrous parts such as structural steel, pipes, rods levers, linkages, nuts and bolts used in other than current path etc. shall be hot dip galvanized. Galvanisation shall be done after completion of fabrication which shall be capable to prevent corrosion in view of the severe climatic conditions. Thickness of zinc coating shall not be less than 610 gm of zinc per sq. meter of surface Zinc coating shall be smooth, clean and of uniform thickness and free from defect. Preparation of galvanising and the galvanising itself shall not adversely affect the mechanical properties of the coated material. The quality shall be established by tests, as per IS-2633. Galvanising of nuts and bolts shall be carried out by centrifugal or suitable process so that the bolts will easily fit into the tapped holes/ nuts.

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

35.4 Complete details of painting, galvanising and climate proofing of the equipment shall be furnished in the offer.

**36.0. SUPPORTING STRUCTURE: (NOT IN BIDDER'S SCOPE)**

Tubular/Lattice type Steel Supporting structures for isolator and earthing switches are included in the scope of supply.

The vendor shall furnish detailed dimensioned drawings indicating weights and all fixing details and relative locations of chassis, operating mechanism box and operating handles. Final responsibility for ensuring that mounting and supporting arrangements of isolator are proper and that there is no interference of any part of the isolator with supporting

structures will rest with the vendor. The foundation drawings for the equipments to be supplied shall be furnished by the vendor for approval.

**37.0. TESTS AND TEST CERTIFICATES :**

**37.01. Type Tests :**

Sl.No	Details of Type Test
1)	Short Time withstand and Peak withstand Current Tests for Main Switch & Earth Switch
2)	Resistance Measurement & Temperature Rise Test of Main Circuit. (After Short Time Withstand Current and Peak Withstand Current Tests)
3)	High Voltage Tests
4)	Mechanical Endurance Test for Main Switch and Earth Switch

The above Type Tests and all other Type Tests should have been conducted as per IEC-62271. Drawing approval will be given only after acceptance of Type Test Reports in full shape.

37.02. The original type test certificates shall be furnished for verification on request.

37.03.

For any change in the design/type, already type tested and the design/type offered against this specification the purchaser reserves the right to demand, repetition of tests without any extra cost.

37.04. During the type test the disconnecter shall be mounted on its own support

structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure, if any, and mounting arrangement made for type tests shall be furnished for purchaser's reference.

37.05. All routine tests as specified in IS 9921 of the latest issue shall be carried

out on each switch and the test results shall be furnished for approval.

37.06. Manufacturer's test certificate in respect of all materials as specified in IS 9921 of the latest issue and elsewhere in the specification shall be furnished in triplicate.

- 37.07. In addition to the above tests, the purchaser reserves the right of carrying out at site such tests as he may decide upon. Such additional test shall be carried out at the purchaser's cost.
- 37.08. The entire equipment shall after erection be run for 60 days under normal operating conditions. Any defects discovered during this period shall be rectified free of all charges to the purchaser. The equipments should be set properly and demonstrated to function correctly.
- 37.09. Test certificate furnishing the results of routine tests as per appropriate Indian Standard Specification should be forwarded for the equipment before dispatching the materials. The equipments will be rejected, if the test results are not satisfactory.
- 37.10 BHEL/TANTRANSCO reserves the rights to have the Acceptance Tests as specified in IS 9921 of the latest issue.
- 37.11 Test certificates and documents of the following, items shall be furnished at the time of routine/acceptance tests:
- a) Chemical analysis test certificate of copper of electrolytic grade.
  - b) Aluminum
  - c) Terminal connectors - (Not applicable)
  - d) Pipes
  - e) Test reports for steel used for Isolator
  - f) Any other items(List to be furnished by the tenderer)
  - g) Test Reports for motor, relay, switches, Timer, Overload/Single Phase Preventer Relay etc.,
- The purchaser may at his discretion request additional test certificates for other items as reasonably required to substantiate the quality of the same. Such tests, if required, shall be done by supplier at no extra cost.

**38.0.** Clause Deleted

**39.0. LIST OF DRAWINGS AND DOCUMENTS:**(To be submitted at the time of detailed engg)

The tenderer shall furnish the following with his offer without fail.

- a) Drawing for MOM Boxes
- b) Type test reports
- c) Test reports, literature, pamphlets of the bought out items and raw materials.
- d) Others (Tenderer to specify)

**PRINCIPAL TECHNICAL PARAMETERS OF  
420 KV ISOLATORS**

SNo.	TECHNICAL PARAMETERS	SPECIFICATION
1	Rated Frequency (Hz)	50
2	System Neutral Earthing	Effectively Earthed
3	No. of Phases (Poles)	3
4	Temperature Rise	As per relevant IS/ IEC Publication
5	Safe Duration of overload: a) 150% of rated current. a) 120% of rated current.	5 minutes 30 minutes
6	Suitable for :- Rated voltage (KV rms) Frequency (Hz)	420 50
7	Type of disconnect (AB)	Centre Break Horizontal / <i>Double Break</i>
8	Rated normal current (Amp.rms)	3150
9	Rated short time withstand current of disconnects and earthing switches for one sec. duration (KA rms)	63
10	Rated dynamic withstand current (KA)	157.5
11	Rated short circuit current of Earth Break (KA peak).	100
12	<b>Rated insulation level:</b>	
12.1	1.2/50 micro second lightning impulse withstand voltage (+ve or -ve polarity) a) To earth (KVp) b) Across the open disconnect voltage applied to. i) One terminal, lightning impulse (KVp) ii) Opposite terminal, power frequency (KVp)	1425  1425 240
12.2	250/2500 micro seconds switching impulse with stand voltage a) To earth (KVp) b) Across terminals of open disconnect	1050

	(KV rms) i) One terminal, switching impulse (KVp). ii) Opposite terminal subjected to power frequency voltage (KV rms)	900 345
12.3	Rated 1 minute power frequency with stand voltage (KV rms)  a. To earth KV (rms) b. Across terminals of open disconnect	520 610
13	Minimum creepage distance of support and rotating insulator (mm)	10500
14	<b>Rated Mechanical Terminal Load :</b>	
14.1	For two column horizontal break disconnect a. Straight load (N) b. Across load (N)	1600 530
14.2	For pantograph disconnect a. Straight load (N) b. Across load (N)	2000 800
15	Rated magnetising/ capacitive current make and break capacity (Amp.rms)	0.7
16	Rated contact zone for P.G. isolator when fixed contacts are supported on flexible conductors. a) Horizontal deflection (Metres) b) Vertical deflection (Metres) c) Total amplitude of longitudinal movement with respect to support conductor (Meters)	0.5 0.3 0.4
17	Phase to Phase spacing for installation (mm)	7000
18	Minimum clearance (mm): a) Phase to earth b) Phase to Phase	3500 4000
19	Height of centre line of terminal pad above ground level (mm)	8200
20	Maximum radio interference voltage at 1 MHz and 1.1 x rated phase to earth voltage (micro volts)	500
21	Minimum corona extinction voltage (KV rms)	320
22	Rating of auxiliary contacts.	10A at 220V DC with breaking capacity of 2 A DC with time constant not less than 20 millisecond.
23	Seismic level (Horizontal Acceleration)	0.3 g
24	Operating time	12 sec. or less.

<b>S.No.</b>	<b>Technical parameters</b>	<b>420 kV</b>
25	Number of auxiliary contacts on isolator/pole	15NO+15NC + 2MBB
26	Number of auxiliary contacts on earth switch/pole	15NO+15NC
27	No. of terminals block in control cabinet	All contacts and control circuits are to be wired upto control cabinet plus 20% Extra evenly distributed spare TB
28	No. of TBs on Isolator in the terminal strip provided for Master pole (to be used for interpole cabling)	50
29	No. of TBs on Earth Switch in the terminal strip provided for Master pole (to be used for interpole cabling)	40
30	Terminal Blocks shall be suitable for 4X25 Sqmm Ar. Alu. Cable	

**PRINCIPAL TECHNICAL PARAMETERS  
OF ISOLATORS**

SNo.	Item	245 KV	132 KV
1	Rated Frequency (Hz)	50	
2	System Neutral Earthing	Effectively Earthed	
3	No. of Phases (Poles)	3	
4	Temperature Rise	As per relevant IS/IEC Publication	
5	Suitable for:- Rated Voltage (kV rms) Frequency (Hz)	245 50	145 50
6	Type of disconnect (AB)	Double Break (DB) /	Double Break (DB)
7	Rated normal current (Amp.rms)	2000	2000
8	Rated short time with stand current of disconnects and earthing switches Duration (KA rms)	40 KA for 3 sec.	40 KA for 3 sec
9	Rated peak withstand current (kA)	100	100
10	Rated short circuit current of Earth Break (kA peak).	100	100
11	Rated insulation level:		
11.1	1.2/50 micro second lightning impulse withstand voltage (+ve or -ve polarity) a) To earth (kVp) b) Across insulating distance: One terminal subjected to lightning impulse (kVp) and opposite terminal subjected to power frequency (kV rms) Voltage	1050 1200	650 750
11.2	Rated 1 minute power frequency with stand voltage (kV rms)	460	275
12	Minimum creepage distance of	6125	3500

SNo.	Item	245 KV	132 KV
	support and rotating insulator (mm)		
13	Rated Mechanical Terminal Load for two column horizontal break disconnect a) Straight load (N) b) Across load (N)	800 270	- -
14	Rated magnetizing/ capacitive current make and break capacity (Amp.rms)	0.7	0.5
15	Phase to Phase spacing for installation (mm)	4000	2800
16	Minimum clearance (mm): c) Phase to earth d) Phase to Phase	2150 3500	1075 2500
17	Height of center line of terminal pad above ground level (mm)	7000	4600
18	Maximum radio interference voltage at 1 MHz and 1.1 x rated phase to earth voltage (micro Volts)	500	-
19	Minimum corona extinction voltage (kV RMS)	176	-
20	Rating of auxiliary contacts.	10A at 220V DC with breaking capacity of 2 A DC with time constant not less than 20 millisecond.	-

<b>S.No.</b>	<b>Technical parameters</b>	<b>220kV</b>	<b>132 kV</b>
20	Number of auxiliary contacts on isolator/pole	15NO+15NC + 2MBB	15NO+15NC + 2MBB
21	Number of auxiliary contacts on earth switch/pole	15NO+15NC	15NO+15NC
22	No. of terminals block in control cabinet	All contacts and control circuits are to be wired upto control cabinet plus 20% Extra evenly distributed spare TB	All contacts and control circuits are to be wired upto control cabinet plus 20% Extra evenly distributed spare TB
23	No. of TBs on Isolator in the terminal strip provided for Master pole (to be used for interpole cabling)	40	40
24	No. of TBs on Earth Switch in the terminal strip provided for Master pole (to be used for interpole cabling)	40	40
25	Terminal Blocks shall be suitable for 4X25 Sqmm Ar. Alu. Cable		

**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 50° 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 drawing 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
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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	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.

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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

Signature of the authorized representative of

Date

Bidder's name .....

Designation .....

Company seal .....

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## 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 ISOLATORS**

- TANTRANSCO datasheet for Isolators as attached.

### 420 KV ISOLATOR

Sl. No	Description	420KV ISOLATORS	
		With Earth	With Out Earth
01	Manufacturer's Name		
02	Manufacturer's Type and Designation		
03	Standard to which equipment conforms		
04	Rated Voltage KV		
05	Maximum design voltage at which the isolator can operate KV		
06	De rating factor, if any, for specified test conditions		
07	Current rating. (Main & Earth Switch)  a) Continuous current A b) Dynamic Current KA c) Three seconds short time Current		
08	Safe duration of over Load		
	a) 150% of rated Current		
	b) 120% of rated current		
09	Capacity to interrupt magnetizing current A		
10	Capacity to interrupt line charging Current A		
11	Maximum Temperature :		
	a) Of current carrying parts when carrying rated continuous current Degree C		
	b) Ambient temperature (Maximum/Average for which (a) is applicable) Degree C		
12	Number of Poles		
13	Operation :		
	a) Main Switch b) Earth Switch		
14	Number of breaks per circuit per pole		
	a) Main Switch b) Earth Switch		

15	Total Length of break per pole (min. air dist., across the isolating distance) mm		
16	<b>Insulation Level :</b>		
	a) Dry one Min. power frequency withstand Voltage		
	i) Across isolating distance : KV rms		
	ii) To earth & between poles : KV rms		
	b) Wet one min. power frequency withstand voltage.		
	i) Across isolating distance : KV rms		
	ii) To earth & between poles : KV rms		
	c) 1.2/50 micro second impulse withstand voltage		
	i) Across isolating distance : KV peak		
ii) To earth & between poles : KV peak			
17	<b>Earthing Switch</b>		
	a) Rated current carrying capacity : Amps		
	b) Short time current rating		
	i) 3 – Seconds : KA		
	ii) Peak withstand : KA		
18	<b>Switch contacts</b>		
	a) Type of contacts		
	i) Fixed contacts		
	ii) Moving contacts		
	b) Material		
	i) Fixed contacts		
	ii) Moving contacts		
	c) Area of contacts : Sq.mm		
	d) Whether contacts are silver plated		
	e) Thickness of silver coating		
	f) Contact pressure		
g) No. of operation isolator can make without deterioration of contacts.			

19	<b>Contact Support</b>	
	i) Material and size of channel	
	ii) Material and size of plate	
20	<b>Type of Operating Mechanism</b>	
	a) Manual Operation Isolator	
	i) Type (Reduction Gear Type)	
	ii) Type of the operating handle hinge pin from ground level.	
21	<b>Bearing</b>	
	<b>Rotating insulator stool and operating guide</b>	
	a) (i) Location	
	ii) Type	
	iii) Qty. of Bearings	
	iv) Size provided	
	v) Bearing No.	
	b) Material and size of housing	
	c) No. of bushes, Joints, location & size	
	d) Make of Bearing	
22	<b>Operating GI pipe</b>	
	i) <b>Tandem Pipe :</b>	
	a) Class of G.I. Pipe	
	b) No. of Pipes	
	c) Wall thickness of G.I. Pipe	
	d) Dia of tandem G.I. Pipe : mm	
	e) Size of shackle and screw	
	f) No. of Clamp and material and size	
	ii) <b>Down Pipe :</b>	
	a) Class of G.I. Pipe	
b) Wall thickness		
c) Dia. of down Pipe		
iii) <b>Type of Joint :</b>		
a) Between rotating stool bearing and down pipe		
b) Between down pipe and operating mechanism		
23	<b>Type and Material of Isolator terminals</b>	
24	<b>Type and material of terminal connectors, where applicable</b>	
25	<b>Motor details :</b>	

	1. Rated voltage 2. Rated current 3. Type of Motor 4. Conforming to IS 5. Other details		
26	Type of Interlock		
27	Type of Switch base		
28	Maximum torsional strength Kg.m		
29	Maximum bending strength that will be subjected on the post insulator on the opening and closing of isolator		
30	<u>Rated Mechanical terminal loads</u> i) Straight Load NKg. ii) Cross Load NKg.		
31	Nuts and Bolts		
	a) Size, Material and Grade in live parts.		
	b) Size, Material and Grade in other parts.		
	c) Whether hot dip galvanised d) Conforming to IS.		
32	Insulator base plate		
	a) Material and size of elevator plate below fixed insulator		
	b) Material and size of stud & bolts		
	c) Material & size of rotating insulator base plate		
33	Clearance :		
	a) Between live parts and ground		
	b) Between Poles		
	c) Between live parts and earth		
	d) Between live parts when the switch is open		
	i) On the same pole ii) between adjacent pole		
e) Between fixed contacts and blade in open position.			
34	Phase spacing		

35	Radio interference voltage at 1 MHZ and at 1.1 times rates phase to earth voltage micro volts.	
36	Minimum corona extinction voltage (KV RMS)	
37	Rating of auxiliary contacts.	
38	Seismic acceleration	
39	Operating time	
40	Torque required to operate the gang operated isolator Kg-m.	
41	Terminal Stud	
	a) Dimensional drawing No.	
	b) Whether horizontal or vertical	
	c) Diameter (mm)	
	d) Length	
	e) TPI, if threaded	
42	a) Clamp boy	
	i) Alloy Composition	
	ii) Plating of if any	
	b) Bolts	
	i) Alloy Composition	
	ii) Tensile Strength	
	c) Types of washers used	
	d) Range of diameter or conductors that can be received	
	e) Maximum temperature rise when carrying rated current at 45° C ambient temperature	
	f) Weight of each type of clamp kg.	
43	Indication mechanism for position of switch Control Cabinet :	
	a) Material	
	b) Thickness	
	c) Degree of Protection	
	d) Cable Glands	
	i) Type	
	ii) Size	
	iii) No.	
	e) Whether removable gland plate provided.	
44	Gear	
	a) Make	

	b) Type		
	c) Rating		
	d) Quantity		
	e) Other details.		
45	Switch Design		
	a) Rotating/Tilting/Lifting Insulator b) Horizontal/Vertical Break		
46	Operating Mechanism- Reciprocating/Torsional		
47	BASE		
	a) Constructional feature		
	b) Size of Steel section used (mm)		
	c) Overall size (mm)		
	d) Total Weight (Kg.)		
48	Actual Dimensions of switch per phase		
49	Weight of the Isolator in Kgs.		
	a) Weight of Steel Parts		
	b) Weight of Copper Parts		
	c) Weight of G.I. Pipes		
	d) Weight of other Parts		
	e) Total Weight of one Isolator.		
50	Dimensions of Switch L X B X H Metre		
51	Shipping dimensions of largest package Metres		
52	No. of AB Switches that can be manufactured per shift per day.		

**245KV/132KV AB Switches**

SL. NO	DESCRIPTION	245 KV Double Break Centre Rotating motor operated AB switches with tubler/lattice support structure		132 KV Double Break Centre Rotating motor operated AB switches with tubler/lattice support structure	
		WOE	WE	WOE	WE
01	Manufacturer's Name & Address				
02	Manufacturer's Type and Designation				
03	Standard to which equipment conforms				
04	Rated Voltage KV				
05	Maximum design voltage at which the isolator can operate KV				
06	Derating factor, if any, for specified test conditions				
07	Current rating.  a) Continuous current A b) Dynamic Current KA c) <b>Three</b> seconds short time Current 40KA				
08	Safe duration of over load a. 150% of rated current b. 120% of rated current				
09	Capacity to interrupt magnetizing current A				
10	Capacity to interrupt line charging Current A				
11	Maximum Temperature :  a) Of current carrying parts when carrying rated continuous current Degree C  b) Ambient temperature (Maximum/Average for which (a) is applicable) Degree C				
12	Number of Poles				
13	Operation : d) Main Switch ii) Earth Switch				

14	Number of breaks per circuit per pole i) Main Switch ii) Earth Switch				
15	Total Length of break per pole (min. air dist., across the isolating distance) mm				
16	Insulation Level : a) Dry one Min. power frequency withstand voltage i) Across isolating distance : KV rms. ii) To earth & between poles : KV rms.  b) Wet one Min. Power Frequency Withstand Voltage. i) Across isolating distance : KV rms. ii) To earth & between poles : KV rms.  c) 1.2/50 micro second impulse withstand voltage i) Across isolating distance : KV peak ii) To earth & between poles : KV peak				
17	<u>Switch contacts</u> Type of Contacts for Main Switch/Earth a) Switch a) Type of contacts i) Fixed contacts ii) Moving contacts b) Material i) Fixed contacts ii) Moving contacts c) Area of contacts : Sq.mm d) Whether contacts are silver plated e) Thickness of silver coating f) Contact pressure g) No. of operation isolator can make without deterioration of contacts.				
18	<u>Earthing Switch</u> a. Current Carrying Capacity - Amps				
19	<b>Contact support</b> i) Material and size of channel ii) Material and size of plate				

20	<p><b>Clearance</b></p> <p>i) Between Poles</p> <p>19.0 Between Live Parts and Earth</p> <p>20.0 Between fixed contact &amp; blade in open position.</p> <p>Minimum clearance between live parts when switch is open.</p> <p>20.1 On the same pole</p> <p>20.2 Between adjacent pole.</p>				
21	<p>Type of operating mechanism</p> <p>a) Manual operation Isolator.</p> <p>i) Type (Reduction gear type)</p> <p>ii) Type of the operating handle hinge pin from ground level.</p>				
22	<p>Bearing</p> <p><u>Rotating Insulating stack &amp; Operating Guide</u></p> <p>a) (i) Location</p> <p>(viii) Type</p> <p>(ix) Qty. of bearings</p> <p>(x) Size.</p> <p>(xi) Bearing No.</p> <p>b) Material and size of housing</p> <p>c) No. of bushes, joints, location &amp; size</p> <p>d) Make of bearing ( Reputed makes. Tenderer to specify.)</p>				



32	<b>Insulator base plate</b> a) Material and size of elevator plate below fixed insulator b) Material and size of stud & bolts c) Material & size of rotating insulator base plate				
33	<b>Phase spacing</b>				
34	<b>Terminal Stud :</b> a) Dimensional Drawing No. b) Whether Horizontal or Vertical c) Diameter (mm) d) Length e) TPI, if threaded.				
35	<b>Clamp Body :</b> a) (i) Alloy Composition (ii) Plating, if any b) Bolts : (i) Alloy Composition (ii) Tensile Strength c) Types of Washers used d) Range of diameter of conductors that can be received. e) Maximum temperature rise when carrying rated current at 45 Degree C ambient temperature. f) Weight of each type of clamp Kg.				
36	<b>Indication mechanism for position of switch</b>				
37	<b>Motor Details</b> 1.1. Rated Voltage 1.2. Rated Current 1.3. Type of Motor 1.4. Confirming to IS 1.5. Other Details.				



**SECTION-5**  
**TECHNICAL CHECK LIST FOR ISOLATORS / EARTHING SWITCHES**  
 (INFORMATION TO BE FURNISHED WITH OFFER)

BIDDERS ARE INSTRUCTED TO

- WRITE 'YES' UNDER COLUMN 'Confirmation', IF THE INFORMATION / SCHEDULE IS FURNISHED / ENCLOSED WITH THE OFFER, OR
- WRITE 'NO' UNDER COLUMN 'Confirmation', IF THE INFORMATION / SCHEDULE IS NOT FURNISHED / ENCLOSED WITH THE OFFER, OR
- WRITE 'NOT APPLICABLE (NA)' UNDER COLUMN 'Confirmation', IF THE INFORMATION / QUERY / SCHEDULE IS NOT RELEVANT TO THEM, AND
- RETURN THIS CHECKLIST AS THE PART OF THE OFFER DULY SIGNED BY THEM.

SN.	Parameters	Specified Requirement		Confirmation
1	Rated Voltage (KV)	420KV	245KV 132KV	
2	Type of Isolator	HCB(Al)/HCB(Cu)/ HDB(Al)/HDB(Cu)	Double Break Double Break	
3	Standard applicable for isolators and earthing switches	IEC:62271-102 (2001-12), IS:9921		
4	Rated Current Under site conditions (A) at 50° C ambient-	3150A	2000A 2000A	
5	Rated short time withstand Current of Isolator and Earth switch	63kA for 1 Sec	40kA for 3 Sec 40kA for 3 Sec	

6	Rated dynamic short circuit withstand Current of Isolator and Earth switch	157.5kAp	100kAp	100kAp
7	Rated frequency (Hz)	50		
8	Number of poles	3		
9	Phase to phase spacing(mm)	7000	4000	2800
10	Whether all 3 poles are ganged	Electrically	Mechanically	Mechanically
11	Opening time of isolator and earth switch (Sec.)	Less than 12		
12	Closing time of isolator (Sec.)	Less than 12		
13	Temperature rise over 50° C ambient temperature corresponding to maximum continuous current (°C)	As per IEC-62271-102 or table-IV of IS: 9921-II		
14	Seismic Acceleration	0.3 g		
15	Dielectric withstand capacity of completely assembled isolator/isolator and earth switch			
15.1	One minute dry power freq. Withstand test voltage(KV rms)			

	i. against ground (KV rms)	520	460	275	
	ii. Across isolating distance (KV rms.)	610	530	315	
15.2	1.2/50 micro's impulse withstand test voltage				
	i. Against ground (KVP)	±1425	±1050	±650	
	ii. Across isolating distance (KVP) -	±1425(240)	±1200	±750	
15.3	250/2500 micro sec. switching surge withstand test voltage (dry & wet)				
	i. Against ground (KVP) -	±1050	-	-	
	ii. Across isolating distance (KVP)	±900(345)	-	-	
16	Corona extinction voltage (KV rms) -	320	176	-	
17	Radio interference level at 1.1 Ur/√3 (in micro volts at 1.0 MHz)	500	500	-	

18	Min creepage distance of support & rotating insulator (mm) – ( 25 mm/kV)	10500	6125	3500	
19	Operating Mechanism for Isolator	Motor/Manual	Motor/Manual	Motor/Manual	
20	Operating Mechanism for Earth Switches	Motor/Manual	Manual	Manual	
21	Whether constructional interlock between Isolator & Earth switch provided	YES			
22	Whether interlock between Isolator & Earth switch provided	Mechanical & Electrical			
23	Arrangement provided to prevent electrical or manual operation unless interlock conditions are satisfied	YES			

24	Rated Mechanical Terminal Load i) Straight Load(N) ii) Across Load(N)	1600 530	800 270	- -	
25	Whether interlock coil is continuously rated	YES			
26	Rated DC control voltage and variation allowed	220V DC(80%-110%)			
27	Material of contacts	Hard drawn electrolytic copper and the surface shall be silver plated			
28	Thickness of silver plating of contacts	25 micron			
29a)	Number of auxiliary contacts on isolator/pole	15NO + 15 NC + 2MBB	15NO + 15 NC + 2MBB	15NO + 15NC + 2MBB	
29b)	Number of auxiliary contacts on earth switch/pole	15 NO + 15NC	15 NO + 15NC	15 NO + 15NC	
29c)	No. of TBs on Isolator in the terminal strip provided for Master pole (to be used for interpole cabling)	50	40	40	

29c)	No. of TBs on Earth Switch in the terminal strip provided for Master pole (to be used for interpole cabling)	40	40	40	
30	Rating of Auxiliary contacts	10 A at 220 V DC			
31	Rated DC breaking current of Auxiliary contacts with time constant not less than 20 ms (A)	2A			
32	Material of Current carrying parts	Copper/ Al (only for 420kV)			
	Material of Arm	Hard drawn electrolytic copper & contact surface shall be heavily silver-plated. For 420kV, Al is also acceptable with contact surface heavily silver plated.			
	Material of Terminal Pads	Hard Drawn Electrolytic Copper/ Al			
33	Current Density Hollow tube sections	Copper : 2.0 Amps/ Sq. mm   Aluminium: 1.0 Amps/Sq. mm (Except Earth Switch moving Contact)			
	Other Sections	Copper : 2.0 Amps/ Sq. mm.			
	Terminal Pad	Aluminium : 1.0 Amps/Sq. mm   Copper: 2.0 Amps/Sq. mm			
34	Height of the centre line of Terminal Pad above ground level	8200	7000	4600	

35	Min Clearance (mm) i) Phase to earth ii) Phase to phase	3500 4000	2150 3500	1075 2500	
36	Capability of Isolator for making and breaking the magnetizing/capacitive currents	0.7 A at 0.15 power factor	0.7 A at 0.15 power factor	0.7 A at 0.15 power factor	
37	All valid Type test reports as per Clause No. 4 of section-1 & Clause No. 37 of section-2 of this specifications , available	Yes, available			
<b>CONTROL CABINETS</b>					
38	Application	Outdoor			
39	Material of control cabinet sheet	Painted sheet steel/ Aluminium Plate			
40	Thickness of sheet (mm)	Aluminium: 10mm Sheet Steel: 3mm			
41	Degree of protection provided	IP55			

	Standard applicable for control cabinet	As per relevant IS/IEC	
43	Whether Hot Dip Galvanised	YES/No	
44	Colour shade of finish paint of control cabinet as per IS : 5	Paint shade No.697 of IS:5.	
45	Size of Conductor used in Control Wiring of control cabinet	2.5 sq.mm	
46	20 % Spare Terminal Blocks provided in control cabinet	YES	
47	Terminal Blocks shall be suitable for 4X25 Sqmm Ar. Alu. Cable	YES	
48	Confirm to follow the	Confirmed	
	BHEL/Customer MQP		
49	<b>Following accessories not limited to this is included in scope or not:</b>		

<b>A</b>	<b>Hardware for Structure (BHEL supply) to Base Channel (vendor supply)</b>	<b>YES</b>	
<b>B</b>	<b>Hardware for Base Channel (vendor supply) to Bottom of Post Insulator (BHEL supply*)</b>	<b>YES</b>	
<b>C</b>	<b>Hardware for Top BPI (BHEL supply*) to Male/Female Member</b>	<b>YES</b>	
<b>D</b>	<b>Hardware for Structure (BHEL supply) to MOM Box</b>	<b>YES</b>	
<b>E</b>	<b>Hardware for Structure (BHEL supply) to Earth Switch MOM</b>	<b>YES</b>	
<b>F</b>	<b>Terminal Connectors</b>	<b>NO</b>	
<b>G</b>	<b>Support Insulators (3 Nos. post insulators if 420kV HDB Isolator is offered.)</b>	<b>YES</b>	
<b>H</b>	<b>Support Structure</b>	<b>NO</b>	

<p>'*' in case of Bidder Quoting for 420kV HDB isolator, the bidder has to include 3 No. centre post rotating Insulators with each isolator in the scope of supply. The details of insulator (given in Annexure-2) should match with BHEL supplied insulator. Applicable only for 420kV Double Break Isolator &amp; not for 245 &amp; 132kV Isolators.</p>	
<b>Date:</b>	
<b>Place:</b>	(Signature of the authorized representative of Bidder / Firm / Company)
<b>Phone:</b>	<b>Name:</b>
<b>Fax:</b>	<b>Designation:</b>
<b>E-mail:</b>	<b>Company Seal:</b>
<b>Mobile:</b>	
<b>Website:</b>	