BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

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CUSTOMER Doc. No.				NAME	RiS	SK/SKS	
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	400/220/132/33 kV Isolators			DATE	27.08.14		29/1/14
				GROUP	TBEM		
				W.O. No	83012		

CUSTOMER	**MADHYA PRADESH POWER TRANSMISSION LTD.**
PROJECT	**Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turnkey basis (Lot no. 1) Balaghat, Badnawar, Bhopal, Chhegaon and Nagda**

List of Contents

Rev.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	CUSTOMER	TBMM	O/C	
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SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1. SCOPE:-

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 400kV, 220kV, 132kV & 33kV Isolators without support insulators, terminal connectors and structure to site.

This section covers the scope and quantities of 400kV, 220kV, 132kV & 33kV Isolators. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification. For environmental conditions, refer Section-3 carefully.

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.
Section-2: Equipment specifications
Section-3: General technical requirements for all equipments under the project.
Section-4: Guaranteed Technical Particulars

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

The equipment is required for the following projects:

Name of the Customer : Madhya Pradesh Power Transmission Company Ltd.

Name of the Project : Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turnkey basis (Lot no.- 1) - Balaghat, Badnawar, Bhopal, Chhegaon and Nagda

The term 'Owner' appearing in this specification shall refer to MPPTCL, the term 'Purchaser/Employer' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.

2. SPECIFIC TECHNICAL REQUIREMENTS:-

As per Appendix-A of Section-2.

3. BILL OF QUANTITIES:-

As per Annexure-1

4. TYPE TESTING:-

The offered equipments should be fully type tested as per the relevant standards. In case the equipment of the type and design offered, has already been type tested, Bidder shall invariably furnish type test reports from the reputed and approved national/international laboratory/Government approved test houses to prove that specifications of equipments offered conform to the relevant standard.
Test certificates shall clearly indicate the type and model number etc., so that relevant details of offered equipments could be verified. While submitting bids the model and type etc., shall be clearly indicated.

Type test reports furnished with the offer should not pertain to the period earlier than five years from the **date of opening of Bid which is 20.11.13.**

In case the type tests were carried out earlier than five years, the manufacturer will have to conduct these tests, without any commercial & delivery implication to BHEL, before commencement of supply. In both the above cases type test certificate must be submitted with the bid. The Bidders have to submit one complete set of Type Test reports for the offered equipments.
All the tests as per relevant IS/IEC shall be carried out.

5. TECHNICAL QUALIFYING REQUIREMENT :- (only for bidders not covered in approved vendor List of MPPTCL)

5.1. The manufacturer for supply of plant and equipment not covered in approved vendor list of customer should have a minimum experience as specified below for supply of respective item (which must have been type tested) and must be an approved vendor of Electricity Boards/ Power Grid/ Transmission utility or a regular supplier of MPPTCL. The certificate of Electricity Boards/ Power Grid/ Transmission utility towards supply of respective item will have to be submitted by the bidder for obtaining approval of such manufacturer from MPPTCL. The equipment/ material manufactured and supplied should be in operation for a period **of two years** as on the date of Bid opening, **which is 20.11.13,** for which performance report is required to be submitted. The performance

report should be issued within last two years from the date of bid opening. The Performance report issued by the Power Utilities or User Agencies clearly indicating the Order No. & Date, Ordered quantity and the quantity for which the performance report has been issued, shall only be acceptable.

S. No.	Equipment/ Material	Minimum experience required
1.	Power Transformers, 400kV Reactor, 400kV & 220kV SF6 Circuit Breakers, CT, CVT, Isolator, LA, C&R Panels, PT, 36kV Capacitor Bank, Transformer oil, Carrier Cabinet, Protection coupler, Wave Trap, Copper Control and Aluminum Power Cable, Station Batteries, Station Transformer, Transformer oil and 132kV SF6 Circuit Breakers	Five Years as on the date of Bid opening
2.	Other equipments and materials for construction of the Facilities	Three Years as on the date of Bid opening
3.	Equipment/ Material covered in the Bid : Manufacturing Capacity	100% quantity of Equipment/ Material covered in the Bid should have been manufactured & supplied in any one year during the past three years by the manufacturer of that Equipment/ Material covered in the Bid, as on the date of Bid opening
4.	To substantiate above requirement indicated in S. No. 1, 2 & 3, Bidder may please note that the design, type, rating & class of equipments/ material must be similar to the design, type, rating & class or higher rating & class, as specified in the Bid. For substantiating requirement at Sr. no 3, CA certificate is acceptable.	

5.2. In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the manufacturer's authorization, using the form to be provided by BHEL, showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in India. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed above for that item.

6. INSPECTION & TESTING:-

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on equipment in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and MPPTCL in accordance with agreed quality plan with 3 weeks advance information.

7. 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 / MPPTCL approval within 1 week of P.O. placement.

Annexure-1

Bill of Quantities

A. Main Quantity

Sl. no.	PI Description	Unit	Quantity.					Total
			Balaghat	Badnawar	Bhopal	Chhegaon	Nagda	
1	400KV Pantograph Isolators (set of three) with ES (2000A, 40kA for 1s Electrically ganged Motor Operated Isolator with individual manually operated 1 ES)	Set	17	26	2	3	0	**48**
2	400KV Horizontal Centre Break single phase Isolator (set of Three) with ES (2000A, 40kA for 1s Electrically ganged Motor Operated Isolator with individual manually operated 1 ES)	Nos.	4	6	0	0	0	**10**
3	400KV Horizontal Centre Break Isolator without ES (3 ph, 2000A, 40kA for 1s Electrically ganged Motor Operated Isolator)	Nos.	0	0	4	1	3	**8**
4	400KV Horizontal Centre Break Isolator with ES (3 ph, 2000A, 40kA for 1s Electrically ganged Motor Operated Isolator with individual manually operated 2 ES)	Nos.	2	4	0	0	0	**6**
5	220kV Isolator (with E/S) [3 ph, 1250A, 40kA for 1s, HDB Isolator (Mechanically Ganged Manually operated) with 1 ES (Mechanically Ganged Manually operated)]	Nos.	0	4	0	0	0	**4**
6	220kV Isolator (without E/S) [3 ph, 1250A, 40kA for 1s, HDB Isolator (Mechanically Ganged	Nos.	0	27	4	4	0	**35**

	Manually operated)]							
7	132kV Isolator (with E/S) [3 ph, 800A, 40kA for 1s, HDB Isolator (Mechanically Ganged Manually operated) with 1 ES (Mechanically Ganged Manually operated)]	Nos.	4	0	0	0	0	**4**
8	132kV Isolator (without E/S) [800A, 40kA for 1s, HDB Isolator (Mechanically Ganged Manually operated)]	Nos.	20	0	0	0	0	**20**
9	33kV Isolator (with E/S) [3 ph, 800A, 26.2kA for 2s, HDB Isolator (Mechanically Ganged Manually operated) with 1 ES (Mechanically Ganged Manually operated)]	Nos.	4	0	0	0	0	**4**
10	33kV Isolator (without E/S) [3 ph, 800A, 26.2kA for 2s, HDB Isolator (Mechanically Ganged Manually operated)]	Nos.	14	4	2	2	0	**22**
11	33kV Isolator (without E/S) 1200 Amps [3 ph, 26.2kA for 2s, HDB Isolator (Mechanically Ganged Manually operated)]	Nos.	2	0	0	0	0	**2**
12	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 400kV 3 phase Pantograph Isolator with 1 E/S	set	1	1	1	1	0	**4**
13	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 400kV 3 phase HCB Isolator with 2 E/S	set	1	1	1	1	1	**5**
14	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 220kV 3 phase Isolator with	set	0	1	1	1	0	**3**

	1 E/S							
15	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 132kV 3 phase Isolator with 1 E/S	set	1	0	0	0	0	**1**
16	Lump Sum Supervision Charges for Erection Testing & commissioning of one No. of 33kV 3 phase Isolator with 1 E/S	set	1	1	1	1	0	**4**

B. Mandatory Spare

B.1 400kV Pantograph Isolator

Sl. No.	PI Description	Unit	Quantity
1	400 KV Pantograph Isolator complete (set of three) (2000A, 40kA for 1s Electrically ganged Motor Operated Isolator with individual manually operated 1 ES)	Set.	2
2	Contact Scissors and Stirrup assembly for Pantograph Isolators (for 1 pole of 400 KV Pantograph Isolator)	Set.	2

B.2 400 KV Horizontal Centre Break Isolator

Sl. No.	PI Description	Unit	Quantity
1	400 KV Horizontal Centre Break isolator (3 ph, 2000A, 40kA for 1s Electrically ganged Motor Operated Isolator without ES)	Nos.	1
2	Male & Female Contact including	set	6

	Current Transfer Assembly (for 1 pole of 400 KV HCB)		

B.3 220 KV HDB Isolators

Sl. No.	PI Description	Unit	Quantity
1	Male & Female contact assembly including current transfer assembly, twin & twist arrangement & female contact holding brackets (for 1 pole of 220 kV HDB)	set	12

B.4 132 KV HDB Isolators

Sl. No.	PI Description	Unit	Quantity
1	Male & Female contact assembly including current transfer assembly, twin & twist arrangement & female contact holding brackets (for 1 pole of 132 KV HDB isolator)	set	6

B.5 33 KV HDB Isolators

Sl. No.	PI Description	Unit	Quantity
1	Male & Female contact assembly including current transfer assembly, twin & twist arrangement & female contact holding brackets (for 1 pole of 33 KV 800A HDB isolator)	set	4
2	Male & Female contact assembly including current transfer assembly, twin & twist arrangement & female contact holding brackets (for 1 pole of 33 KV 1200A HDB isolator)	set	2

Note:-

1. Worm & reduction gear shall be provided for Mechanically Ganged Manually operated 220 & 132 kV Isolators.
2. Supervision charges shall be quoted on lump sum basis only. Bidder shall estimate required no. of man-days for supervision based on his own experience & shall submit a checklist for input w.r.t site readiness. It will be the sole responsibility of the bidder to obtain site readiness checklist before deputing any of his personnel at site.
3. All the insulators (including Operating Rod Insulator), terminal connectors (except for Pantograph Isolator at bus level i.e. 15.6m) and structure (Pipe type for Pantograph and lattice type for HCB/HDB Isolator) will be supplied by BHEL. Equipment mounting hardware on structure shall be supplied by vendor. Inter pole cables and glands shall be supplied by BHEL
4. Total quantity may vary upto ±40% at contract stage. However, individual quantities may vary upto any extent.
5. Exact dispatch destination site of mandatory spares shall be intimated during ordering stage.
6. Prices of accessories to be included in the equipment price.
7. TBs shall be stud type. For power cable each TBs should be suitable for terminating two wires of 10sqmm size on each side. For control cable each TBs should be suitable for terminating two wires of 2.5sqmm size on each side.
8. 400kV pantograph Isolator shall be suitable for Quad or Twin ACSR Moose conductor Bus. Exact details of Quad or Twin Bus shall be intimated during ordering stage. Sub-conductor Spacing between ACSR Moose conductor will be 450mm.

SECTION – II (A)
2.1.5 - TECHNICAL SPECIFICATION FOR 400 KV ISOLATORS

1.0 SCOPE :

The scope of this specification covers design, manufacturing and supply of equipment as per Section-I, Volume-II. The bidder mentioned in the Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The Purchaser means the "~~MPPTCL~~". BHEL

In case bidder is not OEM, sole responsibility of offering equipment/material of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS :

Applicable Standards for the offered equipments / items shall be as per ~~Section-I.~~ Annexure-C

3.0 CLIMATIC CONDITIONS :

Applicable climatic conditions shall be as per Section –3

4.0 SYSTEM PARTICULARS :

Applicable system particulars shall be as per Section –3

5.0 GENERAL TECHNICAL REQUIREMENTS FOR 400 KV ISOLATORS WITH / WITHOUT EARTH SWITCHES :

5.1 The 400 KV isolators shall be a set of three individual poles having individual drive for each pole of main disconnect/ earth switch supported on two insulator columns per pole in case of horizontal center break type and on single support insulator column and one rotary operating insulator per pole in case of pantograph. The pantograph isolator shall have one vertical break earth switch. The center break isolator shall have two/ without vertical break earthing blade/s per pole (phase) suitable for fixing on sides of the poles as per requirement.

5.2 It may Please be noted that all types of Isolators to be supplied should be matching with structure & solid core insulators provided by BHEL.

, As Civil foundation for structure will be as per our civil drawing, structure base should be suitable for civil foundation. ~~The prices of isolators are to be quoted accordingly including the cost of structure and Solid core Insulator~~. Further one prototype Isolator assembly complete with structure and solid core insulator duly assembled as per MPPTCL drawings at the premises of Isolator manufacturer shall be offered for inspection of MPPTCL before taking up mass supply. The proto assembly shall be

(1)

checked for proper operation and fitting to avoid any mismatch during actual erection in the field. Refer Annexure-D for insulator details.

5.3 The disconnects & earthing switches, when installed according to the manufacturer's instructions shall be able to bear on the terminals, the total forces (including wind loading and electro-dynamic forces on the attached conductors) related to the application and rating without impairing the reliability or current carrying capacity.

5.4 Disconnects and earthing switches, including their operating mechanism shall be so designed and constructed that these cannot come out of their open or closed positions by gravity, wind pressure vibrations reasonable shocks, or accidental touching of the connecting rods or their operating mechanisms.

5.5 The operating device shall be capable of closing and opening the disconnect at any value of supply voltage between 75% and 110% of the rated voltage and between 92% and 108% of the rated frequency.

5.6 Flexible copper connections between rotating shaft of the earthing switch and the frame shall have a cross-section suitable to withstand short time rated current.

5.7 AUXILIARY CONTACTS FOR SIGNALLING :

i) Signaling of the closed position shall not take place unless it is certain that the moveable contacts will reach a position in which the rated normal current, the peak withstand current and the short-time withstand current can be carried safely.

ii) Signaling of the open position shall not take place unless the movable contacts have reached a position such that the clearance between the contacts is atleast 80% of the isolating distance.

5.8 AUXILIARY EQUIPMENTS :

i) Auxiliary contacts and auxiliary equipments shall be capable of carrying a current of atleast 10 Amps. continuously.

ii) Auxiliary switches shall be capable of breaking atleast 2A in a 220 V D.C. circuit with a time constant of not less than 20 milli secs. Auxiliary switches shall be positively driven in both the directions.

iii) Number of auxiliary contacts in each AC motor-operated mechanism box for main disconnects for purchaser's use.

a. 20 N.O. and 20 N.C. contacts.
b. 8 Make Before Break (MBB) contacts.

iv) Number of auxiliary contacts in each manually operated mechanism box for earthing switches shall be 8 N.O. and 8 N.C. contacts.

5.9 TERMINAL CONNECTOR DESIGN :

(2)

i) Current carrying capacity of the clamps shall not be less than the current rating of the isolators in an ambient temperature specified in this specification. The clamps shall be so designed that they shall be free from corona emission and the requirement of visual discharge voltage is satisfied. Special care shall be taken in the clamp design to account for Galvanic corrosion and Thermal Cycling.

ii) Clamp body shall be of high conductivity and high strength aluminium or copper alloy. The aluminium alloy shall be copper free. Bolts and nuts shall be of high tensile, non-corrosive, fungus resistant material preferably made of stainless steel. Bolting pressure shall be well distributed, washers of the Beleville type or equivalent shall be used to provide constant pressure under thermal cycling conditions so as to maintain a low contact resistance. Braids for flexible clamps shall be of tinned copper. The use of stranded aluminium conductor like Tarantula with strong welding connections to assemblies instead of copper braids is acceptable. Contact surfaces shall be finished and protected against galvanic action and oxidation. The bidder shall indicate the jointing compound recommended to be applied to the aluminium contact surfaces before bolting the clamps.

iii) Current density adopted for design of clamps for 420 KV isolators shall not exceed 1 Amp/sq.mm. for aluminium alloy clamp and 1.6 Amp./sq.mm. for copper clamps.

iv) Wherever necessary bimetallic strips of standard quality shall be used to avoid galvanic corrosion.

5.10 REQUIREMENT OF TERMINAL CONNECTORS : (to be supplied for 400kV Pantograph isolator at bus level i.e. 15.6m)

i) Terminal connectors required for 400 KV pantograph/ ~~center break~~ type isolators ~~shall have to be suitable for connecting them to either twin MOOSE ACSR conductor (with a sub-conductor spacing of 450 mm) or 4" IPS aluminium tube as the case may be, depending upon their position in the layout. The connectors for 4" IPS aluminium tube shall be of fixed type for some terminals and of the flexible or expansion type for others~~. The fixed contact of the pantograph isolators will be suspended from bus bars which would comprise of 4/2 conductors of MOOSE ACSR. This fixed contact with the suspension arrangement shall be such that it collects juice from each of the four bus bar conductors with equal effectiveness and shall simultaneously function as a spacer to keep the bus bar conductors at the vertices of a square of 450 mm. side.

ii) In case terminal connectors are supplied through sub-suppliers, the bidder should guarantee for suitability of the terminal connectors in regard to the temperature rise being within limits, short time current carrying capability of connectors being same as that of the associated isolator, and connector being corona free.

5.11 Live metal parts shall be non-rusting and non-corroding metal. Current carrying parts shall be provided with lock-washers, keys or equivalent locking

(3)

facilities and shall be made of non-ferrous and non-corroding materials. The structure steel, operating pipes, phase coupling rods, tandem pipes, operating mechanism boxes, bolts, pins etc. used in other than current carrying parts shall be hot-dip galvanized. Galvanized current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator.

5.12 In case of 400 KV isolators the live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces. Where this is impracticable, adequate corona shields shall be provided.

5.13 The live parts shall be so constructed that the switch blade will not fall to the closed position if the operating shaft gets disconnected.

5.14 The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals.

5.15 ACCESSORIES :

The accessories to be provided on the isolators shall include but not necessarily be limited to the following:

5.15.1 BASE :

Each single pole of the pantograph isolator shall be provided with complete galvanised steel base provided with holes and designed for mounting on steel tubular support structures. ~~For pantograph the support structure shall be supplied by the~~ Bidder~~.~~ The support structure should be such as to match the strung bus at an height of 15.6 metres (with a maximum Sag upto 1900 mm) and equipment to equipment terminal connection at a height of 8.2 metres. (Height including 300 mm of plinth level). For center break isolators the structure will be arranged by the purchaser which will match the height of terminal connectors at 8.2 meters (including plinth level of 300 mm) from ground level. The base shall be rigid and self-supporting, requiring no guy, cross bracing between phases other than the supporting structures. The complete details of mounting channels for center break isolators included in the scope of supply shall be given by the bidder. The recommended design of mounting structures shall also be furnished enabling purchaser to procure structures accordingly.

5.15.2 POSITION INDICATOR :

A position indicator to show, whether the isolator is in 'ON' or 'OFF' position, shall be provided for each isolator. Auxiliary contacts for remote indication shall also be provided.

5.15.3 GROUNDING PADS :

Each pole of the isolator shall be provided with two grounding pads at the opposite ends. Also flexible grounding connectors complete with non-ferrous bolts shall be provided for connecting operating handle to the station grounding system. When grounding blades are provided in the isolators, two independent grounding terminals shall be provided for bolted connection to 75x10 mm. M.S. Flat to be provided by the purchaser for connection to station earth mat.

5.15.4 COUNTER BALANCE SPRINGS :

Counter-balance springs shall be provided for counter balancing the isolators to prevent impact at the end of travel both on opening and closing of the isolator. The springs shall be made of non-rusting type alloy.

5.15.5 NAME PLATES :

Isolators, earthing switches and their operating devices shall be provided with a Name plate. The name plate shall be weather-proof and corrosion-proof. The markings shall be punched/ engraved and not painted. The Name plates shall also contain our purchase order no. and date. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following information:-

i) **Earthing Switches**:
Name of manufacturer
Designation type
Serial Number
Rated voltage
Impulse withstand voltage to earth
Rated short time current
Rated maximum duration of short time current
Rated mechanical terminal load
Weight.

ii) **Operating Device**:
Name of manufacturer
Designation type
Rated auxiliary voltage and Horse Power of AC Motor
Weight.

iii) **Isolators**:
Name of manufacturer
Designation type
Serial Number
Rated voltage
Impulse withstand voltage to earth
Rated current
Rated short time current
Rated maximum duration of short time current

5.16 EARTHING SWITCHES :

a) Isolators equipped with earthing switch shall have one or two grounding blades per pole as specified in ~~Schedule~~ Section-I. The grounding

5

blades shall form integral part of the isolator. A flexible braid with a connector suitable for the specified copper stranded conductor shall be provided on the hinge end of the grounding blade for connection to the station ground grid.

b) The grounding blades shall be manually operated by a separate mechanism but shall be constructionally (Mechanically) interlocked with the isolator so that the grounding blades can be closed only when the isolator is open and vice-versa.

5.17 OPERATING MECHANISM AND CONTROL:

5.17.1 a) 3 Phase AC motor operated type operating mechanism shall be provided for each pole of 400 KV Pantograph Isolator and Centre Break main switch for individual as well as simultaneous operation of all the three poles i.e. it should be possible to operate all the poles either individually or simultaneously through electrical operation. The operating mechanisms of three phases should be well synchronized and interlocked. There shall also be manual cranking in the event of power failure.

b) Manual operating mechanism through crank and reduction gear shall be provided for each pole of 400 KV Centre Break Isolator earth switch and pantograph earth switch. Individual mechanism box shall be provided for each earth blade.

5.17.2 The operating mechanism shall provide a quick, simple and effective operation. The design shall be such that one man shall be able to operate the isolator without undue efforts, with about twenty revolutions of the crank.

5.17.3 The mechanism shall be provided with sufficient adjustment to allow for final alignment of the isolator blades for simultaneous operation and adjustable stops shall be provided to prevent over-travel in either direction.

5.17.4 The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes and rods shall be sufficiently rigid to maintain positive control under the most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsional and bending stresses due to operation of the isolator.

5.17.5 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 sufficiently to allow improper functioning of the isolator when the isolator is opened or closed at any speed. All holes in cranks, linkages etc. having pins shall be drilled to accurate fit so as to maintain the minimum amount of slack and lost motion in the entire mechanism.

5.17.6 The operating handle shall be mounted on the base supporting structure. Guide bearings shall be provided if necessary. All brackets, angles or other members necessary for attaching the operating mechanism to the isolator supporting structure shall be supplied by the Bidder. Rust proof pins and bearings of the bronze bushing ball or roller type shall be furnished. All ball and roller bearings shall be protected from

(6)

the weather by means of covers and grease retainers. Bearing pressures shall be kept low to ensure long life and ease of operation.

5.17.7 A weather proof steel cabinet shall be provided to house driving mechanism and auxiliary switches etc. The steel cabinet shall be fitted with 1100 Volt grade barrier type of porcelain terminal blocks. The terminal blocks shall be properly identified. Control wiring shall be carried out with minimum 2.5 sq mm copper wire of 1100 Volt grade insulation. The auxiliary wiring with auxiliary device shall be capable of withstanding a test voltage of 2000 Volts for 1 minute.

5.17.8 In addition to the limit switch contacts required for motor control of the isolator, other normally open and close contacts shall be provided as specified in clause 5.8 of this specification for other services. These switch contacts shall be actuated from the isolator shaft so as to provide true indication of the position of the isolator whether operated manually, or with power driven devices.

5.17.9 Control cabinet and component equipment shall otherwise be in accordance with the details given in clause 5.18 of this specification.

5.17.10 Power operated isolators shall be offered in accordance with this specification. Grounding switches provided with power driven isolators shall be manually operated. Power operation shall be by motor as specified in clause No. 3.2 and 5.17.1 of this specification.

5.17.11 A "Local/ Remote" selector switch and a set of open/ close push buttons shall be provided on the control cabinet of the isolator, to permit its operation from a local or a remote push buttons. The remote push button will be supplied by the ~~purchaser~~. BHEL

5.17.12 An out of step relay for the three poles in case of pantograph and centre break isolators with proper stud shall be supplied with each isolator to give a remote discrepancy alarm.

5.17.13 The control shall be so arranged that the operation shall be completed, when corresponding push button is pressed even momentarily. The control circuit shall be so arranged that necessary interlocks with associated breakers and earthing switches can be incorporated in it.

5.17.14 A lever shall be provided to permit manual operation of the isolator when desired. The lever shall be so arranged that, when manual operation is in progress the power operation shall be made inoperative. Arrangement shall be provided to padlock this lever when not in use.

5.17.15 MOTOR DRIVE:

i) Suitable reduction gearing shall be provided between the motor and the drive shaft to the isolator and a quick acting electro-mechanical brake shall be fitted on the higher speed shaft to provide rapid braking of the drive shaft.

7

ii) Limit switches for motor control shall be fitted on the isolator shaft within the cabinet to sense the open and closed position of the isolators.

iii) All drive motors shall conform to the requirements of IS:325.

5.18. CONTROL CABINETS

5.18.1. This specification covers the requirements of control cabinets and associated control and accessory equipment. Cabinets shall be of the well-mounting type of free standing floor mounting type.

5.18.2. Control cabinets shall be sheet-steel enclosed and shall be dust, weather and vermin proof. Sheet steel shall be atleast 2.0 mm. thick when control cabinets shall be provided with a hinged door and padlocking arrangement. The door hinges shall be of union joint type to facilitate easy removal. Door shall be properly braced to prevent wobbling.

5.18.3. Equipment and devices shall be suitable for operation on a 415 V, 3 phase, 3/4 wire, 50 Hz. AC system.

5.18.4. Motors being controlled from the control cabinet, would be suitable for operation on a 415 V, 3 phase, 50 Hz system.

5.18.5. Isolating switches shall be group operated units, (three pole for use on 3 phase supply system) quick make, quick-break type, capable of breaking safely and without deterioration of the rated current of the associated circuit. Control cabinet on door shall be interlocked with the operating handle of the switch so as to prevent opening of the door when the switch is closed. A device for bypassing the door interlock shall also be provided. Switch handle shall have provisions for locking in both fully-open and fully closed positions.

5.18.6. Fuses shall be HRC cartridge link type having suitable current rating. They shall be provided with visible operation indicators to show when they have operated. One fuse pulling handle shall be supplied for every ten fuses or a part thereof.

5.18.7. Push button shall be rated for not less than 6 Amps. 415 Volts, AC or 1 Amp. 250 V DC and shall be flush mounted on the cabinet door and provided with appropriate name-plates. Red, Green and Amber indicating lamps shall be flush mounted and provided with series resistors to eliminate the possibility of short-circuiting of control supply in the event of fusing of lamps.

5.18.8. The contactors for motors shall be direct-on-line, air-break, single-throw type and shall be suitable for making and breaking the stalled current of the associated motor which shall be assumed equal to 6.5 times and the full load current of the motor at 0.2 p.f., 3 pole contractors shall be furnished for 3 phase motors and 2 pole contractors for single-phase motors. Reversing contactors shall be provided with electrical interlocks between forward and reverse contactors. If possible, mechanical interlock shall also be provided. Contactors shall be suitable for uninterrupted duty and shall be of duty category class AC4 as defined in latest version of IS-2959 or equivalent international standard. The main contacts of the contractors

shall be silver plated the insulation and class for the coils shall be Class-E or better. The drop-out voltage of the contactors shall not exceed 70% of the rated value.

5.18.9. Contactors shall be provided with a three element, positioning acting, ambient temperature compensated, time lagged hand-reset type thermal overload relay with adjustable setting. Hand reset button shall be flush with the front door of the cabinet and suitable for resetting with starter compartment door closed. Relays shall be either direct connected or CT operated depending on the rated motor current.

5.18.10 Suitable relay/ device shall be provided to prevent overloading of the motor. Single phase preventer relay shall be provided to operate on open circuiting of any phase and shall trip off the motor. Complete details of the devices shall be furnished in the bid.

5.18.11. Mini starters shall be provided with no volt coils when required.

5.18.12. Purchaser's power cables will be 1100/ 650 Volt grade, aluminium conductor, PVC insulated PVC sheathed single steel wire armoured and PVC jacketed. All necessary cable terminating accessories such as packing glands, crimp type tinned copper lugs etc. for power as control cables shall be included in bidder's scope of supply. Suitable brass cable glands shall be provided for cable entry.
BY BHEL

5.18.13. Wiring for all control circuits shall be carried out with 650 grade PVC insulated tinned copper conductors of sizes not smaller than 2.5 sq.mm. Atleast 10% spare terminal blocks for control wire terminations shall be provided for each panel. The terminal blocks shall be similar to ELEMEX type. All terminals shall be provided with ferrules indelibly marked or numbered and these identifications shall correspond to the designations on the relevant wiring diagram. The terminals shall be rated for 10 Amps.

5.18.14. Control cabinet shall be provided with a 240V, 1 phase 50 Hz., 240V, 20W fluorescent lighting fixture and a suitable rated 240V, 1 phase, 5 Amp. 3 Pin socket for hand lamps.

5.18.15. Strip heaters shall be provided inside each cabinet complete with thermostat (preferably differential type) to prevent moisture condensation. Heaters shall be controlled by suitably rated double-pole miniature circuit-breakers.

5.18.16. Signal lamp provided shall be of neon-screw-type with series resistors enclosed in bakelite body. Each signal lamp shall be provided with a fuse integrally mounted in the lamp body.

5.18.17. Two coats of zinc-chromate primer and two coats of light gray enamel paint shall be applied both inside and outside after steam cleaning and phosphating. Items inside the cabinet made of organic material and shall be treated with a fungus-resistant varnish.

5.18.18. All doors, panels, removable covers and breaker openings shall be gasketed all around. All louvers shall have screens and filters. Cabinets shall be dust, moisture and vermin proof.

5.19 GEAR :

The disconnector 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 by the bidder.

5.20 GLAND PLATES AND GLANDS :

A removable gland plate ~~with double compression type brass cable glands~~ shall be provided with each operating mechanism for terminating all cables.

5.21 CONTACTS :

Contacts shall be made out of hard drawn electrolytic grade copper. Arcing contacts wherever provided shall close first and open last. The contact surface shall be silver plated. Fabrication of contact shall be made with suitable jig to avoid deviations during production. Details of size and shape of contacts, springs, back plated, fixing arrangements design of contact pressure, life of contacts, limit of temperature rise etc. shall be furnished in the bid.

5.22 MOUNTING OF COTACTS :

The contacts shall rest on a brass 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.

5.23 MOVING BLADE :

Contact surface of moving blade shall be heavily silver plated. The surface shall be wiped during closing and opening operations to remove any film, oxide coating etc. Wiping action shall not cause scouring or abrasion of surfaces.

5.24 ROTATING INSULATOR :

The rotating insulator shall be mounted on a housing with bearing housing. The housing shall be made of gravity die cast aluminium with smooth surfaces 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 atleast 75 mm shaft diameter. The bearing shall be of reputed make e.g. SKF, HMT, NBC, TATA and lubricated for life. All other friction locations shall be provided with suitable bearings or stainless steel or brass bushes. The bearings, bushes, joints, springs etc. shall be so designed that no lubrication shall be required during service. Complete details of bearings, bushes, housing, greasing etc. shall be furnished in the bid.

5.25 OPERATING PIPE :

50 mm internal diameter class B pipe shall be provided for operating disconnects. The pipe shall be terminated into a suitable swivel or universal type joint between the insulator bottom bearing and the operating mechanism to take care of marginal angular misalignment at site.

5.26.0 MISCELLANEOUS :

5.26.1 In centre break isolators, it has been observed that the vertical alignment of support insulator column shifts due to the weighment of conductor/ aluminium tube bus, resulting in mismatching of contact/aluminium blades. The bidder shall ensure manufacturing design to prevent this mishap.

5.26.2 The design of pantograph disconnect shall also permit manual cranking after the half-way operation of disconnect and subsequent power failure. It is our experience that the insertion of handle for manual drive becomes difficult when the blades are stuck-up in mid-position after the power failure.

5.27 LIMITS OF TEMPERATURE RISE :

The temperature rise on any part of equipment shall not exceed the maximum temperature rise specified below under the conditions specified in test clause. The permissible temperature rise indicated is for a maximum ambient temperature of 50 Deg.C. If the maximum ambient temperature is higher, the temperature rise permissible shall be reduced accordingly.

S.no.	Nature of the part or of the liquid	Maximum values of	
		Temperature (Deg.C.)	Temperature rise at a maximum ambient air temperature not exceeding 50 Deg.C.
1.	Contacts in air: Silver-face, copper, copper alloy or aluminium alloy (See Notes i & ii). Bare copper or tinned aluminium alloy.	105 75	55 25
2.	Contacts in oil: Silver-faced copper, copper alloy or Aluminium alloy (See note ii). Bare copper or tinned aluminium alloy.	90 80	40 30
3.	Terminals to be connected to external conductors by screws or bolts silver-face (See Note ii). Bare copper or tinned aluminium alloy.	105 90	55 40
4.	Metal parts acting as springs(See note iv).	Refer note (iv)	
5.	Metal parts in contact with insulation of the following classes :- Class Y : (For non impregnated materials). Class A : (For materials immersed in oil or impregnated) Class E : (in air) (in oil) Class B : (in air) : (in oil)	 . 90 100 120 100 130	 40 50 50 50 80

	Class F : (in air) (in oil) Enamel : Oil base Synthetic : (in air) : (in oil)	100 155 100 100 120 100	50 105 50 50 70 50
6.	Any part of metal or of insulating material in contact with oil, except contacts.	100	50
7.	Oil	50	40

NOTES :

(i) When applying the temperature rise of 55 Deg. C., care should be taken to ensure that no damage is caused to the surrounding insulating materials,

(ii) The quality of the silver facing shall be such that a layer of silver remains at the points of contact after the mechanical endurance test. Otherwise, the contacts shall be regarded as "bare".

(iii) The values of temperature and temperature rise are valid whether or not, the conductor connected to the terminals is silver-faced.

(iv) The temperature shall not reach a value where the elasticity of the materials is impaired. For pure copper, this implies a temperature limit of 75 Deg. C.

5.28.0 MANDATORY SPARE PARTS :

5.28.1 The Bidders may please note that the name of essential items required for operation and maintenance of Isolators may please be included while offering the prices for isolators covered under the package. The spares shall be interchangeable with the identical parts of similar isolators. These shall be of the same materials and workmanship and shall meet the same requirements.

5.29.0 SUPPORT STRUCTURES FOR PANTOGRAPH ISOLATORS :

5.29.1 The bidder shall furnish the detailed drawings of the structures along with relevant calculations. The mean height of the 400 KV strung bus is 15.6 metres and that of connectors for equipment to equipment connection should be 8.2 metres (Heights including plinth of 300 mm.)

5.29.2 The structures shall be made up of hot dip galvanized good quality structural steel tube.

6.0 TESTS :

6.1 TYPE TEST :

All the equipment offered, shall be fully type tested as per relevant Indian Standards or any equivalent International Standard (as specified in clause-2) during the last five years from the date of bid opening. Copy of test reports shall be enclosed with the bid. For any change in the design/ type already type tested and the design/ type offered against this bid, the MPPTCL reserves the right to demand repetition of same or all type tests without any extra cost.

6.2 ACCEPTANCE AND ROUTINE TESTS :

a) The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or equivalent International Standards in presence of Purchaser's representative.

b) Immediately after finalization of the programme of type/ acceptance/ routine testing, the manufacturer shall give sufficient advance intimation to MPPTCL, to enable him to depute his representative for witnessing the tests.

7.0 INSPECTION :

i. MPPTCL shall have access at all times to the works and all other places of manufacture, where the isolators are being manufactured and the Bidder shall provide all facilities for unrestricted inspection, raw materials, manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii. The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages, so that arrangements could be made for inspection.

iii. No material shall be dispatched from the point of manufacture unless the material has been satisfactorily inspected and tested.

iv. The acceptance of any quantity of the equipment shall in no way relieve the successful bidder of his responsibility for meeting all the requirement of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.

8.0 QUALITY ASSURANCE PLAN & STAGE INSPECTION :

QAP & stage inspection shall be as per Section – I ~~Volume – II~~.

9.0 DOCUMENTATION :

9.1 All drawings shall conform to latest version of international standards organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS-11065. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

9.2 LIST OF DRAWINGS AND DOCUMENTS :

The Bidder shall furnish four sets of following details and drawings along with his bid.

i. Complete assembly drawing showing plan and elevation views of the isolator, complete with details of operating mechanism, mounting dimensions etc.

ii. Sketches and descriptive details of :
   a. Bearings
   b. Jaw contacts and main isolator blades.
   c. Inter-locking device.

d. Ground blades.
e. Interrupting device for making and breaking magnetising current.
f. Operating mechanism.
g. Spring operation etc.
h. Control cabinet.

i. Isolator mounting structure.

iii. Drawings with details to substantiate the suitability of the jaw design.

iv. Type Test reports in case the equipment has already been type tested.

9.3 The successful Bidder shall within two weeks of placement of order, submit four sets of final versions of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments/ approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 20 prints and two good quality reproducible of the approved drawings for Purchaser's use.

9.4 The Bidder before commencement of supply, shall submit six sets of the type test reports, duly approved by the Purchaser. Two copies of acceptance and routine tests certificates, duly approved by the Purchaser shall accompany the dispatched consignment.

9.5 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Bidder's risk.

9.6 Twenty (20) copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English Language, for each type and rating of equipment supplied shall be submitted by the Bidder for distribution to field officers prior to the dispatch of the equipment. The manual shall contain all the drawings and information required for erection, operation and maintenance of the equipments. The manual shall also contain a set of all the approved drawings, type test reports etc.

9.7 Approval of drawings/ work by MPPTCL shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

10. PACKING AND FORWARDING :

10.1 Bidder shall ensure that the equipment shall be packed in crates suitable for vertical/ horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit.

11. DISCREPANCY IN TECHNICAL PARTICULARS :

Regarding discrepancy in technical particulars, stipulation under Section-I, ~~Volume-II~~ shall be applicable.

APPENDIX - A

PRINCIPAL TECHNICAL PARAMETERS OF 400 KV ISOLATORS

SNo.	TECHNICAL PARAMETERS	SPECIFICATION
1	Rated Frequency (Hz)	50
2	System Neutral Earthing	Effectively Earthed
3	No. of Phases (Poles)	3
4	Temperature Rise	As per relevant IS/ IEC Publication
5	Safe Duration of overload: a) 150% of rated current. a) 120% of rated current.	 5 minutes 30 minutes
6	Suitable for :- Rated voltage (KV rms) Frequency (Hz)	 420 50
7	Type of disconnect (AB)	Pantograph/ Centre Break Horizontal
8	Rated normal current (Amp.rms)	2000
9	Rated short time withstand current of disconnects and earthing switches for one sec. duration (KA rms)	40
10	Rated dynamic withstand current (KA)	100
11	Rated short circuit current of Earth Break (KA peak).	100
12 12.1	**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 applied to. i) One terminal, lightning impulse (KVp) ii) Opposite terminal, power frequency (KVp)	 1425 1425 240
12.2	250/2500 micro seconds switching impulse with stand voltage a) To earth (KVp) b) Across terminals of open disconnect (KV rms) i) One terminal, switching impulse (KVp). ii) Opposite terminal subjected to power frequency voltage (KV rms)	 1050 900 345

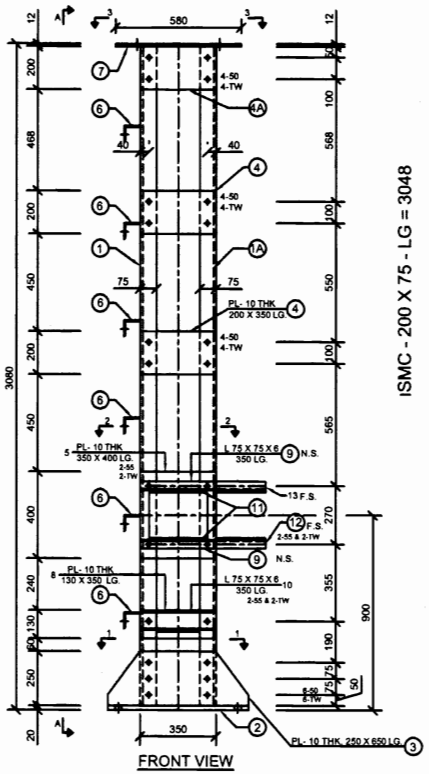
12.3	Rated 1 minute power frequency with stand voltage (KV rms) a. To earth KV (rms) b. Across terminals of open disconnect	 520 610
13	Minimum creepage distance of support and rotating insulator (mm)	10500
14 14.1	**Rated Mechanical Terminal Load :** For two column horizontal break disconnect a. Straight load (N) b. Across load (N)	 1600 530
14.2	For pantograph disconnect a. Straight load (N) b. Across load (N)	 2000 800
15	Rated magnetising/ capacitive current make and break capacity (Amp.rms)	0.7
16	Rated contact zone for P.G. isolator when fixed contacts are supported on flexible conductors. a) Horizontal deflection (Metres) b) Vertical deflection (Metres) c) Total amplitude of longitudinal movement with respect to support conductor (Meters)	 0.5 0.3 0.4
17	Phase to Phase spacing for installation (mm)	7000
18	Minimum clearance (mm): a) Phase to earth b) Phase to Phase	 3500 4000
19	Height of centre line of terminal pad above ground level (mm)	8200
20	Maximum radio interference voltage at 1 MHz and 1.1 x rated phase to earth voltage (micro volts)	500
21	Minimum corona extinction voltage (KV rms)	320
22	Rating of auxiliary contacts.	10A at 220V DC ~~& 110V DC~~ with breaking capacity of 2 A DC with time constant not less than 20 millisecond.
23	Seismic level (Horizontal Acceleration)	0.3 g
24	Operating time	12 sec. or less.
25	Local remote switch indication of Isolator	to be provided

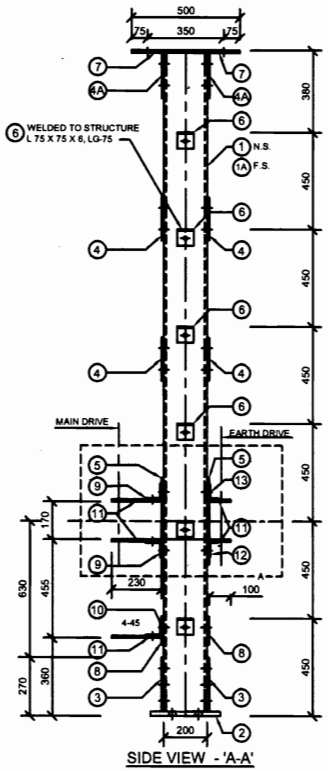
APPENDIX - B

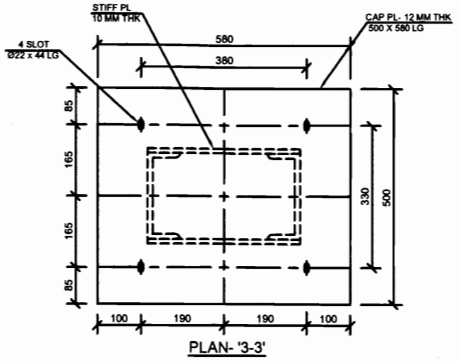
DRAWING OF FOUNDATION AND BASE CHANNEL DETAILS FOR 400 KV ISOLATORS

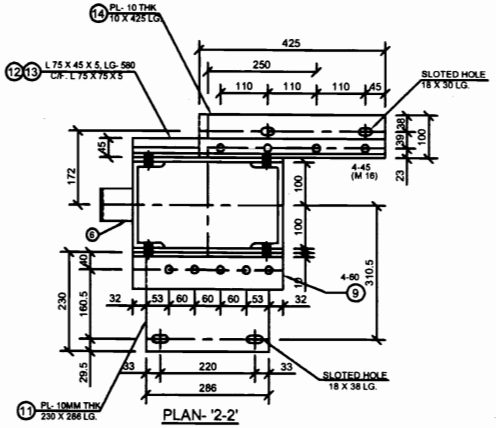
The following drawings for 400 KV Isolators are enclosed herewith for general guidance:

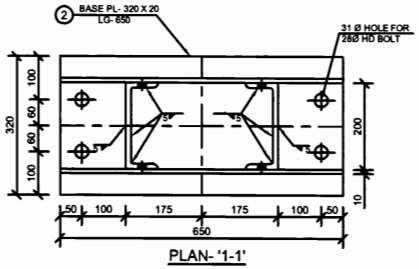
SNo.	Description	Drawing No.
1.	Foundation details for 420 KV Pantograph Isolators.	JICA/MPPTCL/TR-101-107/400 KV PANTO. ISO. FDN.
2.	Base channel fixing details – HCB with two earth switches	JICA/MPPTCL/TR-101-107/400 KV HCB- BASE CHANNEL
3.	G.A. of 400KV center break Isolator type - FDS-6	SR-ES-A2-0297-02-2013
4.	400KV Pantograph structure	Provided at later stage.

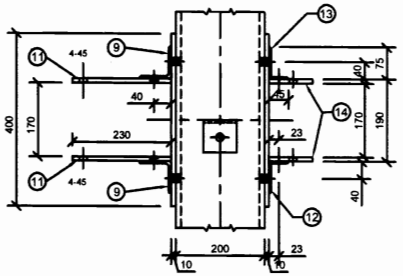


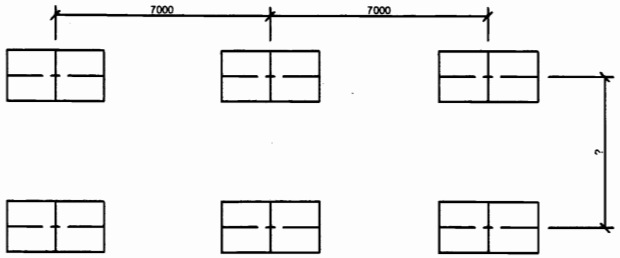


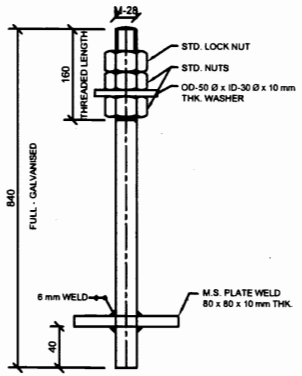


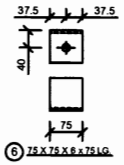












NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL HOLES ARE 17.5Ø FOR M16 DIA BOLTS U.O.S.
3. ALL ERECTION MARKES ARE TO BE PREFIXED 6 FDS.
4. STEEL SECTION / PLATES WITHOUT PREFIX SHALL CONFORM TO IS: 2062 / 1992 - GR 'A' FC 410
5. STEEL SECTION / PLATES WITH PREFIX FDS6 ALL CONFORM TO IS: 8600 / 1991 - FC 490 / 490 B.
6. BOLTS & NUTS CONFORM TO IS :12427 / 1998 FOR DIMENSIONS IS : 1367 (PART-3) / 1901 FOR MECHANICAL PROPERTIES.
7. SPRING WASHER SHALL CONFORM TO IS : 3063 / 1994.
8. GALVANIZING SHALL CONFORM TO IS : 4759 / 1984.
9. 5mm . THICK PLAIN WASHER SHALL BE USED UNDER EACH NUT.

REFER MPPTCL DRG NO :- X-II-FS-5-139 R-1

CUSTOMER :- MPPTCL , JABALPUR.
P.O. NO :- 04 -01 / 6543-7 / JICA / TK. Dt. 10-09-2012 (TR-101) - BHOPAL
P.O. NO :- 04 -01 / 6545-9 / JICA / TK. Dt. 10-09-2012 (TR-104) - JABALPUR
P.O. NO :- 04 -01 / 6548-2 / JICA / TK. Dt. 10-09-2012 (TR-107) - UJJAIN

SUPPLIER / CONTRACTOR	Shreem ELECTRIC LIMITED
OWNER	MADHYA PRADESH POWER TRANSMISSION COMPANY LTD.
PROJECT	CONSTRUCTION OF NEW S/S & EXTENSION WORK IN EXISTING SUB-STATION
LOI NO.	

	SIGN	DATE		
DRAWN	RBN	12-06-2013	G . A . OF 400 kv . CENTER BREAK ISOLATOR STRUCTURE TYPE - FDS - 6	SCALE N.T.S.
CHEKD	ABK	12-06-2013		SHEET NO 1 OF 1
APPRD	RAP	12-06-2013		
DRG - NO - SR-ES-A2-0297-02-2013				REV .

☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☐ APPROVAL ☐ CONSTRUCTION

Annexure - C

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
5	IS: 5621	Specification for large hollow porcelain for use in electrical installation	-
6	IS: 2147	Degree of protection provided by enclosures for low voltage switchgear and control	-
7	IS: 5561	Specification for Electric Power Connector	-
8	-	Indian Electricity Rules, 1956	-
K)	**ISOLATORS FOR 400 KV, 220 KV, 132 KV & 33KV VOLTAGE**		
1	IS :9921	Alternating current isolators (disconnectors) & earthing switches	IEC-60129
2	IS:2544	Insulators	-
3	IS:2147	Degree of protection provided by enclosure	-
4	IS:4691	Degree of protection provided by enclosure	-
5	IS:4722	Rotating electrical machines	-
6	IS:2629	Recommended practice for hot dip galvanizing of iron and steel	-
7	IS:4759	Hot dip galvanization coating on structural steel	-
8	IS:2633	Method of testing weight thickness and uniformity of coating on fasteners.	-
9	IS:1573	Electroplated coating of zinc or iron and Steel	-
10	IS:5561	Electric Power Connectors	-
11	IS:3033	Spring washers	-
12	IS:2016	Plain washers	-
13	--	Indian Electricity Rules 1956.	-
L)	**SOLID CORE INSULATORS FOR 400 KV, 220 KV, 132 KV & 33KV VOLTAGE**		
1	IS:2165	Insulation Co-ordination for equipment of 100 KV and above	-
2	IS:2544	Insulators	-
3	IS:5350	Post Insulators	-
4	-	Test on Post Insulators of nominal voltage greater than 1000 Volt	IEC - 168
5	-	Indian Electricity Rules 1956	
M)	**400KV & 220 KV CAPACITIVE VOLTAGE TRANSFORMERS**		
1	IS- 3156	Voltage Transformers	-
2	IS- 9348	Coupling Capacitor	-
3	-	CVT/Coupling Capacitor	IEC- 358
4	-	Voltage Transformer	IEC- 186

Annexure-D

~~APPENDIX - A~~

PRINCIPAL PARAMETERS OF SOLID CORE INSULATORS

S No.	PARTICULARS	400 KV		220 KV	132 KV	33 KV
1	Type	Outdoor Cylindrical Porcelain Solid Core Post Insulator	Outdoor Porcelain Solid Core Operating Rod Insulator	Outdoor Cylindrical Porcelain Solid Core Post Insulator		
2	Rated Frequency (Hz)	---50---				
3	System Neutral Earthing.	--Effectively Earthed--				
4	Suitable for:- Rated Voltage (KV) Rated Frequency (Hz)	 420 50	 420 50	 245 50	 145 50	 36 50
5	One minute power frequency with stand voltage(Wet) (KV)	680	680	460	275	70
6	Lightning Impulse withstand test voltage (KV)	1550	1550	1050	650	170
7	Switching Impulse withstand Voltage (KV)	1050	1050	-	-	-
8	Minimum creepage distance Total (mm).	10500	10500	6125	3500	900
9	Visible discharge voltage (KV)	320	-	154	105	27
10	Mechanical strength. Ultimate Bending Strength (Nm) Torsional Strength (Nm) Compression Strength (N)	 8000 4000 320000	 2400 2500 80000	 8000 4000 260000	 6000 3000 140000	 6000 1500 60000
11	Height of Insulator (mm).	3910	3910	2500	1500	508
12	Top metal fitting pitch circle dia (mm).	127	127	127	127	76
13	Bottom metal fitting pitch circle dia (mm).	300	127	254	225	76
14	No. of holes & diameter. i) Top flange ii) Bottom flange	 4 holes of M16 8 holes of Ø18	 4 holes of M16 4 holes of Ø18	 4 holes of M16 8 holes of Φ18	 4 holes of M16 8 holes of Φ 18	 4 holes of M12 4 holes of M12
15	No. of units per stack	3	3	2	1	1

SECTION – II (B)
2.1.5 - TECHNICAL SPECIFICATION FOR 220 KV, 132 KV & 33 KV ISOLATORS

1.1 SCOPE :

The scope of this specification covers design, manufacturing and supply of equipment as per Section-I, Volume-II. The bidder mentioned in the Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The Purchaser means the "~~MPPTCL~~". BHEL

In case bidder is not OEM, sole responsibility of offering equipment/material of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS :

Applicable Standards for the offered equipments / items shall be as per ~~Section-I~~. Annexure-C

3.0 CLIMATIC CONDITIONS :

Applicable climatic conditions shall be as per Section –~~4~~.3

5.0 SYSTEM PARTICULARS :

Applicable System Particulars shall be as per Section –3.

5.0 GENERAL TECHNICAL REQUIREMENT FOR 220 KV, 132 KV & 33 KV ISOLATOR WITH / WITHOUT EARTH SWITCH :

5.1 TYPE & RATING :

5.1.1 Three phase / Single phase double break Isolators shall have three posts per phase triple pole /single pole single throw, gang operated outdoor type, silver plated contacts with horizontally operating blade and isolators posts arranged vertically. Single phase horizontal centre break Isolators without earth switch, shall have two posts per phase, double pole gang operated outdoor type silver plated contacts with horizontally operating blade and isolators posts arranged vertically. Rotating blade feature with pressure relieving contacts is necessary, i.e. the isolators shall have turn and twist arrangement. This arrangement shall be described in details alongwith the bid. However, the design of turn & twist arrangement shall be to our approval. Banging type feature is not acceptable.

All isolators with/ without earth switch shall operate through 90 degree from their fully closed position to fully open position, so that the break is distinct and clearly visible from the ground level. All 220 KV & 132 KV isolators will have manual operating mechanism with worm and reduction gear, whereas 33 KV Isolators will have manual operating mechanism without worm and reduction gear. The earth switch shall have separate operating mechanism but without worm and reduction gear.

5.1.2 The equipment offered by the bidders shall be designed for a normal current rating of 1250 Amp for 220 KV Isolators & 1200 Amp / 800 Amp for 132 KV & 33 KV Isolators suitable for continuous service at the system voltages specified

herein. The isolators are not required to operate under load but they must be called upon to handle magnetisation currents of the power transformers and capacitive currents of bushings, busbars connections, very short lengths of cables & current of voltage transformers and dividers.

5.1.3 It may Please be noted that all types of Isolators to be supplied should be matching with structure & solid core insulators provided by BHEL.

. As Civil foundation for structure will be as per our civil drawing, structure base should be suitable for civil foundation. ~~The prices of isolators are to be quoted accordingly including the cost of structure and Solid core Insulato~~r. Further one prototype Isolator assembly complete with structure and solid core insulator duly assembled as per MPPTCL drawings at the premises of Isolator manufacturer shall be offered for inspection of MPPTCL before taking up mass supply. The proto assembly shall be checked for proper operation and fitting to avoid any mismatch during actual erection in the field.

5.1.4 The rated insulation strength of the equipment shall not be lower than the levels specified in IS-9921/IEC Publication No. 129.

5.2 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 sun shall not exceed 45 degree centigrade above ambient. The limit of temperature rise shall not be exceeded when corrected for the difference between ambient temperature at site and the ambient temperature specified in the approved specifications. The corrections proposed shall be stated in the bid and shall be subject to approval of the purchaser.

5.3 ISOLATOR INSULATION :

5.3.1 Insulation to ground, insulation between open contacts and the insulation between phases of the completely assembled isolating switch shall be capable of withstanding the dielectric test voltage specified in IS-9921 / IEC Publication No. 129. Insulation between open contacts of a pole shall be atleast 15% more than the insulation between the live parts of pole to ground.

5.3.2 The insulator for the isolators shall be arranged separately by the purchaser. The scope of the present specification is for the supply of the isolator and base channel but without insulator for the mounting of the isolator. The mounting structure for the isolator shall be arranged by the purchaser separately. However, the following is binding on the bidder :-

a. The isolators offered shall be suitable for solid core insulator. Solid core insulators shall be arranged by the purchaser separately.

b. The bidder shall have to specifically given an assurance in the bid that the isolator of his supply shall be manufactured to make it suitable for us with insulators with following fixing details :-

Sl. No.	Voltage rating	Details of flange	PCD of which these holes are provided	No. of holes	Size of holes
1	220 KV	Top	127 mm	4	M16
		Bottom	254 mm	8	Ø18
2	132 KV	Top	127 mm	4	M16
		Bottom	225 mm	8	Ø18
3	33 KV	Top	76 mm	4	M12
		Bottom	76 mm	4	M12

c. The isolators are to be supplied with mounting base channel and fixing nuts and bolts. The structure would be arranged separately by the purchaser. The drawings of our standard structures for 220 KV, 132 KV & 33 KV Isolators are enclosed herewith in Appendix-B.

The bidder will have to give a specific assurance that the isolators of his supply shall be suitable for mounting on the structure as per drawing enclosed with specification.

5.4 MAIN CONTACTS :

All isolators shall have heavy duty self aligning and high pressure line type fixed contact of modern design and made of hard drawn electrolytic copper. The fixed female contact should be of reverse loop type. The various parts shall be accordingly finished to ensure inter-changeability of similar components. The fingers of fixed contacts shall be preferably in three pieces and each shall form the reverse loops to hold moving contacts. Stopper provided in the fixed contact will over lap inside reverse loop assembly strips to stop over travel of moving contact pipe. It should be made of material having high melting point eg Teflon to withstand rise in temperature. The screw to secure the stopper in fixed contact for moving pipe should be flushed properly to avoid damage to moving contact surface. The fixed contacts would be placed in 'C' clamp. The thickness of Jaw holding bracket ('C' clamp) to hold fixed contact jaws should not be less than 6 mm made of HDG Mild steel. This 'C' clamp shall be placed on a channel of adequate thickness. This channel shall be welded on a insulator mounting plate of 8 mm thickness. The spring of fixed contact shall have housing to hold in place. This spring shall be made of stainless steel minimum thickness of 14 SWG. The cap on spring should be made of Teflon to withstand rise in temperature. The pad for connection of terminal connector shall be of Aluminium Alloy. The minimum size of isolator pad available for fixing of terminal connector shall be 100 mm x 100 mm with thickness not less than 12 mm, to suit terminal connector included in scope of supply.

Suitable rain hood shall be provided overlapping the bushes on turn twist arrangement to prevent accumulation of dust and other foreign particles so as to avoid jamming of rotation of moving contact pipe. Center post top pin for holding the turn & twist assembly should be adequate in size to avoid any bending of turn twist mechanism. Nut & bolt arrangement is preferable to hold the pin in place of lock pin. The turn & twist assembly of moving centre post top contact should be provided with sealed ball bearing at centre of mechanism. Flat washers 2 Nos. on each side of turn

and twist spring may be provided (4 Nos.). In turn and twist mechanism size of hook lever should not be less than 20 mm.

The switch blades forming the moving contacts shall be made from tubular section of hard drawn electrolytic copper having outer diameter not less than 38 mm and suitable thickness. These contacts shall be liberally dimensioned so as to withstand safely the highest short-circuit and over voltages that may be encountered during service. The surfaces of contacts shall be rendered smooth and silver plated. The thickness of silver plating shall not be less than 25 microns. In nut shell, the male and female contacts assemblies shall be robust construction and design of these assemblies shall ensure.

a. Electro-dynamic withstand ability during short circuit without any risk of repulsion of contacts.
b. The current density in the Copper parts & Aluminium parts shall be less than 2.0 Amp/sqmm & 1 Amp/sq.mm respectively.
c. Thermal withstand ability during short circuit
d. Constant contact pressure even when the live parts of the insulator stacks are subjected to tensile stresses due to linear expansion of connected busbar of flexible conductors either because of temperature variations or strong winds.
e. No wiping action during closing and opening.
f. Self alignment assuring closing of the switch without minute adjustment. The details/drawings of contacts, springs, fixing arrangement, contact pressure, current transfer assembly, limit of temperature rise etc., shall be furnished alongwith the bid.

The thickness of moving contact pipe should be uniform on the periphery at all points. Due care should be taken to ensure that the copper pipe of good quality from reputed source and of electrolytic grade only is utilized in manufacture of moving contacts. The moving contact pipe should be supported with 2 mm thickness brass bushes at rotating points with lubricating facility for smooth operation. The bushes should be machined having one side proper collar and other side to be press fitted. The earthing switches shall each be provided with three sets of suitable type of fixed contacts below the fixed contacts assemblies of the main switch on the incoming supply side and three sets of moving contacts having ganged operation. These contacts too shall be fabricated out of electrolytic copper for isolators with earth switch and dimensioned to withstand the current on the line. Nut & Bolts of minimum 12 mm size shall be used, except in case of current carrying parts.

5.5 ARCING CONTACTS/HORN :

Arcing contacts of first to make and last to break type shall be provided for main contacts.

5.6 AUXILIARY SWITCHES :

5.6.1 All 220 KV isolators and earthing switches shall be provided with 220Volt / ~~110 Volt~~ DC auxiliary switches for their remote position indication on the control board and for electrical interlocking. The auxiliary switch shall have the following number of contacts ~~:for~~ BHEL USE.

a. For all earthing switches : 6 normally open and 6 normally closed.

b. For all main isolators : 8 normally open and 8 normally closed set of contacts.

All contacts should be brought out on terminals. Provision shall be kept for adding more auxiliary switch contacts at a later date. Auxiliary switches shall be of robust construction of some reputed make and housed in weather proof, vermin proof, dust free covers mounted on the respective operating mechanism. Schematic diagram for set of contacts shall be furnished. The auxiliary switches should be positive type. They are spring loaded so that contacts are either NO or NC. The wire connection to the auxiliary switches shall be through suitable lug screwed to the switch. The connection to the auxiliary switches should be screw on type.

The auxiliary switches shall be capable of carrying the current of atleast 10 Amps continuously and shall be capable of breaking atleast 2A in 220V/ 110V DC circuit, with time constant of not less than 20 milliseconds. 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 to ensure fool proof operation.

It shall be possible to change normally closed contact into normally open contacts and vice versa at site.Auxiliary switches are not required

5.6.2 For 132 KV & 33 KV Isolators, auxiliary switches ~~are not required~~. and earth switch For BHEL use - Same as above 220kV Isolator and earth switch.

5.7 CLAMPS/CONNECTORS :

i) The clamps/connectors shall be made of Aluminium alloy Grade A6 as per IS:5561(1970) and shall be suitable for twin moose / twin zebra ACSR for isolators without earth switch and single Zebra ACSR conductor for isolator with earth switch with universal take off arrangement. The details in regard to dimension, the number of bolts to be provided, material and manufacture shall be furnished in the bid.

ii) The design of clamp shall be to our approval. The clamps to be offered should be manufactured by gravity die-casting method only and not by sand casting process.

iii) It is necessary that suitable clamps are offered alongwith the isolator and also it is obligatory to give complete technical particulars of clamps alongwith the drawing, as per details given above and as per following details.

a. The terminal connector shall be manufactured and tested as per IS-5561 or equivalent International standard.

b. All castings shall be free from blow holes, surface blisters, cracks and cavities. All the sharp edges shall be blurred and rounded off.

c. No part of the clamp shall be less than 12 mm thick. The minimum size of terminal connector pad for fixing on isolator pad shall be 100 mm x 100 mm.

d. All current carrying parts shall be designed and manufactured to have minimum contact resistance.

e. Connectors shall be designed to be corona free as per relevant standard.

f. All nuts and bolts shall be made of HDG mild steel.

g. Bimetallic sleeve/liner shall be 2 mm

h. The conductor should be tightened by six bolts. Conductor hold length must not be less than 100mm.

iv) Wherever necessary bi-metallic strip of standard quality shall be used.

v) The surface of clamps to be tightened by six bolts should be flat in shape so that it may be possible to open the nuts and bolts by normal spanners. Therefore, any type of groove in the clamp body for fixing of nuts should be avoided.

vi) The portion of clamp to hold the conductor should be flat and straight and not zig-zag in construction, at both the sides, so that heating of clamp by throttling action of current may be avoided.

vii) Space of at least 50% of diameter of nuts should be available after the hole at both the sides of conductor holding portion for better mechanical strength.

viii) The clamp for twin moose/ twin zebra ACSR Conductor shall be in three pieces so that each conductor may be tightened separately.

ix) Size of terminal connector for which the clamp is designed and also rated current under site conditions shall be embossed / punched on each part of clamps except hardware.

5.8 ISOLATOR AND EARTH SWITCH OPERATION :

5.8.1 Each 220 KV & 132 KV isolator switch shall be equipped with local manual operating device with worm & reduction gear. It shall be possible to pad lock the manual operating handle both in the open and close positions of the switches. Additional castle type outer lock shall be provided on the manual operating handle and control cubicle as to prevent the operation of isolator manually & locally when the corresponding circuit breaker is 'ON'. The earth switch may be local manual operated by separate mechanism without worm & reduction gear.

5.8.2 All 33 KV Isolators and earthing switches shall have manual operating mechanism without worm and reduction gear.

5.8.3 **OPERATING MECHANISM FOR 220 KV, 132 KV & 33 KV ISOLATOR :**

All Isolators and earthing switches shall have separate dependent manual operation. The main isolator operation for 220 KV & 132 KV Isolator shall be through worm and reduction gear and without worm and reduction gear for 33 KV. The operating mechanism shall provide quick, simple and effective operation. The design of manual operation shall be such that one man shall be able to operate the isolator without undue effort and isolator should open/close with about 20 revolutions of crank. In case of any operational problem in worm and reduction gear assembly, suitable arrangement should be incorporated for manual operation of main switch, after by passing worm/reduction gear assembly. To hold operating pipe of main switch in position, suitable guide should be provided to arrest movement in case of by passing of worm & reduction gear assembly. The earth switch shall have simple manual operating mechanism. In the earth switch only banging type feature is required, therefore the operating mechanism should be such that the blade goes very smoothly in the fixed contact. There should not be any jerk during operation. The earth switch plate should not move due to gravity. In the rotating insulator, the design should be such that the shaft length is enough to accommodate the locknut in a proper manner. Flexible copper strips should be provided for main and earth handle.

5.8.4 The isolators may be required to operate occasionally with considerable long idle intervals. Special care shall be taken for selection of material of gear to meet this requirement. The gear shall made of alluminium bronze or any better quality material and lubricated for life with suitable lubricant. Gear operating box should be properly sealed to prevent any leakage of grease / lubricating material. Provision for future lubrication should also be made. The gear box enclosure should be made by casting process and not of sheet steel to provide proper gear alignment. It should be filled with graphite grease or non hardening grease. Complete details of component, material and grade, lubricant material and grade shall be furnished in the bid.

5.8.5 The gear operating mechanism shall be housed in cabinet made out of 12 SWG sheet steel with adequate channel support to withstand weight of gear. The operating handle shall also be placed in the cabinet. The cabinet shall be liberally designed to have sufficient working space. 2 Nos. rectangular frames made of 50x50x6 mm angle shall be provided to fix gear operating box on structure angles (for 220 KV & 132 KV Isolator). 20 x 14 mm slots both in horizontal and vertical direction will be provided on gear operating box support to facilitate adjustment for fixing.

5.8.6 The isolators and isolator with earth switches inclusive of their operating mechanism, should be such that they cannot come out of their open or closed positions by gravity, wind pressure, vibrations reasonable shocks, or accidental touching of connecting rods of the operating mechanism. Isolators and earth switches should be capable of resisting in closed position, the dynamic and thermal effects of maximum possible, short circuit current at the installation point. They shall be so constructed that they do not open under the influence of the short circuit current. The operating mechanism should be robust constructions, easy to operate by a single person and conveniently located for local operation in the switchyard. Operating mechanisms for main switch & earth switch should be provided with flexible copper strips for earthing of handle.

5.8.7 ON/OFF marking will be given on operating mechanism of main switch and earth switch. Direction will also be indicated. Proper locking arrangement with lock & key of operating handle in ON & OFF position should be provided.

5.9 PIPES :

Tandem pipes and operating handle shall be class B pipe having atleast 32 mm, 30 mm & 24 mm internal diameter for 220 KV, 132 KV & 33 KV Isolators respectively. The operating pipe shall also be class B with internal diameter of atleast 50mm for 220 KV & 132 KV Isolator and 38 mm for 33 KV Isolator. The pipe shall be terminated into suitable universal type joints between the insulator bottom bearing and operating mechanism.

Bushes may be provided on coupling of tandem pipe with insulator rotating base (3 Nos.). Bushes may also be provided on both sides of operating down pipe (2 Nos.) at support clamps. Bushes shall be made by machining process for smooth movement and should have minimum thickness of 2 mm. Bushes should be machined having one side proper collar and other side to be press fitted. Flange type joint should be provided at the bottom and universal coupling at top of down operating pipe to avoid any play during operation.

The 33 KV Isolator with earth switch shall be mounted on gantry structure at height of 4240 mm from ground level. The operating mechanism for earth switch and main switch are to be fixed on the gantry columns which are at a distance of 1600 mm on either side from the isolator pole. Therefore the phase coupling pipe for earth switch and main switch should have length of 4500 mm each for proper operation. The length of operating pipes for main switch and earth switch should also be about 3700 mm.

5.10 BASE CHANNELS :

The isolator shall be mounted on a base fabricated from steel channel section of adequate size not less than 125x65 mm for 220 KV & 132 KV Isolators and 100x50 mm for 33 KV Isolators respectively to withstand total weight of Isolator and insulators and also all the forces that may encountered by the isolator during service. The strengthening /jointing of base channels should be made by same size channels, to eliminate any vibrations during operations. Mounting plates for insulators shall be big enough to properly accommodate insulator metal parts (Base flanges). For fixing of bearing housing one M.S. plate of 8 mm thickness should be welded on mounting channels, covering entire width of mounting channel base. The M.S. Plate will have slotted round hole in the middle for accommodating bearing assembly. Suitable holes shall be provided on the base channel to facilitate its mounting on our standard structures as detailed in enclosed drawing. The steel channel in each phase shall be mounted in vertical position and over it two mounting plates atleast 8 mm thick with suitable nuts and bolts shall be provided for minor adjustment at site. Suitable marking on various parts including mounting channel should be provided for proper identification.

5.11 CLEARANCES :

We have adopted the following minimum clearances for isolators in our system. The bidders should therefore keep the same in view while submitting their bids.

Sl. No.	Description	Centre distance between poles (centre to centre) i.e ph. to ph. clearance	Distance between centre lines of outer posts on same pole.
1	a. 220 KV 3 Phase Double Break Isolator	4.0 metres	3.2 metres
	b. 220 KV Single Phase HCB Isolator	4.0 metres	2.6 metres
2	132 KV Isolator	2.5 metres	2.1 metres
3	33 KV Isolator	1.4 metres	0.96 metre

The plate provided for fixing insulator shall be of hot dip galvanized steel with thickness not less than 8 mm. ¾" size bolt should be used on insulator mounting plate for adjustment of height of insulators.

5.12 **INTERLOCKS AND EARTH SWITCHES :**

i) Line earth switches shall consist of three earthing links per isolator which will normally rest against the frame when the connected isolator is in closed position. The earthing links for the three phase shall be mechanically linked to a coupling shaft which shall be capable of being fitted on either side of the isolator. Earth switch shall be mechanically interlocked with the main switch so that is possible to close or open the earth switch only when the main switch is in the open position & its closing operation shall not be possible. In the earth switch only banging type feature is required. Therefore, the earthing switches should be provided with counter balance weight so that the earth switches do not fall due to gravity and it moves very smoothly in upward direction i.e. against gravity. The length of lever and counter weight should be selected carefully so that earth switch is in horizontal position in fully opened condition. Each earthing switch shall be designed to withstand electrodynamics stress due to currents upto 50 KA (peak) as per IEC recommendations. The contacts shall be of silver plated copper only.

ii) All shafts, couplings etc shall be galvanised. Flexible copper connectors of atleast 50sq.mm cross-section shall be provided between the rotating shafts and the frame work.

5.13 **BEARINGS :**

The design and construction of the various bearings shall embody all the features required to withstand climatic conditions specified, so as to ensure dependable and effective operation even after long periods of in-action of these isolators and switches. Bearing housings should be weather proof. Facilities should be provided for lubrication of bearings. The location and number of bearings provided for reducing friction shall be clearly intimated alongwith suitable drawings.

The bearing housing shall be made of gravity die-cast alluminium with smooth surface suitably machined for sealing the bearings. Each bearing assembly shall have two nos. (taper roller thrust and ball) bearing with adequate shaft diameter. A minimum distance of 150 mm,100 mm & 70 mm between thrust and ball bearings shall be provided for 220 KV,132 KV & 33 KV isolators respectively, to avoid wobbling during operation. The bearings shall be of reputed make e.g. SKF, HMT,NBC,TATA & lubricated for life. All other friction locations shall be provided with suitable bearings/ stainless steel or brass bushes. Complete details of arrangement offered shall be furnished.

5.14 DESIGN, MATERIAL AND WORKMANSHIP :

The successful bidder shall assume full responsibility for co-ordination and adequate design. All materials used in the construction of the equipment shall be of the appropriate class, well finished and of approved design and name. All similar parts should be accurately finished and inter-changeable.

5.15 PAINTING, GALVANISING AND CLIMATE PROOFING :

All interiors and exteriors of control cabinets shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surfaces treated by recognized phosphating (e.g seven tank phosphating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable staving and air drying before final painting. Colour of the final paints shall be of shade No. 697 of ISI i.e. epoxy light gray. The finally painted cubicle shall present aesthetically pleasing appearance free from any dent or un-even surface. 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 or equivalent international standard so as to withstand corrosive and severe service condition.

5.16 All ferrous parts shall be heavily hot dip galvanised. Bolts, nuts, pins and washers, etc. used on the isolators shall also be galvanised. All the nuts, bolts and washers in current carrying parts shall also be of hot dip galvanised. Special attention shall be paid to give tropical treatment to all the equipment as it will be subjected during service to extremely severe exposure to atmospheric moisture and to long period of high ambient temperature. All current carrying parts shall be of non-ferrous metal or alloys and shall be designed to limit sharp points edges and similar sharp faces.

5.17 GENERAL:

~~As described in the above paragraphs, the bidder shall quote the prices of isolators inclusive of set of terminal connectors.~~ Mounting structure and post insulators will be arranged by the purchaser separately. The bidder should not include post insulators and mounting structures in this bid. The base channel alongwith nuts, bolts and washers for the mounting of isolator on our structure and operating down pipe shall however be included. The operating mechanism together

with down take pipe operating handle etc., will be included in the scope of supply by the bidder. Bill of material will be provided with details of all minor /major items. The counter balance spring cushions etc. shall be provided to prevent impact at the end of travel in both on opening and closing. The name plate engraved and riveted on the channel and operating mechanism shall be provided. The name plate shall contain all details e.g. customers name, order No. and date, type serial no. rated voltage, rated current, rated short time current etc.

5.18 ESSENTIAL SPARE ITEMS :

5.18.1 The Bidders may please note that the name of essential items required for operation and maintenance of Isolators have been mentioned in Annexure – E of Section – I Volume – II Part – I. The prices of those essential spare items may please be included while offering the prices for isolators covered under the package. The spares shall be interchangeable with the identical parts of similar isolators. These shall be of the same materials and workmanship and shall meet the same requirements.

5.18.2 Description of Essential Spare Items : The technical specification of essential spare items mentioned in Annexure – E have been already described in this bid document.

6.0 TESTS :

6.1 **TYPE TEST :**

All the equipment offered, shall be fully type tested as per relevant Indian Standards or any equivalent International Standard (as specified in clause-2) during the last five years from the date of bid opening. Copy of test reports shall be enclosed with the bid. For any change in the design/type already type tested and the design/type offered against this bid, the MPPTCL reserves the right to demand repetition of same or all type tests without any extra cost. Non compliance of this requirement will make the bid non-responsive.

6.2 **ACCEPTANCE AND ROUTINE TESTS :**

a) The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or equivalent International Standards in presence of Purchaser's representative.

b) Immediately after finalisation of the programme of type/acceptance/ routine testing, the manufacturer shall give sufficient advance intimation to MPPTCL, to enable him to depute his representative for witnessing the tests.

7.0 INSPECTION :

i. MPPTCL shall have access at all times to the works and all other places of manufacture, where the isolators are being manufactured and the Bidder shall provide all facilities for unrestricted inspection, raw materials, manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii. The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages, so that arrangements could be made for inspection.

iii. No material shall be dispatched from the point of manufacture unless the material has been satisfactorily inspected and tested.

iv. The acceptance of any quantity of the equipment shall in no way relieve the successful bidder of his responsibility for meeting all the requirement of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.

8.0 QUALITY ASSURANCE PLAN & STAGE INSPECTION :

QAP & stage inspection shall be as per Section – I ~~Volume – II~~.

9.0 DOCUMENTATION :

9.1 All drawings shall conform to latest version of international standards organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS-11065. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

9.2 LIST OF DRAWINGS AND DOCUMENTS :

The Bidder shall furnish four sets of following details and drawings along with his bid :-

i. Complete assembly drawing showing plan and elevation views of the isolator, complete with details of operating mechanism, mounting dimensions etc.

ii. Sketches and descriptive details of :

a. The outline dimensions of the isolating and earth switches.

b. Details of main contacts.

c. The mechanical interlock between earth and isolating switches.

d. The details of fixed and moving contacts and the arrangement of pressure relief.

e. Turn and Twist mechanism.

f. Bearing assembly.

g. Terminal connectors.

h. Name plates to be provided.

i. Operating mechanism, type of gear, size and thickness of box, gland plate, gland etc.

iii. Drawings with details to substantiate the suitability of the jaw design.

iv. Type Test reports in case the equipment has already been type tested.

9.3 The successful Bidder shall within two weeks of placement of order, submit four sets of final versions of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments/approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 20 prints and two good quality reproducible of the approved drawings for Purchaser's use.

9.4 The Bidder before commencement of supply, shall submit six sets of the type test reports, duly approved by the Purchaser. Two copies of acceptance and routine tests certificates, duly approved by the Purchaser shall accompany the dispatched consignment.

9.5 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Bidder's risk.

9.6 Twenty (20) copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English Language, for each type and rating of equipment supplied shall be submitted by the Bidder for distribution to field officers prior to the dispatch of the equipment. The manual shall contain all the drawings and information required for erection, operation and maintenance of the equipments. The manual shall also contain a set of all the approved drawings, type test reports etc.

9.7 Approval of drawings/work by MPPTCL shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance there with.

10. PACKING AND FORWARDING :

10.1 Bidder shall ensure that the equipment shall be packed in crates suitable for vertical/horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit.

11. DISCREPANCY IN TECHNICAL PARTICULARS :

Regarding discrepancy in technical particulars, stipulation under Section-I, ~~Volume-II~~ shall be applicable.

APPENDIX- A

PRINCIPAL TECHNICAL PARAMETERS OF ISOLATORS

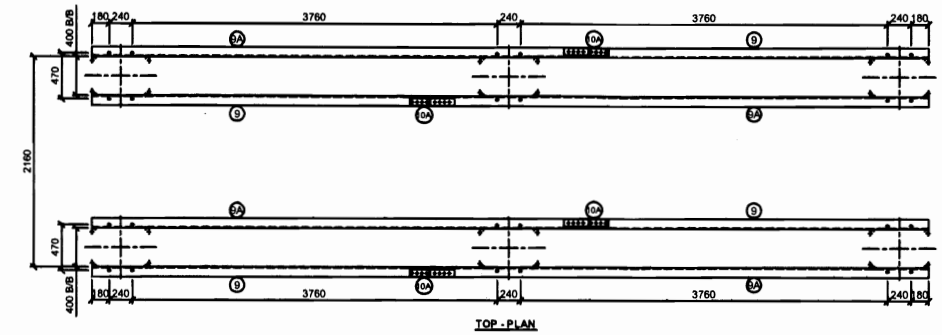
SNo.	Item	220 KV	132 KV	33 KV
1	Rated Frequency (Hz)	50		
2	System Neutral Earthing	Effectively Earthed		
3	No. of Phases (Poles)	3		
4	Temperature Rise	As per relevant IS/IEC Publication		
5	Suitable for:- Rated Voltage (kV rms) Frequency (Hz)	 245 50	 145 50	 36 50
6	Type of disconnect (AB)	Double Break (DB) / ~~Horizontal Centre Break (HCB)~~	Double Break (DB)	Double Break (DB)
7	Rated normal current (Amp.rms)	1250	800/~~1250~~	800/1200
8	Rated short time with stand current of disconnects and earthing switches Duration (KA rms)	40 KA for 1 sec.	40 KA for 1 sec	26.2 KA for 2 sec
9	Rated peak withstand current (kA)	100	100	65.5
10	Rated short circuit current of Earth Break (kA peak).	100	100	65.5
11 11.1	Rated insulation level: 1.2/50 micro second lightning impulse withstand voltage (+ve or –ve polarity) a) To earth (kVp) b) Across insulating distance: One terminal subjected to lightning impulse (kVp) and opposite terminal subjected to power frequency (kV rms) Voltage	 1050 1200	 650 750	 170 195
11.2	Rated 1 minute power frequency with stand voltage (kV rms)	460	275	70
12	Minimum creepage distance of support and rotating insulator (mm)	6125	3500	900

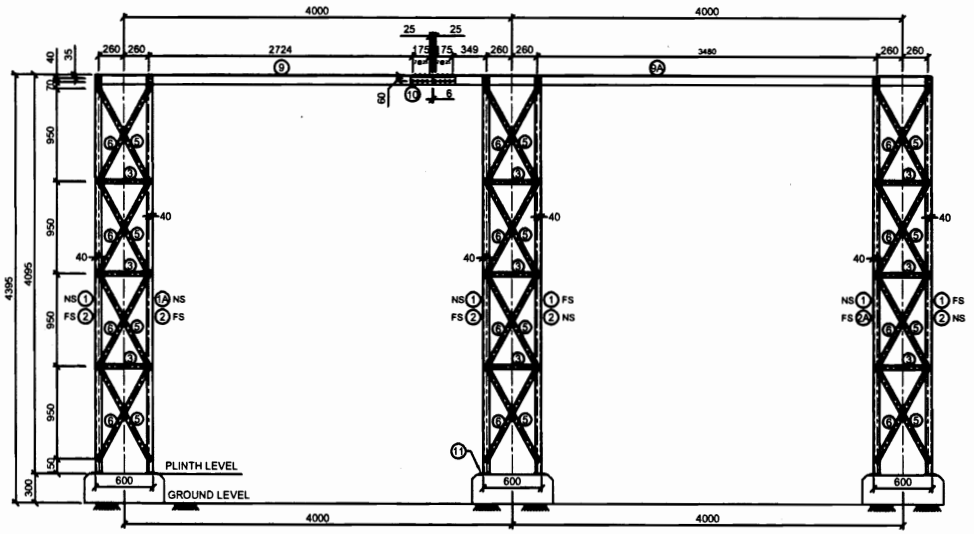
13	Rated Mechanical Terminal Load for two column horizontal break disconnect a) Straight load (N) b) Across load (N)	 800 270	 - -	 - -
14	Rated magnetizing/ capacitive current make and break capacity (Amp.rms)	0.7	0.5	0.5
15	Phase to Phase spacing for installation (mm)	4000	2500	1400
16	Minimum clearance (mm): c) Phase to earth d) Phase to Phase	 2150 3500	 1075 2500	 480 1400
17	Height of center line of terminal pad above ground level (mm)	7000	4600	3900
18	Maximum radio interference voltage at 1 MHz and 1.1 x rated phase to earth voltage (micro Volts)	500	-	-
19	Minimum corona extinction voltage (kV RMS)	176	-	-
20	Rating of auxiliary contacts.	10A at 220V DC & ~~410V DC~~ with breaking capacity of 2 A DC with time constant not less than 20 millisecond.	-	-
21	Approximate Height of insulator (not included in scope of supply) (mm)	2500	1500	508
22	plinth Height above ground (mm)	300	300	300
23	Local remote switch indication of Isolator	to be provided		

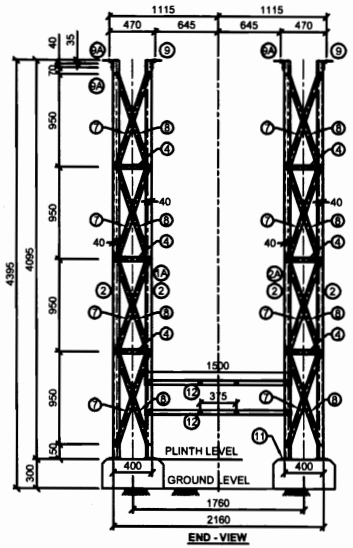
APPENDIX-B

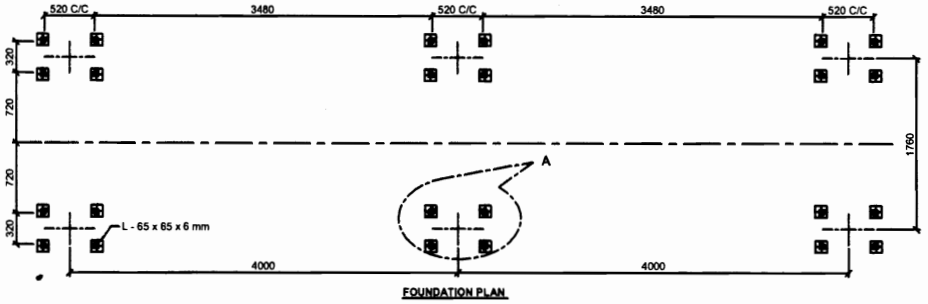
Drawing of support structure of 220kV, 132kV and 33kV Isolator.

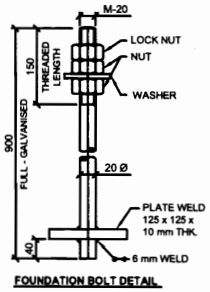
Sl. No.	Description	Drawing no.
1.	Structure drawing for 220kV Isolator type AITCH	SR-ES-A2-0267-02-2013
2.	Structure drawing for 132kV Isolator (Low level) type -3DO2	SR-ES-A3-0039-09-2000
3.	33kV S/S . structural Isolator -1DO3 bolted (For low level)	SR-ES-A3-0672-09-2005

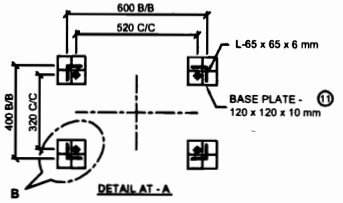


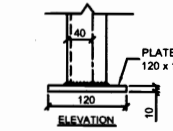


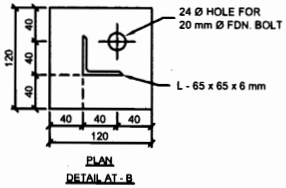












NOTE :-

1) ALL DIMENSIONS ARE IN m.m.
2) DIMENSIONAL & WEIGHT TOLERANCE ± 10 %
3) ALL ERECTION MARKS ARE TO BE PREFIXED AITCH...1...2...3... ETC
4) ALL STRUCTURAL MEMBERS WILL BE HOT DIP GALVANISED.
5) ALL HOLES ARE 17.5 Ø FOR M-16 BOLTS U. O. S.
6) STEEL SECTION / PLATES WITHOUT PREFIX SHALL CONFORM TO IS:2062 / 1992-GR "A" Fe 410.
7) BOLTS & NUTS SHALL CONFORM TO IS:12427 / 1968 FOR DIMENSIONS IS:1367 (PART-3) / 1991 FOR MECHANICAL PROPERTIES.
8) SPRING WASHERS SHALL CONFORM TO IS:3063 / 1994.
9) GALVANISING SHALL CONFORM TO IS:4759 / 1984.

REFFER MPPTCL DRG-NO. AT-141 / MP / SS-8

CUSTOMER : - MPPTCL, JABALPUR.

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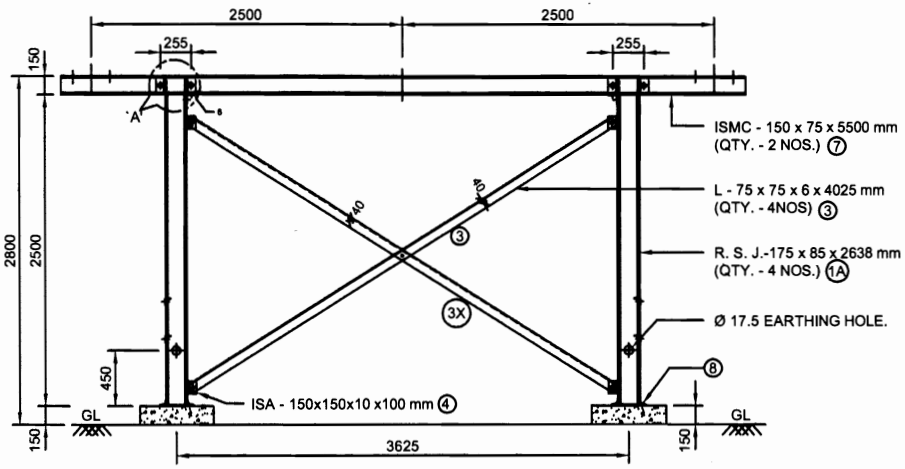
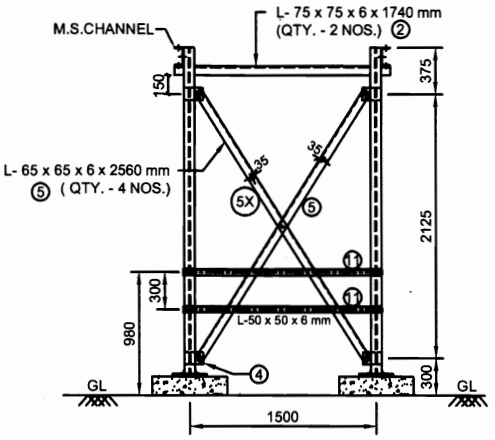
P.O. NO :- 04- 01 / 6545-9 / JICA / TK. Dt. 10-09-2012. (TR-104)- JABALPUR
P.O. NO :- 04- 01 / 6546-0 / JICA / TK. Dt. 10-09-2012. (TR-105)- SAGAR
P.O. NO :- 04- 01 / 6547-1 / JICA / TK. Dt. 10-09-2012. (TR-106)- SATNA
P.O. NO :- 04- 01 / 6548-2 / JICA / TK. Dt. 10-09-2012. (TR-107)- UJJAIN

SUPPLIER / CONTRACTOR	**Shreem** ELECTRIC LIMITED			
OWNER	MADHYA PRADESH POWER TRANSMISSION COMPANY LTD.			
PROJECT	CONSTRUCTION OF NEW S/S & EXTN. WORK AT 220 / 132 KV S/S IN JICA PROJECT			
LOI NO.	-			
	SIGN	DATE	STRUCTURE DRAWING FOR 220 KV ISOLATOR TYPE - AITCH	SCALE N. T. S.
DRAWN	BMM	24-01-2013		
CHEKD	ABK	24-01-2013		SHEET NO. 1 OF 1
APPRD	RAP	24-01-2013		
DRG - NO - SR - ES - A2 - 0267 - 02 - 2013				REV. 0
RELEASED FOR	☐ PRELIMINARY	☐ TENDER	☐ INFORMATION	☑ APPROVAL ☐ CONSTRUCTION

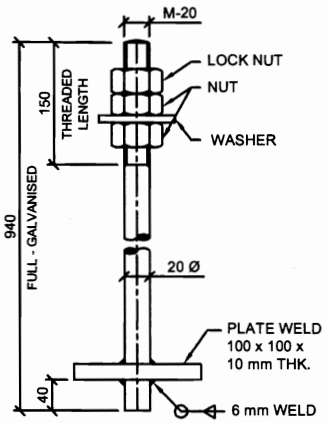
38



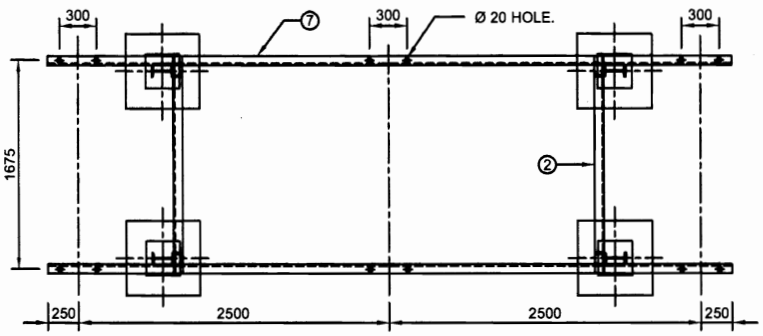
ELEVATION



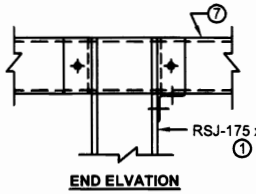
END-VIEW



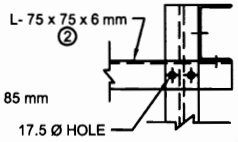
FOUNDATION BOLT DETAIL



PLAN

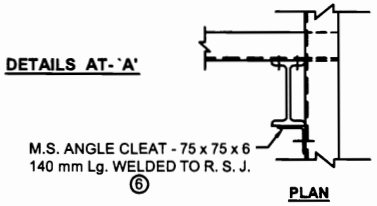


END ELVATION



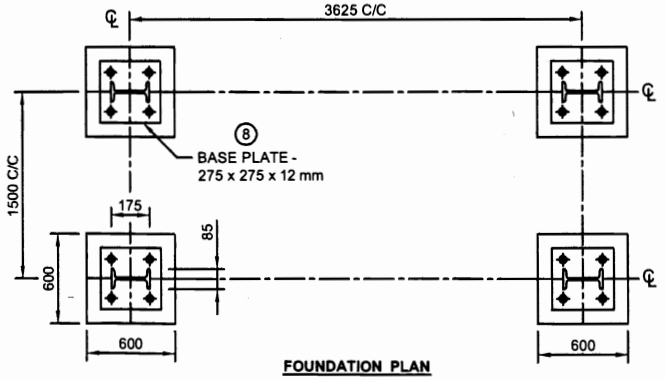
FRONT ELVATION

DETAILS AT- 'A'

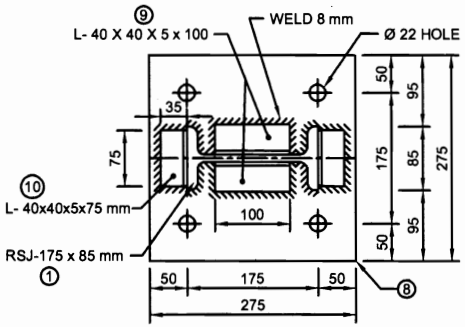


PLAN

NOTE :-
1) ALL DIMENSIONS ARE IN m.m.
2) DIMENSIONAL & WEIGHT TOLERANCE ± 10 %
3) ALL STRUCTURAL MEMBERS WILL BE HOT DIP GALVANISED.
4) ALL HOLES ARE 17.5 Ø FOR M-16 BOLTS UNLESS OTHER WISE STATED.
5) ALL FILLET WELDS ARE 6 mm SIZE UNLESS OTHER WISE STATED.
6) MATERIAL FOR THE STEEL SETIONS CONFORMS TO IS : 2062 UNLESS OTHER WISE STATED.
7) ALL BOLTS & NUTS ARE GRADE 5.6 & GALVANISED AS PER IS : 5358.
8) ALL ITEM NOS TO BE PREFIXED WITH 3DO2...1...2...3... ETC



FOUNDATION PLAN



DETAILS OF BASE PLATE

REFFER MPPTCL DRG-NO. NL/132 KV/XII-HO8-20A

CUSTOMER : - MPPTCL, JABALPUR.

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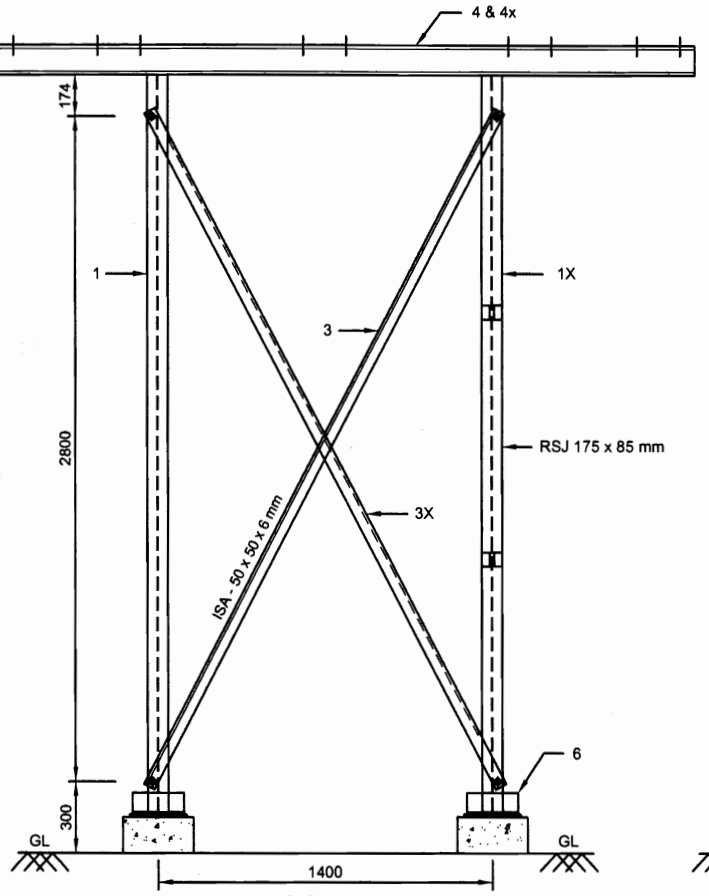
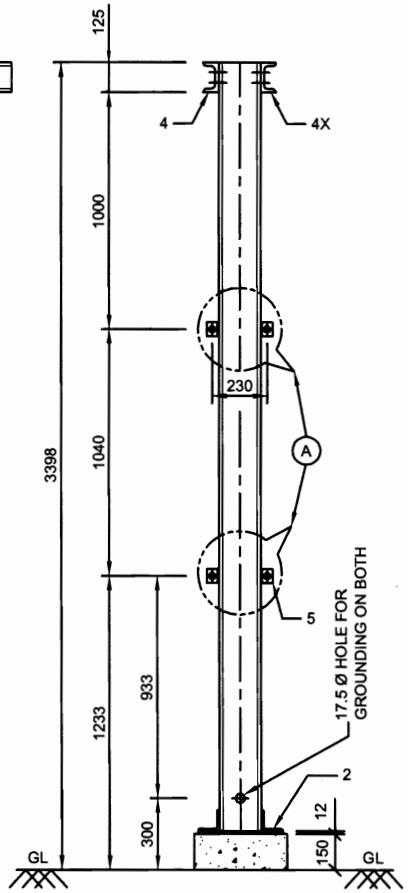
P.O. NO :- 04- 01 / 6545-9 / JICA / TK. Dt. 10-09-2012. (TR-104)- JABALPUR
P.O. NO :- 04- 01 / 6546-0 / JICA / TK. Dt. 10-09-2012. (TR-105)- SAGAR
P.O. NO :- 04- 01 / 6547-1 / JICA / TK. Dt. 10-09-2012. (TR-106)- SATNA
P.O. NO :- 04- 01 / 6548-2 / JICA / TK. Dt. 10-09-2012. (TR-107)- UJJAIN

FOR APPROVAL ONLY

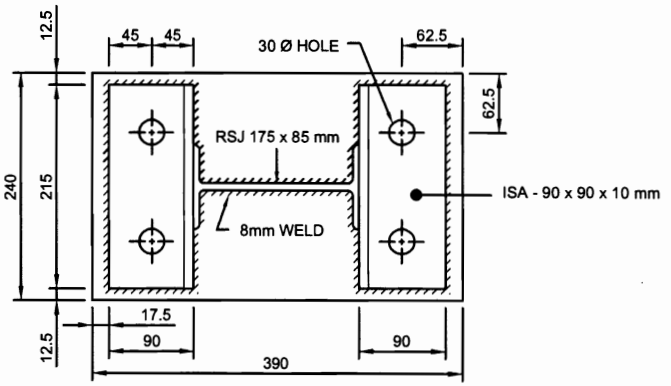
	SIGN.	DATE		
DRAWN BY	BMM	24-01-2013	STRUCTURE DRAWING FOR 132KV, ISOLATOR (LOW LEVEL) TYPE - 3 DO2	SCALE N. T. S.
CHEKD. BY	ABK	24-01-2013		SHEET NO. - OF -
APPRD. BY	RAP	24-01-2013	Shreem ELECTRIC LIMITED	REV. 0
DRG-NO-SR-ES-A3-0039-09-2000				



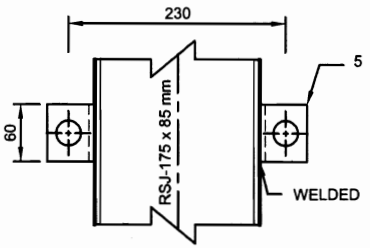
ELEVATION

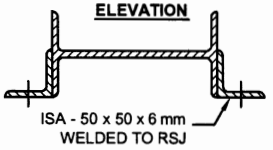


END VIEW



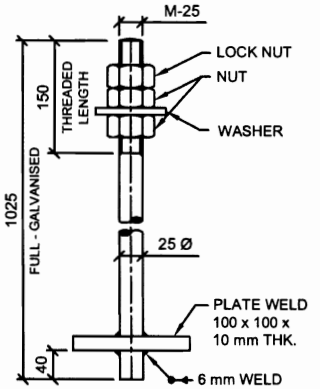
DETAILS OF BASE PLATE



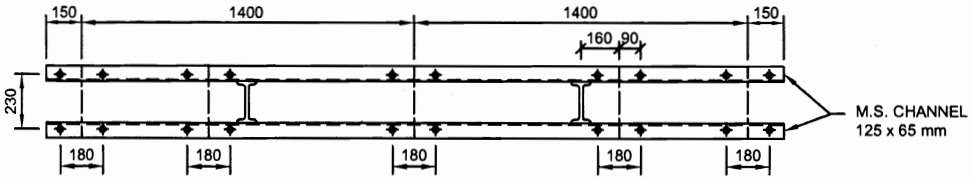


ELEVATION

PLAN
DETAIL AT - A



FOUNDATION BOLT DETAIL



PLAN

NOTE :-
1) ALL DIMENSIONS ARE IN m.m.
2) DIMENSIONAL & WEIGHT TOLERANCE ± 10 %
3) ALL STRUCTURAL MEMBERS WILL BE HOT DIP GALVANISED.
4) ALL HOLES ARE 17.5 Ø FOR M-16 BOLTS UNLESS OTHER WISE STATED.
5) ALL FILLET WELDS ARE 6 mm SIZE UNLESS OTHER WISE STATED.
6) ALL MLLD STEEL CHALL CONFORMS TO IS : 2062 GR-A EQULVALENT.
7) ALL ITEM NOS TO BE PREFIXED WITH 1DO3...1...2...3... ETC

REFFER MPPTCL DRG-NO. SAEI/33 KV/XII-HO8-323 R1

FOR APPROVAL ONLY

CUSTOMER : - MPPTCL, JABALPUR.

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P.O. NO :- 04- 01 / 6547-1 / JICA / TK. Dt. 10-09-2012. (TR-106)- SATNA
P.O. NO :- 04- 01 / 6548-2 / JICA / TK. Dt. 10-09-2012. (TR-107)- UJJAIN

	SIGN.	DATE
DRAWN BY	BMM	23-01-2013
CHEKD. BY	ABK	23-01-2013
APPRD. BY	RAP	23-01-2013
DRG-NO-SR-ES-A3-0672-09-2005		

33KV S/S STRUCTURAL ISOLATOR - **1DO3**
BOLTED (FOR LOW LEVEL)

Shreem ELECTRIC LIMITED

SCALE N. T. S.
SHEET NO. - OF -
REV. 0

SECTION-3

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Madhya Pradesh power Transmission company Ltd.				
b)	Project Title	Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turn key basis (Lot no. 1) – Balaghat , Badnawar, Bhopal, Chhegaon and Nagda substation				
c)	Location	Balaghat	Badnawar	Bhopal	Chhegaon	Nagada
		Balaghat is Located in district of Balaghat of Madhya Pradesh. Distance between Jabalpur to Balaghat is 232 km by Road and 130 km by Rails.	Badnawar is Located in district of Dhar of Madhya Pradesh. Distance between Badnawar to Ujain is 70 km by Road .	Bhopal site is located 20 kM away from Bhopal city.	Chhegaon is located in Khandwa district of Madhya Pradesh . Distance between Chhegaon to Khandwa is 15 km by Road.	Nagda is located in Ujjain district of Madhya Pradesh. The road distance between Nagda to Ujjain is 47 km
d)	Transport Facilities	Road/Rail				
e)	Postal Address	To follow				

SITE CONDITIONS		
a)	Maximum ambient air temperature	50°C
b)	Minimum ambient air temperature	1°C
c)	Average daily ambient temperature	35°C
d)	Maximum Relative humidity	95 %(sometimes approach saturation)
e)	Pollution Severity	Heavily Polluted
f)	Seismic level (horizontal acceleration)	0.3g
g)	Wind zone as per IS 802 (PART 1) - 1995velocity	4
h)	maximum wind pressure	150kg/sq.mts
i)	Average annual rainfall	1250 mm
j)	Maximum altitude above mean see level	1000m
k)	Isolceraunic level	90 days per year
l)	Climate	Moderately hot & humid tropical climate , conductive ti rust & fungus growth

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V 50 Hz, 3-phase 4 wire, solidly earthed
1 phase A.C power supply	240V ,50 Hz, 1-phase , 2 wire
D.C. power supply	**220V , 2-wire ungrounded**, for all equipments and panels except PLCC of 400kV /220kV /132kV /33kV substation
D.C. power supply	48V , 2 wire system positively earthed for PLCC

The above supply voltage may vary as below and all devices shall be suitable for continuous operation over entire range of voltage.

i.	AC supply	Voltage + 10 % to -25% , frequency ± 4%
ii.	DC supply	Voltage + 10 % to -20%

SYSTEM PARAMETERS

Description parameters	**400kV System**	**220kV System**	**132kV System**	**33kV System**
System operating voltage	400 kV	220kV	132kV	33kV
Maximum operating voltage(rms)	420 kV	220kV	145kV	36 kV
Rated frequency	50Hz			
Full wave impulse withstand voltage (1.2/50 micro second)	1425kVP	1050kVP	650kVP	250kVP/ 170kVP
One minute Power frequency dry/wet withstand voltage (rms)	630kV/ 520kV	460kV	275kV	95kV/70kV
Switching Impulse withstand voltage (250/2500 micro sec.) dry and wet	1050kVP	-	-	-
Corona extinction voltage	320kV	156kV	105kV	-
Maximum radio interference voltage for frequency between 0.5MHz and 2 MHz at 320kV rms phase for 400kV system , 156kVrms for 220kV system & 92 kV rms for 132kV system	1000 Micro volt	1000 Micro volt	500 Micro volt	-
Rated short time current	40 kA for three seconds/one second as applicable			25 kA for three seconds/2 6.2kA for two second
Creepage distance @25mm/kV	10500mm	6125mm	3625mm	900mm
System Earthing	Effectively Earthed			

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of bid opening (i.e. 20.11.13)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type

test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modem practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to

previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.
All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

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

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

Painting process shall be of powder coating type.All surface shall be cleaned , phosphated and given two coats of rust –resistant primer followed by two coats of finish paints . The interior of all panels cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey

shade(697 of IS-5) shall be given to exterior surface of all the panels. Sufficient quantities of touch paint shall be furnished for application at site. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 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.

3.6 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.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly 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 paintaing shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitabley wrapped or other wise 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. All external painting shall be as per shade no. 697 of IS:5.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support

channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 & or 4759 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvasized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Net weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

Mandatory spares shall be packed in separate packing with clear identification.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any

demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

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 out door: IP-55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area IP:52

d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41

e) 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.

3.12 RATING PLATES, NAME PLATES AND LABELS

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

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor

marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 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 box** –clamp type 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 Publictions, 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.

3.15 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 **CRCA** sheet steel of minimum 2.5 mm thickness. The thickness of door s/covers shall not be less than 2.5 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

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

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

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box

shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project 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

3.16 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. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant ,the unit designation, contract no. , and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

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

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

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

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

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings

2) Guaranteed Technical Particulars

3) Type Test Reports

4) Manufacturing Quality Plan

3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1.	Drawings and Data Sheets	1	6	21	7 nos of all drawings/documents
2.	Drawings "As Built "	-	-	21	
3.	Type Test Reports	1	6	21	
4.	Erection Manuals	-	6	21	
5.	Operation and Maintenance Manuals	-	6	21	
6.	Manufacturing Quality Plan	1	6	21	
7.	Field Quality Plan	1	6	21	
8.	Inspection Test Reports	-	-	21	

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

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

SECTION 4
GUARANTEED AND TECHNICAL PARTICULARS
(To be submitted at contract stage)
(TO BE FILLED SEPARATELY FOR EACH TYPE AND RATING OF SWITCH)

1.		**GENERAL**	
	a)	Name and country of Manufacturer	
	b)	Manufacturer's Type Designation	
	c)	Standard Applicable	
	d)	Rated Voltage	
	e)	Rated current (A)	
		i) Under Normal Current	
		ii) Under Site Conditions at 50 degree C ambient	
	f)	Rated Frequency (Hz)	
	g)	No. of poles	
	h)	Whether poles are mechanically ganged	
	i)	Pole to pole spacing	
2.		**GUARANTEED RATINGS**	
	a)	Rated short time current (kA rms)	
		i) For 1 sec.	
		ii) For 3 secs.	
		iii) Dynamic current (kA peak)	
		iv) Rated short circuit current which can be made	
		by earthing switches (kA rms)	
	b)	Opening Time of	
		i) Disconnecting Switch (sec)	
		ii) Earth switch (sec)	
	c)	Closing Time of	
		i) Disconnecting Switch (sec)	
		ii) Earth switch (sec)	
	d)	Temperature rise over 50^0 C ambient temperature	
		corresponding to maximum continuous current	
	e)	Maximum capacity for interrupting magnetizing current of transformers	

	f)	Max. capacity for interrupting line charging current	
	h)	Whether Earth Switch capable of discharging	
		trapped charges of 500 km long line	
3.		**DIELECTRIC WITHSTAND CAPACITY OF COMPLETE ASSEMBLED DISCONNECTING SWITCH AND EARTHING SWITCHES**	
	a)	One minute dry power frequency withstand test voltage	
		i) against ground (kV_{rms}) -dry	
		- wet	
		ii) Across open contacts (kV_{rms}) -dry	
		- wet	
	b)	1.2/50 microsecond dry impulse withstand voltage	
		(positive and negative polarity)	
		i) against ground (kV_{rms}) -dry	
		- wet	
		ii) Across open contacts (kV_{rms}) -dry	
		- wet	
	c)	250/2500 micro second switching impulse withstand	
		voltage (+ve & -ve polarity)	
		i) against ground (kV_{rms}) -dry	
		- wet	
		ii) Across open contacts (kV_{rms}) -dry	
		- wet	
	d)	Corona extinction voltage (kV_{rms})	
	e)	Radio Interference Voltage at 1.1 Um/√3 in micro	
		volts) for Frequency between 0.5 MHz to 2.0 MHz.	
	f)	Total Creeepage distance to ground (mm)	
4.		**OPERATING MECHANISM**	
	a)	Operating Torque required to	
		i) to operate 3 pole gang-operated Main switch	

		ii) to operate 3-pole gang- operated earthing switch	
	b)	Type and Rating (KW) of motor	
	c)	Rated Voltage of the motor	
	d)	Full load current (A)	
	e)	Starting Current (A)	
4.1		**INTERLOCKING**	
	a)	Whether mechanical / constructional interlock between	
		Disconnecting Switch and earth switch provided	
	b)	Details of Electrical Interlock enclosed for	
		i) Disconnecting Switch	
		ii) Earth switch	
	c)	Arrangement provided to prevent electrical or manual	
		operation unless interlock conditions are satisfied.	
		(Please provide write up separately)	
	d)	Whether interlock coil is continuously rated	
	e)	Whether DC Control Voltage and variation allowed.	
	f)	Power Consumption	
4.2		**CONTROLS**	
	a)	Rated DC control Voltage	
	b)	Limits of Voltage	
	c)	Power Consumption of the Voltage	
5.		**CONSTRUCTIONAL FEATURES**	
	a)	Whether position of earth switch can be interchanged	
		At site to either side of the pole	
	b)	Main Contacts	
		i) Type of Contacts	
		ii) Contact area (sq cm)	

		iii) Material of contact	
		iv) Contact pressure in kg/ sq cm	
		v) Max. Current density under normal current Carrying capacity (amps/sq cm)	
		vi) Thickness of Silver coating	
	c)	Auxiliary Contacts on Disconnecting Switch	
		i) Total Number	
		ii) NO	
		iii) NC	
		iv) Adjustable	
		v) Make before break	
		vi) Rated Voltage (volts)	
		vii) Rated Continuous current (Amps)	
		viii) Rated DC breaking current with 20 ms time constant (A)	
	d)	Auxiliary Contacts on Earthing Switch	
		i) Total Number	
		ii) NO	
		iii) NC	
		iv) Adjustable	
		v) Rated Voltage (volts)	
		vi) Rated Continuous current (Amps)	
		vii) Rated DC breaking current with 20 ms time constant (A)	
	e)	Whether counter balance spring/ weight provided	
		For Disconnecting switch / earth switch	
	f)	Type of bearing	
	g)	Locations of bearings	
	h)	Type of lubricant for bearings	
	i)	Rated mechanical terminal load	
		- Longitudinal load (Kg)	
		- Transverse load (Kg)	
6.		CONTROL CABINET	
		- Material & Thickness	
		- Degree of protection	
7.		**GALVANIZATION:**	
	a)	Applicable standard	

	b)	Method of galvanization	
	c)	Weight of zinc coating	
8.		**WEIGHTS:**	
	a)	Weight of 3-phase isolator	
	b)	Motor Operating Mechanism box	
	c)	Manual operating mechanism box	
	d)	3 pole Earthing Switch	
	e)	Weight of the heaviest package.	
9.		**OVERALL DIMENSIONS:**	
	a)	3 phase isolator	
	b)	Motor Operating Mechanism box	
	c)	Manual operating mechanism box	
	d)	Earthing Switch	
	e)	Largest package	
	f)	No of packages & Shipping dimension of each package	
10.		LITERATURE	
		Whether the following are enclosed	
	a)	Type test Reports	
	b)	OGA drawings of Disconnecting switches with and	
		without Earth Switches	
	c)	Details of constructional interlock	
	d)	Details of Motor operating Mechanism	
	e)	Leaflets and Literature bringing out salient features	
	f)	Operation & Maintenance Manual	

SECTION-5

TECHNICAL CHECK LIST FOR ISOLATORS / EARTHING SWITCHES

(INFORMATION TO BE FURNISHED WITH OFFER)

BIDDERS ARE INSTRUCTED TO

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

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

SN.	Parameters	Specified Requirement				Confirmation
1	Rated Voltage (KV)	**420**	**245**	**145**	**36**	
2	Type of Isolator	Pantograph/ Horizontal centre Break	Double Break	Double Break	Double Break	
3	System Neutral Earthing	Effectively Earthed				
4	Rated normal Current (Amp. rms)	2000	1250	800	800/1200	
5	Rated short time withstand Current of Isolator and Earth switch	40kA for 1 Sec	40kA for 1 Sec	40kA for 1 Sec	26.2kA for 2s	
6	Rated dynamic short circuit withstand Current of Isolator and Earth switch	100kAp	100kAp	100kAp	65.5kAp	
7	Rated frequency (Hz)	50				
8	Number of Phases (Poles)	3				

9	Phase to phase spacing(mm)	7000	4000	2500	1400	
10	Whether all 3 poles are ganged	Electrically	Mechanically	Mechanically	Mechanically	
11	Operating time	Less than 12	-	-	-	
12	Safe duration Overload:					
	i) 150% of Rated current	5min	-	-	-	
	ii) 120% of rated current	30min	-	-	-	
13	Temperature rise	As per relevant IEC/IS publication				
14	Seismic Acceleration	0.3 g				
15	Rated Insulation Level					
15.1	Rated One minute Power freq. Withstand voltage(KV rms)		460	275	70	
	i. To Earth (KV rms)	520				
	ii. Across Terminals of open disconnect (KV rms.)	610				
15.2	1.2/50 micro sec impulse withstand voltage					
	i. To Earth(KVp)	±1425	±1050	±650	±170	
	ii. Across insulating distance (KVp) -	±1425(240)	±1200	±750	±195	
15.3	250/2500 micro sec. switching surge withstand test voltage (dry & wet)					
	i. Against ground (KVP) -	±1050	-	-	-	
	ii. Across insulating distance (KVp) -	±900(345)	-	-	-	

16	Corona extinction voltage (KV rms)	320		176	-	-	
17	Radio interference level at 1.1 Ur/_/3 (in micro volts at 1.0 MHz)	500		500	-	-	
18	Min creepage distance of support & rotating insulator (mm) – (25 mm/kV)	10500		6125	3500	900	
19	Operating Mechanism for Isolator	Motor/Manual		Manual	Manual	Manual	
20	Operating Mechanism for Earth Switches	Manual		Manual	Manual	Manual	
21	Whether constructional interlock between Isolator & Earth switch provided	YES					
22	Which interlock between Isolator & Earth switch provided	Mechanical					
23	Arrangement provided to prevent electrical or manual operation unless interlock conditions are satisfied	YES					
24	Rated Mechanical Terminal Load	HCB	Pantograph				
	i) Straight Load(N)	1600	2000	800	-	-	
	ii)Across Load(N)	530	800	270	-	-	
25	Rated contact zone for P.G. isolator when fixed contacts are supported on flexible conductors.						
a)	Horizontal deflection (Metres)	0.5		-	-	-	-

b)	Vertical deflection (Metres)	0.3	-	-	-	-
c)	Total amplitude of longitudinal movement with respect to support conductor (Meters)	0.4	-	-	-	-
26	Rated DC control voltage and variation allowed	220V DC(75%-110%)				
27	Material of contacts	Hard drawn electrolytic copper and the surface shall be silver plated				
28	Thickness of silver plating of contacts	25 micron				
29a)	Number of auxiliary contacts on isolator/pole	20NO + 20 NC + 8MBB	8NO + 8NC	8NO + 8NC	8NO + 8NC	
29b)	Number of auxiliary contacts on earth switch/pole	*8 NO + 8NC*	*6 NO + 6NC*	*6 NO + 6NC*	*6 NO + 6NC*	
30	Rating of Auxiliary contacts	10 A at 220 V DC				
31	Rated DC breaking current of Auxiliary contacts with time constant not less than 20 ms (A)	2A				
32	Material of Current carrying parts	non-ferrous and non-corroding material				
	Material of Arm	non-rusting and non-corroding metal	Hard drawn electrolytic copper & contact surface silver-plated for 25micron			
	Material of Terminal Pads	Hard Drawn Electrolytic Copper/ Al				
33	Current Density	Aluminium : 1.0 Amps/Sq.mm; Copper: 2.0 Amps/Sq. mm				
34(a)	Height of the centre line of Terminal Pad above ground level	8200	7000	4600	3900	

34(b)	Strung bus height for Pantograph Isolator	15.6 metres (with a maximum Sag upto 1900 mm)				
35	Min Clearance (mm)					
	i) Phase to earth	3500	2150	1075	480	
	ii) Phase to phase	4000	3500	2500	1400	
36	Capability of Isolator for making and breaking the magnetizing/capacitive currents	0.7 Arms	0.7 Arms	0.5 Arms	0.5 Arms	
37	All valid Type test reports as per Clause No. 4 of section-1, Clause No. 6 of section-2A & Clause No. 6 of section-2B of this specifications , are available	Yes, available				
	CONTROL CABINETS					
38	Application	Outdoor				
39	Material of control cabinet sheet	sheet steel (Dust, weather & vermin Proof)				
40	Thickness of sheet (mm)	Sheet Steel: 2mm				
41	Degree of protection provided	IP55				
42	Standard applicable for control cabinet	As per relevant IS/IEC				
43	Whether Hot Dip Galvanised	YES				
44	Colour shade of finish paint of control cabinet as per ISI	Paint shade No.697 of ISI				

45	Size of Conductor used in Control Wiring of control cabinet	2.5 sq.mm	
46	10 % Spare Terminal Blocks provided for each panel	YES	
47	Terminal Blocks shall be suitable for terminating 2 wires of 10sqmm Sqmm for power cable and terminating two wires of 2.5sqmm for control cable	YES	
48	Local Remote Switch indication of Isolator provided	Yes	
49	Confirm to follow the BHEL/Customer MQP	Confirmed	
50	Following accessories not limited to this is included in scope or not:		
A	Hardware for Structure (BHEL supply) to Base Channel (vendor supply)	YES	
B	Hardware for Base Channel (vendor supply) to Bottom of Post Insulator (BHEL supply)	YES	
C	Hardware for Top BPI (BHEL supply) to Male/Female Member	YES	
D	Hardware for Structure (BHEL supply) to MOM Box	YES	

E	Hardware for Structure (BHEL supply) to Earth Switch MOM	YES	
F	Terminal Connectors (except for Pantograph Isolator at bus level i.e. 15.6m)	NO	
G	Support Structure	NO	

Date:				
Place:	**(Signature of the authorized representative of Bidder / Firm / Company)**			
Phone:	**Name:**			
Fax:	**Designation:**			
E-mail:	**Company Seal:**			
Mobile:				
Website:				