BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-394-316-110	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	SK	SK	RS/DM
TITLE				SIGN			
400 kV ISOLATORS				DATE	18.09.17	19/09/17	
				GROUP	TBEM	W.O. No	86009
CUSTOMER	Tamilnadu Transmission Corporation Limited (TANTRANSCO)						
PROJECTS	765/400kV AIS S/S Ariyalur						

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
				Distribution	*TBMM*	*TBQM*	*TBCM*	*TBTS*
				Copies	-	-	01	-

CHECKLIST FOR TECHNICAL EVALUATION

Along with the Technical Bids of the offers, the Bidder should submit this checklist confirming the inclusion of the enclosures as listed below. (Shall tick as ✓)

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted as per BOQ OF SECTION-1	
2.	Schedule of Technical Deviation format duly signed.	
3.	Supporting documents as asked in the Technical PQR.(Annexure-A)	
4.	Checklist of Technical parameters as per Section-5 duly filled and signed.	
5.	Compliance to Technical Specification	

NOTE:- If the Bidder fails to submit any of the documents as asked in the above check list, their bid is likely to be rejected / not evaluated.

The above checklist is verified for:-

NIT Ref No. :

Name of Equipment :

Name of Project :

Name of Bidder :

Signed with Seal of Bidder.

Date .....

ANNEXURE- A

TECHNICAL REQUIREMENT

Name of Project: - 765/400kV AIS S/S ARIYALUR **Name Of Item** : - 400kV Isolators

Sr. No	Technical Requirement	Supporting documents	Reference of attached documents
1.	The manufacturer(s) whose Isolator(s) are offered, should have manufactured, type tested (as per IEC/IS) for specified fault level (i.e. 40kA or above fault level for 345kV voltage class) and supplied 345kV or above class Isolator, which are in satisfactory operation* for at least two (2) years as on the date of award of contract (i.e. 31.03.2017). OR	1 .Bidder to Provide Compliance/Confirmation of fulfilling SL No.1 Technical Requirement. 2. Performance certificate /Letter /MOM etc. issued by end customer for Satisfactory operation 3. PO Copy 4. Inspection/ dispatch clearance 5. LR details 6. Commissioning Report/ Handing over Documents Etc.	
2.	400kV Isolator may also be offered from the manufacturer, who have established production line in India and have manufactured & type tested (as per IEC/IS) for specified fault level (i.e. 40kA or above fault level for 345kV voltage class) 345KV or above class Isolator manufactured in their Indian works, which are in satisfactory operation* as on the date of award of contract(i.e. 31.03.2017). In case the above Isolator is not in satisfactory operation* for two (2) years as	1 .Bidder to Provide Compliance/Confirmation of fulfilling Sl. No.2 of Technical Requirement. 2. Performance certificate /Letter /MOM etc. issued by end customer for Satisfactory operation. 3. PO Copy Bidder	

TECHNICAL REQUIREMENT

	on the date of award of contract (i.e. 31.03.2017), the contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the Isolators. This performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor. * Satisfactory operation means certificate issued by the Employer certifying the operation Without any adverse remark.	4. Inspection/ dispatch clearance Bidder 5. LR details Bidder 6. Commissioning Report/ Handing over document 7. Confirmation of Performance Guarantee of 10% of the ex-works of Cost of isolator . Etc.	

Signed with Seal of Bidder.

Date .....

SECTION-1
SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1.1 SCOPE-

This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch and supervision of erection and commissioning of 400kV Isolators (double break type) and earth switches complete with accessories but without support insulators, terminal connectors and structure to site.

This section covers the specific technical requirements, scope and quantities. The specific technical requirements for the above item as specified by the TANTRANSCO are given in Section-2A & 2B. The offered equipment shall also comply with the general technical requirements for the project as detailed under section-3 of this specification.

400kV Isolators is required for the following project:

Name of the Customer : **Tamilnadu Transmission Corporation Limited (TANTRANSCO)**
Name of the Project : **765/400kV AIS S/S Ariyalur**

This specification comprises of following sections:
Section-1: Scope, Specific Technical Requirements & Bill of Quantities
Section-2A: Amendment of Technical Specification of Isolator
Section-2B : Technical Specification of Isolator
Section-3 : Project Details & General Technical Requirements
Section-4 : Guaranteed Technical Particulars
Section-5 : Technical Checklist
In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

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

1.2 SPECIFIC TECHNICAL REQUIREMENTS-

All equipment's shall perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.

Technical parameters

1	Rated voltage (kV, rms)	**400**
2	Highest system voltage(kV)	420
3	Rated insulation levels:	
a	Full wave lightning impulse withstand voltage (1.2/50 micro sec.)	
	- between line terminals and ground	± 1425 kVp
	- between terminals with isolator open	± 1425 kVp impulse on one terminal and 240 kVp power freq. voltage of opposite polarity on other terminal
b	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	

	- between line terminals and ground	± 1050 kVp
	- between terminals with isolator open	900 kVp impulse on one terminal and 345 kVp power freq. voltage of opposite polarity on other terminal
c	One minute power frequency dry and wet withstand voltage	
	- between line terminals and ground	520 kV rms
	- between terminals with isolator open	610 kV rms
4	corona extinction voltage (kV rms) with isolator in all positions	320 (min)
5	Max. radio interference Voltage (micro-volts) at 1 MHz and 1.1 X rated phase to earth voltage	500
6	Minimum creepage distance	10500
7	Phase to phase spacing (mm) (min)	**6000**
8	Rated short time withstand Current of Isolator and earth switch	**63 kA for 1 Sec**
9	Rated dynamic short circuit withstand Current of isolator and earth switch	157.5kAP
10	Rated short circuit current of earth break(kA peak)	100
11	Operating mechanism of Isolator and earth switch	**AC Motor operated and manual**
12	Rated normal current	**3150A rms**
13	Plinth height from ground level(mm)	300
14	Center-line of busbar for equipment connection from the base of support structure (plinth level) in mm	**8000/11300**
15	Rated frequency (Hz)	50
16	No. of poles	3
17	Design Ambient Temperature (°C)	50
18	System neutral earthing	Effectively Earthed
19	Seismic acceleration	0.3g horizontal
20	Thermal Rating of auxiliary contracts	10 A at 220 V DC
21	Breaking capacity of auxiliary contacts	2 A DC with circuit Time constant of not less than 20 ms
22	Temperature rise over design Ambient temperature	As per relevant IS/IEC
23	Rated mechanical Terminal load for two column horizontal break disconnect (a) Straight load (N) (b) Across load (N)	 (a) 1600 (b) 630
24	Type	**Outdoor, HDB**
25	Min. No. of auxiliary contacts On each isolator (For 400kV)	Besides requirement of this spec., the bidder shall wire up 10 NO +10 NC +2 MBB to TBs for purchaser's future use
26	Min. No. of auxiliary contacts On each earthing switch (For 400kV Earth Switch)	Besides requirement of this spec., the bidder shall wire up 10 NO +10 NC to TBs for purchaser's future use
27	Operating time for Isolators	12 Sec or less

28	Number of terminals in Control cabinet **(inter-pole Cabling shall be supplied By BHEL)**	(1) All contacts and control circuits are to be wired upto control cabinet including potential free auxiliary contacts of Isolator/Earth switch. (2) Additional 24 nos. evenly distributed spare TBs in Master to be provided for interpole cabling of Auxiliary contacts (employer's use). (3) Sufficient TBs shall be provided in control cabinet for looping of AC supply from master to follower of Isolator and earth switch.
29	TB size & Type	(1) TBs shall be stud type (2) Power Cable-Each TBs Should be Suitable for terminating two wires of 10 Sq. mm size on each side (3) Control cable- Each TBs Should be Suitable for terminating two wires of 2.5 Sq. mm size on each side or extra TB to be provided.
30	Local remote switch indication of Isolator for Substation Automation system (SAS)	**Yes**
31	Support structure of Isolator	Lattice type

Proposed insulator for 400kV isolator

Sl. No.	**Parameter**	**420**
1.	Total minimum creepage distance in mm (i.e. 25 mm/kV)	10500
2.	Cantilever strength of Insulator in kg	800
3.	Height of insulator in mm	3650
4.	Top PCD in mm	127
5.	No. of holes on top	4X M16
6.	Bottom PCD in mm	300
7.	No. of holes on bottom	8 X 18 dia.

1.3 BILL OF QUANTITIES-

1.3.1 Main Items

Sl. No	**Description**	**Unit**	**Quantity**
1.	420 kV, 3150 A, **3 phase, 63 kA for 1 sec, double break** type isolator (individual pole operated motorized and electrically ganged) **with one Earth switch** (individual pole operated motorized and electrically ganged) with operating mechanism alongwith with all accessories but without support insulator , structure & terminal connectors. Distance between Center-line of busbar for equipment connection and plinth level is **8000 mm**.	Set	26
2.	420 kV, 3150 A, **3 phase, 63 kA for 1 sec, double break** type isolator (individual pole operated motorized and electrically ganged) **with one Earth switch** (individual pole operated motorized and electrically ganged) with operating mechanism alongwith with all accessories but without support insulator , structure & terminal connectors. Distance between Center-line of busbar for equipment connection and plinth level is **11300 mm.**	Set	2

3.	420 kV, 3150 A, **3 phase, 63 kA for 1 sec, double break** type isolator (individual pole operated motorized and electrically ganged) **with two Earth switch (** individual pole operated motorized and electrically ganged) with operating mechanism alongwith with all accessories but without support insulator , structure & terminal connectors. Distance between Center-line of busbar for equipment connection and plinth level is **8000 mm.**	Set	12
4.	Supervision of Erection testing and commissioning including checking of alignment of all supplied Isolators and earth switches	Lot	1
5.	Flexible braided copper alongwith lugs for earthing as per note no. 3 (1 set is equal to 420kV , 3 phase isolator with 1 earth switch/two earth switch)	set	40

NOTE:

1. Total quantity may vary upto ±25% at contract stage.
2. Isolator blade /arm shall be made from hard drawn electrolyte **copper /Aluminium**.
3. Flexible braided copper of adequate capacity for earthing between bottom of rotating support post insulator and 75x12 mm MS flat running on channel shall be in Bidder scope (refer attached annexure-1 for detailed of flexible copper earthing). Required lugs for connection of flexible copper braided at both end shall be in Bidder scope. The sizing calculation of flexible copper braided shall be submitted by the Bidder during detailed engineering stage. 75x12 mm MS flat shall be in BHEL scope.
4. Fixing hardware of earthing flat (i.e. 75X12 mm /50x8 mm MS flat) to MOM box and isolator shall be in bidder scope(refer attached Annexure-1 for earthing details of Isolators and MOM BOX) .
5. Terminal pad /stud of isolator shall be suitable for quad Bersimis ACSR conductor /4.0 " Al tube .
6. All the support insulators, terminal connectors and support structure will be supplied by BHEL.
7. Each disconnecting switch shall be supplied with mounting hardware and any other accessories as may be required for fixing the disconnecting switch with structure for the satisfactory erection /operation of the Isolator.
8. Inter pole cables and glands shall be supplied by BHEL.
9. Prices for accessories of Isolators shall be included in the equipment prices.
10. It may be noted that disconnecting switch and Isolator both are same meaning.
11. Fixing hardware of Isolators and MOM box on structure shall be in Bidder scope.

1.3.2 Mandatory Spares-

Sl. No	Description	Unit	Quantity
1.	420 kV, 3150 A, **3 phase, 63 kA for 1 sec, double break** type isolator (individual pole operated motorized and electrically ganged) **with two Earth switch (** individual pole operated motorized and electrically ganged) with operating mechanism alongwith with all accessories but without support insulator , structure & terminal connectors. Distance between Center-line of busbar for equipment connection and plinth level is **8000 mm.**	Set	1
2.	Flexible braided copper alongwith lugs for earthing as per note no. 3 (1 set is equal to 420kV , 3 phase isolator with 1 earth switch/two earth switch)	Set	1

1.4 TECHNICAL REQUIREMENT OF 400kV ISOLATORS -

1.4.1 The manufacturer(s) whose Isolator(s) are offered, should have manufactured, type tested (as per IEC/IS) for specified fault level (i.e. 40kA or above fault level for 345kV voltage class) and supplied 345kV or above class Isolator, which are in satisfactory operation* for at least two (2) years as on the date of award of contract (i.e. 31.03.2017).

OR

1.4.2 Isolator may also be offered from the manufacturer, who have established production line in India and have manufactured & type tested (as per IEC/IS) for specified fault level (i.e. 40kA or above fault level for 345kV voltage class) 345KV or above class Isolator manufactured in their Indian works, which are in satisfactory operation* as on the date of award of contract(i.e. 31.03.2017). In case the above Isolator is not in satisfactory operation* for two (2) years as on the date of award of contract (i.e. 31.03.2017), the contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the Isolators. This performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor.

Note:

* Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remarks.

1.5 TYPE TESTING -

Bidder shall submit valid type test reports (As per relevant IEC/IS standard) for the tests carried out within last five years **from the date of opening of the tender** (i.e. 30.09.2016). The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 5 years old (from the date of opening of the tender **i.e. 30.09.2016**) or the reports of type tests are found to be technically unacceptable , the type test shall be conducted by the vendor without cost and delivery implication to BHEL. The type test if conducted shall be witnessed by BHEL/Customer.

1.6 QUALITY PLAN-

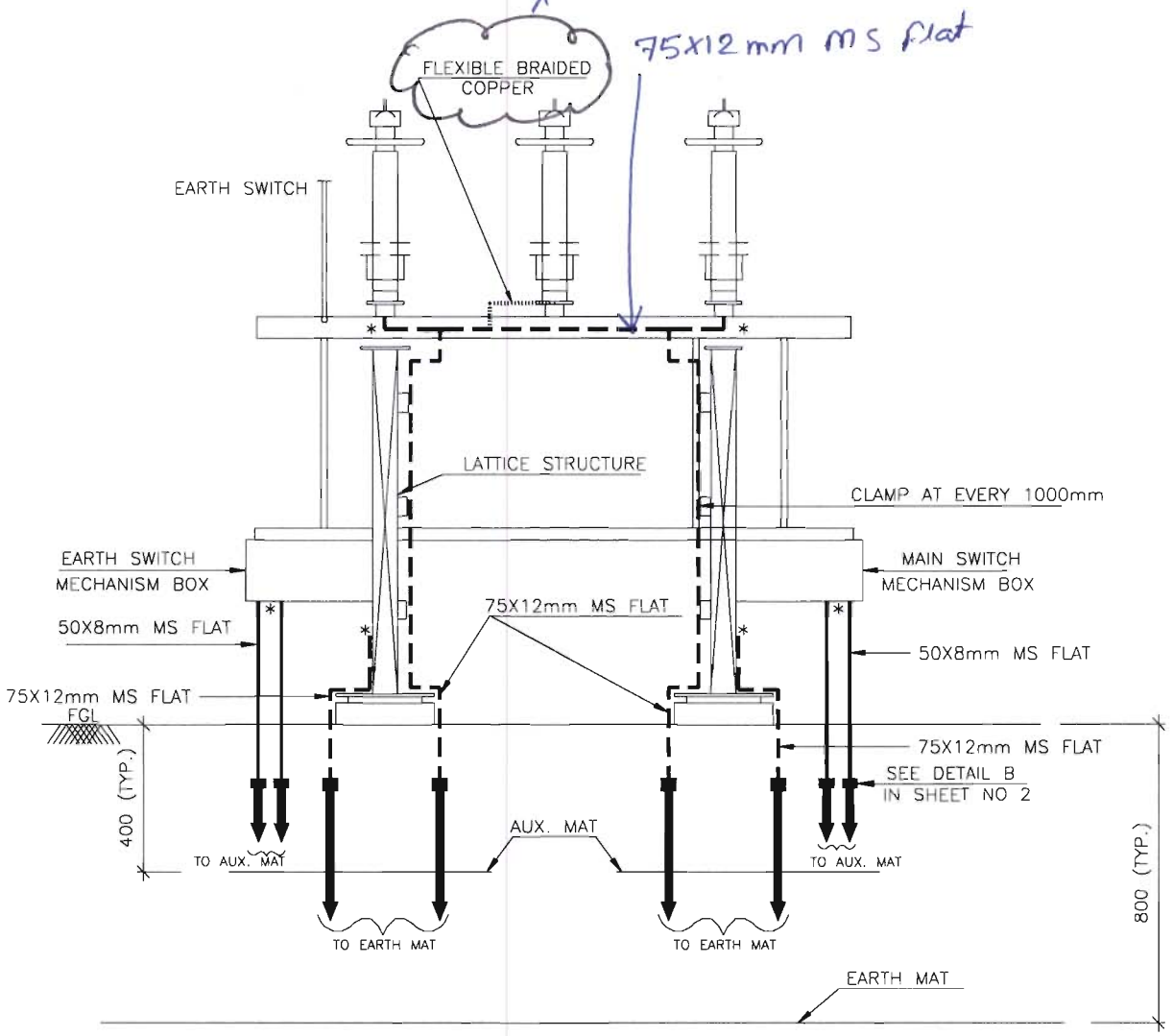
The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval within 1 week of P.O. placement.

1.7 SUPERVISION OF ERECTION, TESTING & COMMISSIONING-

Bidder shall quote charges for supervision of erection, testing & commissioning of all offered isolator and earth switch. Field test Reports of Isolators and Earth switches should be signed by supplier's representative. BHEL site will inform the supplier regarding readiness of site. Bidder may have to visit site multiple times depending on the readiness of site.

Annexure-1

IN SCOPE OF BIDDER



NOTES

1. AUXILIARY EARTH MAT SHALL BE PROVIDED BELOW EVERY MOM BOX (REFER SHEET 11).
2. NO. OF RISERS FOR ISOLATOR = 4 NOS. PER PHASE.
3. NO. OF RISERS FOR MAIN SWITCH MECHANISM BOX = 2 NOS. PER BOX.
4. NO. OF RISERS FOR EARTH SWITCH MECHANISM BOX = 2 NOS. PER BOX.
5. * BOLTED JOINTS.
6. NO. OF AUXILIARY EARTHMAT = 1 No. FOR EACH MECHANISM BOX.
7. NO. OF AUXILIARY EARTHMAT & MECHANISM BOX IS INDICATIVE ONLY. IT SHALL BE EXECUTED AS PER ACTUAL NUMBER/POSITION OF MECHANISM BOX.
8. Flexible braided copper between bottom of rotating post insulator and 75x12mm MS flat shall be in Bidder scope. Required Lugs for connection of flexible braided copper at both end shall be in Bidder scope.

BHEL

EQUIPMENT & STRUCTURE EARTHING DETAILS

400KV/22kV HDB

ISOLATOR & EARTH SWITCH (TYPICAL)

COMPUTERREF.NO.	DRG. No.	REV.	SHEET No.
	TB-4-394-316-012	01	7

Saad Alam

	PACKAGE NAME		765/400KV AIS SUBSTATION AT ARIYALUR	
	CLIENT		TANTRANSCO	
SL. NO.	VOLUME/SECTION	CLAUSE/DRAWING NO.	BIDDER'S QUERY	CLIENT'S REPLY
17	SLD & Electrical layout of Ariyalur 765/400kV Substation		As per the referred layout, Space for 2 dia's are provided on either side of 400kV ICT2-Tie-Pugalur-#1 Diameter where as in the SLD it is not shown. Please clarify.	Shall be decided during detailed engineering.
18	Electrical layout of Ariyalur 765/400kV Substation		As per the layout, two switchyard panel rooms are indicated for each diameter. As per standard practice, we presume that only one switchyard panel room shall be provided for each diameter. Please clarify.	One switch yard panel room per dia is to be provided
19	Electrical layout of Ariyalur 765/400kV Substation		We presume transmission line side stringing hardware are excluded from our scope of work. Please confirm.	Yes,transmission line side stringing hardware are excluded from scope of work,but termination hardware are included
20	400kV Circuit breaker		We presume, all the 400kV Circuit breakers are without PIR & CSD. Please confirm.	Confirmed
21	Section-8 - Isolator, Endurance Class		Please specify the Mechanical Endurance class for Isolator (765kV & 400kV).	765kv/400kv isolators shall be of mechanical endurance class M2 type as per IEC 62271-102
22	BPI for Isolator		We presume the cantilever strength of BPI used for isolator shall be 8kN for both 765kV & 400kV system. Kindly confirm.	As per IEC
23	765kV & 400kV BPI Quantity		We presume the quantity mentioned in BPS for bus post insulator is inclusive of Isolator BPI also. Kindly confirm.	Insulators required for isolators are covered in the scope of isolators
24	Earthmat software		In the specified clause, the earthmat and earthing design shall be prepared by design software like CDEGS. We presume that earthmat and earthing design shall also be prepared by other softwares like ETAP, CYMGRID etc. Kindly confirm.	standard software taking into account multilayered soil resistivity for earthmat calculation/design shall be adopted

Please read section-8 as section 2B

SECTION-2A

Sl.No	Section / Page	Clause No	Customer Specification Requirement	Recommendation/Query/ Comment	Justification	TANTRANSCO REPLY
9	Section – 08 (page 397)	Cl. 7	Terminal pads shall be hard drawn electrolytic copper flats.	We request to accept terminal pads of Aluminum.	Terminal pads shall be of Aluminum Alloy material suitable to carry rated & short time current. We have already carried the temperature rise test successfully with Aluminum. We request to accept.	As per specification for 400 KV isolators. For 765KV isolators all current carrying parts shall be made from high conductivity electrolytic copper/aluminium.
10	Section – 08 (page 398)	Clause - 8	For 800 & 420 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.	For 800kV disconnector are with individually pole operated mechanism for main blade & earth switch hence they are electrically ganged operated only. There will be no mechanically gang operation for 800KV isolators and we request to please confirm.		For 800 & 420 KV AB Switches each phase shall be suitable for both manual & Electrical operation.Manual operation by individually and ganged electrically. Please refer Annexure IV

Please read section-08 as section-2B

Sl.No	Section / Page	Clause No	Customer Specification Requirement	Recommendation/Query/ Comment	Justification	TANTRANSCO REPLY
12	Section – 08 (page 401)	clause 15.03	The Earthing switch shall be capable of making on a dead short circuit without damage or endangering the operator.	The Earthing Switch will not be capable to make short circuit currents. Such duties in AIS Disconnector may damage not only equipment but also endangers the safety of operating personnel. Hence we request to confirm deletion of this clause.		As per specification
13	Section - 08 (page 401)	clause 16.02 & 16.05	The isolator blades/arms shall be made from tubular section of hard drawn electrolytic copper.	We request to confirm acceptance of isolator blades/arms of of Cu/AL in line with your clause no. 3.01 of specification.		Blade/Arm: shall be made from high conductivity electrolytic copper/aluminium.

Please read section-8 as section-2B

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

2.Reactor Oil

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

V.SECTION 05(CURRENT TRANSFORMER):

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

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

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

VI.SECTION 06(SURGE ARRESTORS):

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

VII.SECTION 08(ISOLATORS):

1.Isolater Terminal Pads

a)As per specification for 400 KV isolators.

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

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

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

SECTION – 2B

ISOLATOR

1.0 SCOPE:

This scope covers for design, manufacture, inspection, testing before dispatch, packing and delivery of Isolators ~~800 KV &~~ 420KV along with all accessories & terminal connector.

2.0. STANDARDS:

Unless otherwise specified elsewhere in the specification, the Isolators to the latest revisions and amendments thereof the IS:3156 and IEC62271-102 Standards.

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

ISOLATORS :-

SL. NO	SPECIFICATION NO.	DESCRIPTION
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(partii)	Insulators

3.0 The 800/420 KV Outdoor Isolators offered shall be as detailed below:

3.01) 800 kV,50 Cycles, 3150 Amps Isolators shall be outdoor, off-load type and isolator design shall be copper/Al double break or vertical break or knee-type.

Earth switches shall beprovided on isolators wherever called for, with possibility of being mounted on any side of the isolator.

3.02)420 KV, 50 Cycles, 3150 Amps, upright mounted, copper/Al horizontal centre break/ horizontal double break, 3 pole motor operated switches with ground blade (Single or Double blade)

3.03)Each phase of Isolators and earth switch to be electrically operated individually and suitable for gang operation electrically. Motor shall be suitable for operation at 3 phases 50 cycles.

3.04)Complete isolator with all the necessary items for successful operation shallbe supplied including but not limited to the following:

3.05) Isolator assembled with complete Support Insulators, operating rod insulator, base frame, linkages, operating mechanism, control cabinet, interlocks etc.

3.06) All necessary parts to provide a complete and operable isolator installation,control parts and other devices whether specifically called for herein or not.

3.07) The isolator shall be designed for use in the geographic and meteorologicalconditions.

4.0 DESIGN :

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

4.02 The short time current rating of the switch shall be ~~50 kA(rms) for 1 sec for 800 KV system and~~ 63 KA (rms) for one second for 420 KV system. The rated peak short circuit current shall be 2.5 times the rated short time withstand current.

4.03 The switches shall be capable of being operated by control voltage of 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.

4.04 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.

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) For 800 kV Insulator: (For Isolator)

Top PCD = 225 mm

No. of holes = 4 x 18mm dia.

Bottom PCD = 356 mm

No. of holes = 8 x 18mm dia.

b) For 420 kV Insulator: (For Isolator), Cantilever strength = 800kg

Top PCD = 127 mm

No. of holes = 4 x M16

Bottom PCD = 300 mm

No. of holes = 8 x 18 dia

Total height of support insulator - 3650mm

5.2 INSULATORS: Insulator required for the switches is included in the scope of supply. -(NOT IN SCOPE)

6.0 POWER TERMINAL CONNECTORS : (NOT IN 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 Quad AAC Bull or / 4.5" Aluminium Bus Bar Rigid/ expansion type as per site requirements for 800 KV & for 420 KV terminal connectors suitable to receive 4" Aluminium busbar & Quad Bersimis 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 flats. All electrical parts should be of adequate cross section to handle the designed rated current safely.

8.0 OPERATING MECHANISM :

8.01 For ~~800 &~~ 420 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.

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

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

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

8.05 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 :

a) Local remote transfer switch

b) Control switch (for local closing and opening)
c) Limit switches to prevent over-travel both in the closing and opening position.
d) The interlock to cut off the supply to the operating motor when operated manually.
e) Facility for the remote indication of failure of A.C. supply.
f) Illumination for the mechanism box.
g) Mechanical ON/OFF indication.
h) Electrical Lamp ON/OFF indication on the operating pipe.
i) Space heater.
j) Auxiliary contacts

8.06 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.

8.07 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.

8.08 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.

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

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

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

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

9.0 EARTHING DEVICE (Wherever Applicable):

9.01.One earthing switch per pole forming an integral part of the line

disconnecting switch and electrically and manually operated shall be

supplied.

9.02. The earthing switches shall be constructionally interlocked with the isolator so that the earthing 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.

Suitable mechanical arrangement shall be provided for delinking electrical drive for manual operation

9.03.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

9.04.For ~~800/~~ 420 KV Isolators both Single Earth and Double Earth switch should be electrically operated. Necessary arrangement should be made for Manual operation also. Earthing switches shall be only locally operated

9.05. Isolator design shall be such as to permit addition of earth switches at a

future date. It should be possible to interchange position of earth switch to either side.

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

10.0 AUXILIARY SWITCHES :

10.1 The earthing devices and air disconnecting switches shall be equipped with an auxiliary switch designed for both 220 D.C. Operation. The auxiliary switch shall be equipped with 10 "normally open" and 10 "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.

10.2 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.

10.3 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.

10.4 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 ~~765~~/400 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 elsewhere in the Specification.

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 4.02. 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 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). 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 in manufacture of any

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.

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 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 I.I 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 in action.

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 disconnect 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.

28.04Isolator and earth switches shall be able to bear on the terminals the total forces including wind loading and electrodynamics 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.

31.05 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 purchaser 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 before finalising the tender. 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 in the tender offer. 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. PAINTING , GALVANISING AND CLIMATE PROOFING :

35.01 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 phospating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable stoving and air drying before final painting, Colour of the final paints shall be of shade No.697 of IS:5. The finally painted cubicle shall present aesthetically pleasing appearance, free from any dent or uneven surface.

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

35.02 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.

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

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

36.0. SUPPORTING STRUCTURE: (NOT IN 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 test should have been conducted not earlier than five years (5 years) as on the date of submission. 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. If warranted, the purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative at no extra cost. 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 disconnector 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 The 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
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. ERECTION :

The Erection, inter pole wiring with necessary cable and allied accessories, co ordination for testing and Commissioning of the equipments is also included in the scope of the vendor.

39.0. LIST OF DRAWINGS AND DOCUMENTS:

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

OUTDOOR 420 KV ISOLATORS

SNo.	TECHNICAL PARAMETERS	SPECIFICATION
1	Rated voltage(KV)	400
2	Highest system voltage(KV)	420
3	Rated normal current (Amp.rms)	3150
4	Rated Frequency (Hz)	50
5	System Neutral Earthing	Effectively Earthed
6	No. of Phases (Poles)	3
7	Temperature Rise	As per relevant IS/ IEC Publication
8	Safe Duration of overload: a) 150% of rated current. b) 120% of rated current.	 5 minutes 30 minutes
9	Operating mechanism	AC motor operated & manual
10	Type of disconnect (AB)	~~Centre Break Horizontal /~~ Double break horizontal
11	Rated short time withstand current of disconnects and earthing switches for one sec. duration (KA rms)	63 KA 1 sec
12	Rated dynamic withstand current (KA)	157.5
13	Rated short circuit current of Earth Break (KA peak).	100
14 14.1	**Rated insulation level:** 1.2/50 micro second lightning impulse withstand voltage (+ve or -ve polarity) a) To earth (KVp) b) Across the open disconnect voltage	 1425

	applied to. i) One terminal, lightning impulse (KVp) ii) Opposite terminal, power frequency (KVp)	 1425 240
14.2	250/2500 micro seconds switching impulse with stand voltage a) To earth (KVp) b) Across terminals of open disconnect (KV rms) i) One terminal, switching impulse (KVp). ii) Opposite terminal subjected to power frequency voltage (KV rms)	 1050 900 345
14.3	Rated 1 minute power frequency with stand voltage (KV rms) c. To earth KV (rms) d. Across terminals of open disconnect	 520 610
15	Minimum creepage distance of support and rotating insulator (mm)	10500
16 16.1	**Rated Mechanical Terminal Load :** For two column horizontal break disconnect a. Straight load (N) b. Across load (N)	 1600 530
16.2	For pantograph disconnect a. Straight load (N)	

	b. Across load (N)	2000 800
17	Rated magnetising/ capacitive current make and break capacity (Amp.rms)	0.7
18	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
19	Phase to Phase spacing for installation (mm)	~~7000~~ 6000
20	Minimum clearance (mm): a) Phase to earth b) Phase to Phase	 3500 4000
21	Height of centre line of terminal pad above ~~ground level (mm)~~ FGL (mm)	~~8200~~ 8350/11300
22	Maximum radio interference voltage at 1 MHz and 1.1 x rated phase to earth voltage (micro volts)	500
23	Minimum corona extinction voltage (KV rms)	320
24	Rating of auxiliary contacts.	10A at 220V DC with breaking capacity of 2 A DC with time constant not less than 20 millisecond.
25	Seismic level (Horizontal Acceleration)	0.3 g
26	Operating time	12 sec. or less.

** ** **

SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

3.0 FOREWORD

The provisions under this section are intended to supplement general requirements for the materials, equipment's and services covered under other sections.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a) Customer : M/s Tamil Nadu Transmission Corporation Limited

b) Project Title : 765/400KV AIS SUB STATION AT ARIYALUR

c) Transport facilities : Road/Rail

Physical and other parameters:

3.1.1 Location of the substation

3.1.2 Nearest Railway station : Tindivanam
Railway : Southern Railway

3.1.3 Meteorological data

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

(xii) Basic Wind Speed : **39 m/s (Zone -2)**

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

3.1.4 System Parameter

SL No	Description of parameters	765kV System	400 kV System
1.	System operating Voltage	765kV	400k V
2.	Maximum operating voltage of the system(rms)	800kV	420k V
3.	Rated Frequency	50HZ	50H
4.	Number of Phases	3	3
5.	Rated Insulation Levels (i)Full wave impulse withstand voltage.(1.2 to 50 micro sec) (ii)Switching impulse withstand voltage(250/2500 micro sec) dry and wet. (iii) One minute power frequency dry withstand voltage (rms)frequency dry withstand voltage (rms)	 2100kVp 1550kVp 830kV	 1550kVp 1050kVp 630kV
6.	Corona extinction voltage	508kV	320kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV,and 266kV rms for 400kV system	2500 microvolts	1000 microvolts
8.	Minimum creepage distance (25mm/kV)	20000 mm	10500 mm
9.	Rated short circuit current for 1 sec. Duration	50kA	63kA
10.	System neutral earthing	Effectively earthed	Effectively earthed
11.	Seismic acceleration	0.3g horizontal	0.3g horizontal
12.	Plinth level of switchyard	300mm above FGL	300mm above FGL

3.1.5 AUXILIARY POWER SUPPLY :

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

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

3.2 GENERAL REQUIREMENT

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

3.2.1 The bidder shall also furnish drawings for the following:

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

3.2.2 **GENERAL**:

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

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

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

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

3.3 SPECIFIC REQUIREMENT

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

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

3.4 STANDARD:

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

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

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

3.5 TYPE TEST:

The Type Test for all the equipments/materials used for this project should have been conducted in any approved Government/Govt. recognized laboratories conforming to latest IS/IEC. The above type test certificates should accompany the drawings of the materials equipments, duly signed under seal by the Institution, who have issued the type test certificate. The above type test should have been conducted not earlier than Ten years , subject to no change in design as on the originally scheduled date of technical bid opening i.e. **30.09.2016**

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

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

3.6 MATERIALS AND WORKMANSHIP:

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

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

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

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

3.7 **INSPECTION** :

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

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

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

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

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

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

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

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

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

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

3.8 GUARANTEE:

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

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

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

3.9 PRE COMMISSIONING TESTING (if applicable) :-

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

3.10 DOCUMENTATION : All drawings shall conform to relevant international standards Organization (ISO) specification. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. units.

3.11 PAINTING, GALVANISING:

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

All metal surfaces exposed to atmosphere shall be given, in addition to the treatment, two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limits specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external paintings shall be as per shade **No.697/631 of IS-5**.

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

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

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

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

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

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

3.12 SURFACE FINISH

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

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

3.13 PROTECTION

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

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

3.14 FUNGI-STATIC VARNISH

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

3.15 DEGREE OF PROTECTION

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

a) Installed outdoor: IP-55
b) Installed indoor in air conditioned area: IP-42
c) Installed in covered area IP:52
d) For LT switchgear (AC & DC distribution Boards): IP-54

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

3.16 RATING PLATES, NAME PLATES AND LABELS :-

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

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

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

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

Alternately two separate plates one with Hindi and other with English inscriptions may be provided. During approvals drawings of Rating/name plates/labels shall also be submitted.

3.17 EARTHING :

The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate earthing terminals suitable for bolted connection to 50x8mm mild steel flat to be provided for connection to station earth mat.
Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat of Size 75X12 mm. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.18 TERMINAL BLOCKS AND WIRING

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

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

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

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

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

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

each side.

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

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

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

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

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

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

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

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

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

All door, removable covers and plates shall be gasketed all around with suitably profiled Neoprene /EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary

to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

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

3.20 SPACE HEATERS

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

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

3.21 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

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

3.22 INCIDENTAL SERVICES:

The Supplier is required to provide any or all the services broadly outlined in the Technical specification. Any other minor incidental service related to the scope of work like providing necessary assistance whether specifically mentioned or not must be carried out by the Supplier at his own cost. All tools, Tackles Plant etc., required for completion of above works shall be brought by the Supplier.

3.23 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

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

3.24 LIST OF DRAWINGS AND DOCUMENTS :

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

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

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

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

The supplier shall, within 1 weeks of placement of order submit Six sets of final version of all the above drawings for BHEL/TANTRANSCO's approval. The TANTRANSCO shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for TANTRANSCO's approval within two weeks from the date of comments.. However the drawing approval does not absolve the supplier from complying with the terms of the specification.
The following should be supplied to each consignee circle along with the initial supply of equipment's ordered.

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

3.25 **QUALITY ASSURANCE PLAN :**

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

(a) Contact material
(b) Insulation
(c) Porcelain
(d) Sealing material
(e) Contactor, limit switches, etc. in control cabinet.
Name of sub-supplier for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative,

copies of test certificates.

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

The supplier shall submit following information to the TANTRANSCO.

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

3.26 **TEMPERATURE RISE :**

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

3.27 **FITTINGS AND ACCESSORIES :**

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

3.28 PACKING AND FORWARDING:

The equipment shall be packed in crates suitable for vertical/horizontal Transport, as the case may be and suitable to withstand handling transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

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

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

3.29 SPECIFICATION FOR NITRYL BUTYL RUBBER

The gaskets are to be used in tanks exposed to Transformer mineral oil/SF6 at about 110° C.

1. Hardness should be Shore A 70 ± 5.
2. Tensile Strength should be min. 10.8N/sq.mm (Minimum)
3. Elongation strength should be 270% (Minimum)

3.30 APPROVAL PROCEDURE

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

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

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

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer below mention Title block for Submission of Documents.

Title Block

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

3.31 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

Drawings, GTP ,Type Test Reports and List of Past Supplies. Drawings & Documents

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

3.31 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

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

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD-2004 or Later version or any other CAD package along with conversion files for all major items. Final Documentation shall be submitted in bound volumes with details of Customer & Project etc. written on top.

SECTION-4

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS OF 420 KV ISOLATORS/GROUNDING SWITCHES

1. Name and address of the Manufacturer	1. .....
2. Manufacturer's type designation	2. .....
3. Standard applicable	3. .....
4. Rated Voltage **Ur**	4. .....
5. Rated Current under site conditions at 50 deg.C ambient (Amps)	5. .....
6. Rated frequency (Hz)	6. .....
7. Number of poles	7. .....
8. Whether all 3 poles are ganged mechanically	8. YES / NO
9. Pole to pole spacing (mm)	9. .....
10. Rated short time current of isolator and earth switch for 1(one) second and dynamic current	10. .....
11. Opening time of isolator and earth switch	11. .....
12. Closing time of isolator and earth switch	12. .....
13. Rated mechanical terminal load	13. .....
14. Dielectric withstand capacity of completely assembled isolator/ earth switch	14. .....
15. One minute dry power frequency withstand test voltage	15.
i) against ground (kVrms)	i) .....
ii) across isolating distance (kVrms)	ii) .....
16. 1.2/50 micro sec impulse withstand test voltage	16.
i) against ground (kVp)	i) .....
ii) across isolating distance **(**kVp)	ii) .....
17. 250/2500 micro sec switching surge withstand test voltage (dry & wet)	17.
i) against ground (kVp)	i) .....
ii) across isolating distance (kVp)	ii) .....
18. Corona Extinction voltage (kVrms)	18. .....
19. Radio interference level at 1.1 Ur/ root 3 (in micro volts) at 1 MHz	19. .....
20. Operating Mechanism	20.
i) For main blades	i) .....
ii) For earth switches	ii) .....
21. Controls	21.
i) Rated DC control voltage (V)	i) .....
ii) Limits of voltage	ii) .....
22. Constructional Features	22.
i) Main Contacts	i)
a) Type of contacts	a) .....
b) Contact Area (sq. cm)	b) .....
c) Material of contact	c) .....
d) Contact pressure (kg/sq.cm)	d) .....
e) Max. current density under normal current carrying capacity (A/sq.cm)	e) .....

f) Thickness of silver plating (Microns)	f) .....
23. Compliance to Technical specification w.r.t	23.
i) MOM Box	i) YES / NO
ii) Support insulators	ii) YES / NO
iii) Terminal Connectors	iii) YES / NO
24. Whether similar equipment are type tested as per IEC / IS and are in successful operation for at least 2 (two) years	24. YES / NO
25. Overall General Arrangement drawing of Isolator/ Earthswitch is to be enclosed.	25. .....

SECTION -5

TECHNICAL CHECK LIST FOR ISOLATORS / EARTHING SWITCHES

(INFORMATION TO BE FURNISHED WITH OFFER)

BIDDERS ARE INSTRUCTED TO

WRITE **'YES'** UNDER CLOUMN '2', IF THE INFORMATION / SCHEDULE IS FURNISHED / ENCLOSED WITH THE OFFER, **OR**
WRITE **'NO'** UNDER CLOUMN '2', IF THE INFORMATION / SCHEDULE IS NOT FURNISHED / ENCLOSED WITH THE OFFER, **OR**
WRITE **'NOT APPLICABLE (NA)'** UNDER CLOUMN '2', IF THE INFORMATION / QUERY / SCHEDULE IS NOT RELEVANT TO THEM, **AND**

RETURN THIS CHECKLIST AS THE PART OF THE OFFER DULY SIGNED BY THEM.

	ISOLATORS / GROUNDING SWITCHES	1	2	3
S.No.		Specified Requirement	Confirmation Yes/No	Comments, if Col.2 is No
1.	Rated Voltage (KV)	400kV		
2.	Type of Isolator	HDB		
3.	Equipment mounting	Lattice Structure		
4.	Standard applicable for isolators and earthing switches	IEC:62271-102 (2001-12), IS:9921-1985		
5.	Rated Current Under site conditions (A) at 50° C ambient-	3150A		
6.	Rated short time withstand Current of Isolator and Earth switch	63 kA for 1 Sec		
7.	Rated dynamic short circuit withstand Current of Isolator and Earth switch	157.5kAP		
8.	Rated frequency (Hz)	50		
9.	Number of poles	3		
10.	Phase to phase spacing(mm)	6000		
11.	Whether all 3 poles are ganged	Electrically		
12.	Operating time for Isolators	12 Sec or less		
13.	Design Ambient Temperature (°C)	50		
14.	Temperature rise over 50° C ambient temperature corresponding to maximum continuous current (°C)	As per relevant IS/IEC		
15.	Seismic Acceleration	0.3 g		
16	Dielectric withstand capacity of completely assembled isolator/isolator and earth switch for 400kV Isolator			

SECTION -5

TECHNICAL CHECK LIST FOR ISOLATORS / EARTHING SWITCHES

	ISOLATORS / GROUNDING SWITCHES	1	2	3
S.No.		Specified Requirement	Confirmation Yes/No	Comments, if Col.2 is No
16.1	One minute dry & wet power freq. Withstand test voltage(KV rms)			
	i. against ground (KV rms)	520		
	ii. Across isolating distance (KV rms.)	610		
16.2	1.2/50 micro's impulse withstand test voltage (For 400kV Isolator)			
	i. Against ground (KVP)	± 1425 kVp		
	ii. Across isolating distance (KVP) -	± 1425 kVp impulse on one terminal and 240 kVp power freq. voltage of opposite polarity on other terminal		
16.3	250/2500 micro sec. switching surge withstand test voltage (dry & wet)			
	i. Against ground (KVP) -	± 1050 kVp		
	ii. Across isolating distance (KVP)	900 kVp impulse on one terminal and 345 kVp power freq. voltage of opposite polarity on other terminal		
17	Corona extinction voltage (KV rms) –	320		
18.	Total creepage distance to ground (mm) – (25 mm/kV)	10500		
19.	Operating Mechanism for Isolator (electrically ganged)	AC Motor operated and manual		
20.	Operating Mechanism for Earth Switches (electrically ganged)	AC Motor operated and 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	As per cl. No. 1.2 of section -1		

SECTION -5

TECHNICAL CHECK LIST FOR ISOLATORS / EARTHING SWITCHES

	ISOLATORS / GROUNDING SWITCHES	1	2	3
S.No.		Specified Requirement	Confirmation Yes/No	Comments, if Col.2 is No
25.	Whether interlock coil is continuously rated	YES		
26.	Rated DC control voltage and variation allowed	220V DC		
27.	Material of main contacts	Hard drawn electrolytic copper and surface shall be silver plated		
28.	Number of auxiliary contacts on isolator/pole for Owner's use for 400kV	10NO + 10 NC +2MBB		
29.	Number of auxiliary contacts on earth switch/pole for Owner's use for 400kV	10 NO + 10NC		
30.	Rating of Auxiliary contacts	10 A at 220 V DC		
31.	Rated DC breaking current of Auxiliary contacts with 20 ms time constant (A)	2 A		
32.	Rated short circuit current of earth break(kA peak)	100		
33.	Isolator blade /arm shall be made from	**hard drawn electrolyte copper /Aluminium**.		
34.	Support Insulator Cantilever strength (BHEL's scope)	800kg		
35.	Bottom PCD of Insulators	300		
36.	Height of insulator in mm	3650		
37.	Top PCD of Insulators	127		
38.	Capability of Isolator for making and breaking the magnetizing/capacitive currents	0.7 A at 0.15 power factor		
39.	All valid Type test reports not older than 5 years as per cl. No. 1.5 of section -1 , are available	Yes, available		
40.	Center-line of busbar for equipment connection from the base of support structure (plinth level) in mm	8000/11300		
41.	List of special Tools & Tackle	Yes /NA		
	CONTROL CABINETS			
42.	Application	Outdoor		
43.	Degree of protection provided	IP55		

SECTION -5

TECHNICAL CHECK LIST FOR ISOLATORS / EARTHING SWITCHES

	ISOLATORS / GROUNDING SWITCHES	1	2	3
S.No.		Specified Requirement	Confirmation Yes/No	Comments, if Col.2 is No
44.	Standard applicable for control cabinet	IS-5093/IS-8623, IEC-439		
45.	20 % Spare Terminal Blocks provided in control cabinet	YES		
	General			
46.	Each disconnecting switch shall be supplied with mounting hardware and any other accessories as may be required for fixing the disconnecting switch with structure for the satisfactory erection /operation of the Isolator.	YES		
47.	Flexible braided copper of adequate capacity for earthing between bottom of rotating support post insulator and 75x12 mm MS flat running on channel shall be in Bidder scope. Required lugs for connection of flexible copper braided at both end shall be in Bidder scope.	YES		
48.	Conduction of type test (if any)	Free of cost		
49.	Fixing hardware of Isolators and MOM box on structure	Included		
50	Fixing hardware of earthing flat (i.e. 75X12 mm /50x8 mm MS flat) to MOM box and isolator shall be in bidder scope	YES		

Date:
Place:

Phone:
Fax:
E-mail:
Mobile:
Website:

(Signature of the authorized representative of Bidder / Firm / Company)
Name:
Designation:
Company Seal: