



**GUJARAT ENERGY TRANSMISSION  
CORPORATION LTD.**

**SARADAR PATEL VIDYUT BHAVAN,  
RACE COURSE, BARODA – 390 007.**

**TECHNICAL SPECIFICATION  
OF**

**400, 220 & 132 kV Double Break ISOLATORS**

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## **TECHNICAL SPECIFICATION of 400 / 220 / 132 KV CLASS Double Break & TANDEM ISOLATORS**

### **1.1.0 SCOPE**

1.1.1 This covers the specific technical particulars, climatic and isoceraunic conditions, system particulars etc., according to which the isolators with accessories shall be offered as per the requirement specified.

### **1.2.0 CLIMATIC & ISOCERAUNIC CONDITIONS**

1.2.1 The climatic conditions at site under which the equipment shall operate satisfactory are as under:

- |   |   |
|---|---|
| (i) Altitude above mean sea level (meters)                | : Not exceeding 1000 meters   |
| (ii) Maximum ambient air temperature °C                   | : 50 °C   |
| (iii) Maximum daily average ambient air temperature °C    | : 40 °C   |
| (iv) Relative humidity for design of equipment %          | : 95%   |
| (v) Maximum yearly average temp °C                        | : 30 °C   |
| (vi) Minimum temperature of air in shade                  | : 4 °C  |
| (vii) Climate growth                                      | : Moderately hot and humid tropical climate conducive to frost and fungus |
| (viii) Maximum annual rain fall in mm                     | : 1150 mm   |
| (ix) Isoceraunic level                                    | : 30  |
| (x) Average number of thunder storm days per annum (Nos.) | : 15  |
| (xi) Maximum wind pressure(kg/mt <sup>2</sup> )           | : 150   |
| (xii) Earth-quake acceleration (g)                        | : <b>0.5 g</b>  |

1.2.2 All electrical devices shall be given tropical and fungicidal treatment and shall be capable of satisfactory operation under the severe climatic conditions that would prevail at site as described above.

1.2.3 The equipment offered shall be suitable for continuous operation under above conditions at the full rated capacity.

1.2.4 Since the sub-stations, where the equipments are to be installed, are on the coastal and/or industrial areas, the equipment offered shall be suitable for heavily polluted atmosphere.

1.2.5 The equipment offered shall be suitable for hot line maintenance techniques.

### **1.3.0 SYSTEM PARTICULARS:**

- 1.3.1 Nominal system voltage : **400 / 220 / 132 KV**
- 1.3.2 Highest system voltage : **420 / 245 / 145 KV**
- 1.3.3 System frequency : 50 Hz
- 1.3.4 No. of Phases : Three (3)
- 1.3.5 System neutral : Effectively earthed

Note: The rated voltage of Isolator or Earthing Switch shall be the highest system voltage.

#### 1.4.0 AUXILIARY POWER SUPPLY

1.4.1 Auxiliary Electrical equipment shall be suitable for operation on the following supply system:  
Particulars.

- (i) AC control & protective devices :240 V, 1-phase, 2-wire, lighting & space heaters  
AC supply with one lead grounded
- (ii) DC alarm, control and protective device:220 V/110 V DC supply from station batteries
- (iii) AC control for motor operating :415 V, 3-phase, 4 wire, Mechanism  
neutral grounded AC supply

1.4.2 In the above supply, voltage may vary as follows:

All devices shall be suitable for continuous operation over entire range of voltage as stated below.

- (i) AC supply : Voltage variation  $\pm 10\%$ . Frequency variation  $\pm 3\%$
  - (ii) DC supply : -15% to +10% variation
- 1.4.3 Each of the foregoing supplies will be made available by the purchaser at one terminal point for each Isolator for operation of the accessories and auxiliary equipment. Bidders' scope shall include distribution beyond the points of supply including supply of terminal blocks, HRC Fuses, Switches etc. Inter-connection of poles will be done by purchaser.
- 1.4.4 110 V, 1-phase AC supply will not be provided by the purchaser. To obtain 110 V supply from purchaser's 415 V, 3-phase, 3 Wire supply, the supplier shall incorporate 415/110 V single phase dry type control transformers with  $\pm 10\%$  OFF – circuit voltage of taps on 415 Volt side with switches and fuses on both primary and secondary sides, with one end of secondary earthed.

#### 1.5.0 SPECIFIC TECHNICAL REQUIREMENTS

1.5.1 The Isolators shall comply with the following technical requirements:

- (i) (a) Nominal system voltage : **400 / 220 / 132 KV**  
(b) Rated voltage : **420 / 245 / 145 KV**
- (ii) Rated frequency : 50 Hz.
- (iii) No. of phases : Three (3)
- (iv) (a) Type of Isolator (220 / 132 kV) : Double break outdoor *electrically* gang operated type.  
(400 kV isolators): **Double break outdoor electrically gang**

- operated type.*
- (b) Type of earthing switch : *Vertical break, electrically gang operated.*
- (v) Insulation : Outdoor.
- (vi) Rated normal current  
     a) 400 kV HDB : **3150/2000 Amp.** (As indicated in Schedule – A or BOQ of respective tender)  
     b) 220 / 132 kV HDB : **1600 Amp**
- (vii) Rated short time current with stand: 40 KA.
- (viii) Rated duration of short circuit. : 3 seconds.
- (ix) Rated peak short circuit current withstand. : 100 KA (peak)
- (x) Interruption capacity :-  
     (i) Magnetizing current : 0.7 Amps. At 0.15 P.F.  
     (ii) Line charging current : 0.7 Amps. At 0.15 P.F.
- (xi) 1.2/50 microsecond lighting impulse withstand voltage:-  
     (a) Between Poles and earth : **1425 / 1050 / 650 KV (peak)**  
     (b) Across the open Disconnecter : **1665 / 1200 / 750 KV (peak)**  
         (voltage applied to one terminal with opposite terminal grounded).
- (xii) 1- Minute power frequency withstand voltage:  
     (a) To Earth & between poles : **1050 / 460 / 275 KV (rms)**
- (xiii) Safe duration of over load :  
     (a) 150% of rated current : 5 minute  
     (b) 120% of rated current : 30 minute
- (xiv) Temperature rise:

The temperature rise shall not exceed the maximum temperature rise specified below :

Sr. No.	Part	Maximum permissible temperature rise in °C over an ambient temp. up to		
		45 °C	50 °C	55 °C
(1) Copper contacts in air :				
	(a) Bare	30	25	20
	(b) Silver facing less than 1 mm thick.	45	40	35
	(c) Silver facing more than 1 mm thick.	60	55	50
(2) Terminals to be screwed or bolted to external conductors.				
		45	40	35

- |   |    |    |    |
|---|----|----|----|
| (3) For all other current Carrying parts. | 30 | 25 | 20 |
|---|----|----|----|

NOTE: (i) The temperature shall not reach a value where elasticity of the materials is impaired.

(ii) Rated ambient temperature is 50 °C.

- (xv) Minimum cantilever strength : 8 kN for 400 & 220 kV and 6 kN for 132 kV.
- (xiv) Minimum creepage distance : 10500 / 6125 / 3625 mm.  
of support insulators (*Note: The above Creepage distance shall be offered unless otherwise specifically indicated in Schedule – A or BOQ of respective tender*)
- (xvii) Operating mechanism of Isolator: Motor and Manual operating mechanism
- Earth switch : ***Motor & Manual operating mechanism***
- (xviii) Current Density:  
Current density to be adopted for all part of the Isolator and terminal connector shall not exceed the following limits:
- (a) Hollow tube section : Copper – 2.0 A/mm<sup>2</sup>  
Aluminum–1.25 A/mm<sup>2</sup>
- (b) Other sections & terminal connectors: Copper – 1.60A/mm<sup>2</sup>  
Aluminum – 1.0 A/mm<sup>2</sup>
- (xix) Auxiliary contacts on Isolator: 10 NO & 10 NC (***Additional 2 NO & 2 NC as spare***)  
(***MBB contact 2NO & NC (Additional 1 NO & 1 NC as spare)***)
- (xx) Auxiliary contacts on earthing switch: 6 NO & 6NC (***Additional 1 NO & 1 NC as spare***)
- (xxi) Phase to phase spacing : 7000 / 4500 / **3100** mm
- (xxii) Ground clearance ***up to plinth level*** : 8000 / 5500 / **4600** mm
- (xxiii) Interlocks with circuit breaker. : Electrical interlocking required.

### 1.6.0 OTHER REQUIREMENTS

- 1.6.1 The earthing switches should be of non-ferrous materials especially of the same material as that of main switch assembly and able to carry the same fault current as assigned to the main disconnectors and withstand the dynamic stresses.
- 1.6.2 *All the three poles of 132, 220 & 400 kV isolators and earthing switches shall be electrically ganged operated by separate operating mechanism to ensure that operations of all the three poles are simultaneous.*
- 1.6.3 Flexible copper connections between rotation shaft of the earthing switch and the frame shall have cross section suitable to withstand **Rated** short time current.
- 1.6.4 Each Isolator will be electrically interlocked with its breakers, *earthing switch* & other

Isolators as per the switchyard interlocking scheme. Isolator manufacturer shall have to co-ordinate with breaker supplier for this purpose. For this Auxiliary Switches are to be provided with 10 NO & 10 NC auxiliary contacts per pole. *and* two pair of auxiliary contacts i.e. 2 NO + 2 NC shall be adjusted for advancement **MBB** of total travel for bus bar protection application. In **each Earth Switch** 6 NO & 6 NC auxiliary contacts shall be provided for purchaser's use. **The spare contact shall be as per cl. 1.5.1 (xix).** The auxiliary contacts shall be make before break type with adjustable contact travel. **Isolator's motor operating mechanism shall be equipped with CAM operated type independently adjustable auxiliary contacts. It shall be possible to field adjust the cams of each micro switch. The regulation of each cam shall be possible without loosening all other cams; other non adjustable signaling devices (commutaters) are not acceptable.**

- 1.6.5.1 Signaling of the closed position shall not take place unless it is certain that the movable contacts have reached a position in which the rated normal current, the peak withstand current and the short time withstand current can be carried safely. Limit position switches shall be provided for this signaling.
- 1.6.5.2 **The signaling device shall be housed inside the mechanism to ensure direct and reliable correspondence between the position of the mechanism and the position of Disconnecter. On pipe mounted auxiliary contacts are not acceptable.**
- 1.6.6 Signaling of the open position shall not take place unless the movable contact have reached a position such that the clearance between the contacts is at least 80% of the isolating distance.
- 1.6.7 Each earthing switch in addition to being mechanically interlocked with its main blades shall also be provided with solenoid type electrical interlocking feature suitable for operation on purchaser's 110 V/220 V DC supply. The interlock shall comprise of two electromechanical castle locks with the common key to prevent operation of isolator with earth switch closed and vice a versa. The key can be released by energizing the coil when certain preset conditions of purchaser's interlock scheme are fulfilled, hence making the interlock feature "fail safe type".
- 1.6.8.1 The terminal connectors shall be supplied for connecting Isolator terminals to purchaser's conductor. *The type of connector shall be rigid and/or flexible as indicated in Schedule – A or BOQ of respective tender. The final requirement as per project shall be informed during detailed engineering. The terminal connector shall not foul with moving arm in any position, even after provision of corona rings. Terminal connector shall be universal type for both vertical and horizontal take off.*
- 1.6.8.2 **Short time current withstand capability of terminal connector shall be equal to isolator.**
- 1.6.8.3 The terminal connectors, *if not indicated in Schedule – A or BOQ of respective tender, then it shall be* suitable for twin ACSR moose conductor with conductor spacing of 350 mm shall be supplied for 220 & 132 kV class HDB isolators. *In case of 400 kV the terminal connector shall be suitable for quadruple ACSR Moose conductor or 4" IPS pipe (Sch – 80 – range II) with conductor spacing of 450 mm.* The terminal connector shall be suitable for both vertical & horizontal connections of the transmission line conductor or station bus bar.
- 1.6.8.4 The terminal connector shall be supplied as per **IS: 5561**. The terminal connector shall be **bimetallic compression type. Nut bolts shall be of non magnetic stainless steel along with two nos of washers & check nuts. The size of nut bolts shall not be less than 12 mm.**
- 1.6.8.5 The drawings of the clamp connectors shall be submitted with the technical bid

- 1.6.9 The frame of each disconnector and earthing switch shall be provided with two reliable earthing terminals for connection to an earthing conductor having a clamping screw suitable for specified earth fault currents. ***The earthing conductor will be of GI strip of 50 x 6 mm.***
- 1.6.10 Disconnector and earthing switches, including their operating mechanism shall be so constructed that they can not come out of their open or closed position due to ***short circuit forces***, gravity, wind pressure, vibrations, reasonable shocks or accidental touching of the connecting rods or their operating mechanisms. The reliability of current carrying capacity shall not be impaired due to such forces.
- 1.6.11 If earthing switch is combined with an isolator as a single unit, the rated peak short circuit current and the rated short time current, of the earthing switch shall be at least equal to those specified for the isolator.
- 1.6.12 The earthing switches shall be capable of discharging trapped charges of 100 KM ***or*** long transmission line
- 1.6.13 The isolator shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminal of each pole of the isolator on account of make/break operation.
- 1.6.14 The equipment offered shall be suitable for hot line ***maintenance***.
- 1.6.15 Total operating time of isolator / earthing switch ***when electrically operated*** shall not exceed 12 seconds.
- 1.6.16 The support structure for all type of isolators are in scope of bidder ***if specified in schedule – A of respective tender***. The support structure specifications are attached separately. *The structure for 400 kV HDB isolator shall be pipe type, while 132 & 220 kV shall be lattice type. The pipe type structure shall be provided with climbing arrangement for maintenance purpose. Design calculations along with bill of Material for structure shall have to be submitted by the successful bidder.*



**SECTION – II****GENERAL TECHNICAL REQUIREMENTS****2.1.0 SCOPE**

2.1.1 This covers design, manufacturer, assembly, inspection and testing at manufacture's works, supply and delivery at site, **420 / 245 / 145** kV high voltage, **horizontal double** break type air-break alternating current isolators **with or without** earthing switches & support structures suitable for out door use. **Isolators may be operated in tandem position also.** Also, at the discretion of the purchaser, **bidder** shall have to undertake **the scope of support structure, complete erection or** supervision of erection, testing and commissioning of the isolators as **indicated in schedule - A of respective tender.** *Design calculations along with bill of Material for structure shall be submitted by the successful bidder.*

2.1.2 It is not the intent to specify completely herein all the details of design and construction of the equipment. However, the equipment shall conform, in all respects, to high standards of engineering, design and workmanship and be capable of performing, in continuous commercial operation. **GETCO** reserve right to reject any work or material which in his opinion are not in full accordance therewith.

**2.2.0 CODES AND STANDARDS**

2.2.1 The design, manufacture and performance of high voltage isolators and accessories shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this Specification shall be construed to relieve vender of this responsibility.

2.2.2 Unless otherwise specified, the equipment shall conform to the latest India or IEC Standards (including amendments) as specified below: (latest editions)

Sr.No.	Standard No.	Title
1	IS:9921	Alternating current isolators (Disconnectors) and earthing switches.
2	IEC-62271-102	Alternating current isolators (Disconnectors) and earthing switches.
3	IS:2544	Insulators
4	IS:13947	Low voltage switchgear and control gear.
5	IS:4691	Degree of protection provided by enclosure.
6	IS:325	Three phase induction motors.
7	IS:4722	Rotating electrical machines.
8	IS:2629	Recommended practice for hot dip galvanizing of iron and steel.
9	IS:4759	Hot dip galvanization coating on structural steel.
10	IS:2633	Method of testing weight thickness and uniformity of coating on fasteners.
11	IS:1573	Electroplated coating of zinc on iron & steel.
12	IS:6735	Spring Washers.
13	IS:2016	Plain Washers.
14	<b>IS: 5561</b>	<b>Specification of electric power connector</b>
15	IS:5350	Solid core insulators or multi-core type insulators

2.2.3 In case equipment conforms to other internationally acceptable standards which ensures equivalent or better performance than that specified shall be submitted with justification.

2.2.4 Accessories, components, parts and raw materials shall conform to relevant Indian Standards.

### 2.3.0 DRAWINGS

2.3.1 As a part of the proposal, the bidder shall furnish relevant descriptive and illustrative literature and the following drawings **with technical bid**.

- (i) Drawing showing plan, **side view** and elevation of isolator and earthing switch incorporating mounting dimensions, overall dimensions, weight etc.
- (ii) Dimensional drawing for the **main switch contact** assembly for line and earthing of the isolator.
- (iii) Mounting details, operating handle, **motor operating box** and operating devices.
- (iv) Details of contacts, **hinged terminal contact** and main isolator blades.
- (v) Drawing of isolators supporting structures.
- (vi) Control wiring/ **schematic diagram**.
- (vii) Copies of type test certificates and relevant oscillograms.
- (viii) Isolator and Earth switch operating mechanism box with accessories and mechanism.**

2.3.2 The bidder may furnish any other drawings which he considers necessary for giving complete information about his equipment.

2.3.3 After receipt of an order, the successful Bidder shall have to furnish within one month, the following drawings for approval of the purchaser.

- (i) Assembly drawing showing plan and elevation of isolators and earthing switch incorporating mounting dimensions, detailed dimensions, shipping weight, net weight etc.
- (ii) Schematic control wiring diagram and interlocking scheme.
- (iii) Dimensional control for the line and earth side terminals of the isolator. Also, dimensional drawing of the clamps and connectors.
- (iv) Location and mounting details of operating handle and operating devices.
- (v) Drawing giving details of guides and guide bearings (**Type, designation, No. & make**) to be mounted on isolator supporting structure.
- (vi) Details of jaw contacts and main isolator blades.
- (vii) Details of terminal stud.
- (viii) Drawing necessary for design and fabrication of isolators supporting structure, if structures are not included in the scope of supply.
- (ix) Drawing showing various position (close and open) of the isolator.
- (x) Drawing of corona rings.
- (xi) Drawings of supporting insulators & operating rods insulators.
- (xii) Name plat details.
- (xiii) Bill of materials.
- (xiv) Drawing for support structure**

2.3.4 After receipt of the order the supplier shall prepare a program for submission of drawing

for the approval of the purchaser. Submission of drawing should be as per clause no. 2.3.3.

2.3.5 Drawing, diagrams, instructions and report shall be identified by descriptive title indicating their application to the equipment offered. All drawings and data shall be annotated in English language. Dimensions shall be in metric system.

2.3.6 Supplier shall furnish of three sets of all the drawings pertaining to the equipment along with **soft copy** for each as the final submission **for approval**.

#### 2.4.0 GENERAL CONSTRUCTION DETAIL

2.4.1 The isolators/earthing switch shall be completed with all parts that are necessary or essential for efficient & **safe** operation. Such part shall be deemed to be within the scope of supply, whether specifically mentioned or not.

2.4.2 All similar parts shall be interchangeable.

#### 2.4.3 Base:

2.4.3.1 *Each single pole of isolator shall be provided with complete galvanized steel based with holes and designed for mounting on a supporting structure.*

2.4.3.2 Base channels and other structural steel members such as operating pipes, bolts etc. shall be hot dip galvanized. All castings accept current carrying parts shall be made of malleable cast iron or cast steel. Grey iron shall not be used in the manufacture of any parts. Manual operating handles shall be of **G I pipe of class B** having length of 1000 mm min. **All the handles of motor operating isolators shall be of suitable length. All the handles shall be covered with high insulating sleeve (not tape) having min. thickness of 3 mm & dielectric strength of 12 kV/mm. Necessary type test report shall be submitted.**

2.4.3.3 *Provision of continuous adjustment/alignment of insulator shall be there which is required to compensate permitted tolerances of insulator and structure or base frame assembly. Adjustment/alignment using shim washers is not allowed.*

2.4.4. Live metal parts shall be of non-rusting and non-corroding metal. All nut-bolts, screws and pins shall be provided with lock, washers, keys or equivalent locking facilities, and made of non - rusting and non-corroding metal, such as Copper, Silicon Alloy or **stainless steel**. **All current carrying parts excluding contacts shall be made of high strength copper or Aluminum Alloy.**

2.4.5.1 The design of isolator shall be such that no lubrication of any part is required except at vary infrequent intervals *i.e. after every 1000 operations or after 5 years whichever is earlier.*

2.4.5.2 *All joint in link mechanism exposed directly to external environment shall be of such materials that they do not call for any periodic lubrication and will not create jamming or excessive play which can result into loss of setting of complete isolator or deformation in links and levers.*

- 2.4.6 During the course of normal operations, it is likely that the isolator/earthing switch may be left in the open closed position for long periods, of time. They shall be designed to operate satisfactorily even after they are kept in one position for long periods.
- 2.4.7 The isolators and earth switches shall be designed to withstand stresses corresponding to short circuits duties specified.
- 2.4.8 Isolators and earth switches shall be able to bear on the terminals the total force including wind loading and electrodynamics forces and the attached conductor without impairing reliability of current carrying capacity.
- 2.4.9 The isolator design shall be such that it is free from visible corona discharge in both open end closed positions. Necessary stress relieving rings or shields shall be provided to meet this requirement.
- 2.4.10 *Terminal head/stud of isolator arms where conductor will be terminated shall be strong, robust and shall be adequate to carry rated current and short-circuit rating of isolator. It should have built in cover to eliminate deposition of dust or foreign particles.*

## 2.5.0 CONTACTS

- 2.5.1.1 The isolators provided with high pressure current carrying contacts on the hinges and the jaw (**Make – Break contacts**) and all contact surfaces of copper shall be with silver plating. (**min** 20 micron.) *The contacts shall be backed by Stainless Steel spring properly covered to avoid accumulation of dust.* The contacts shall be accurately machined and self aligned, the hinged ends shall be provided with **terminal pad of size and rating** adequate to carry rated current and suitable for the short-circuit rating specified.
- 2.5.1.2 *The copper shall be tinned on bolted side and silver plated on contact side. Manufacturers test report to prove that silver will not disappear after the mechanical endurance test shall be submitted.*
- 2.5.2 *Construction of Make - Break contacts of main blade shall be such that no external springs are used to achieve contact pressure OR If the Switch jaws are equipped then it shall be with reverse loop fingers design such that springs shall not carry current & shall not loose their characteristics due to heating effect.*
- 2.5.3.1 *The contact shall be self aligning & self cleaning & so designed that binding cannot occur after remaining closed for prolonged period of time in a heavily polluted atmosphere.*
- 2.5.3.2 *No undue wear or stuffing shall be evident during mechanical endurance tests. Contacts & spring shall be so designed that readjustment in contact pressure shall not be necessary throughout the life of Isolator or earthing switch.*
- 2.5.3.3 The position movable contact system of each of the isolator and earthing switches shall be indicated by a mechanical indicator at the lower and earthing switch. The indicator shall be of metal and shall be visible from operating level.

## 2.7.0 BLADES:

2.7.1 All live metal parts shall be designed to eliminate sharp points, edges and other corona producing surfaces, *where this is impracticable, adequate corona shield / rings of Aluminum/ Aluminum alloy shall be provided.*

2.7.2 The isolators shall be so constructed that the switch blade contact will not fail to the close position if the operating shaft gets disconnected.

## 2.8.0 INSULATORS

2.8.1 The insulators of solid core type (nine nos. for double break type isolator) shall be in scope of Bidders. *The Insulator shall confirm to IS: 2544 and IEC 60168. The porcelain of Insulator shall confirm to minimum cantilever strength of 6 KN for 132 kV and 8 KN for 220 kV & 400 kV respectively. The pressure due to contact shall not be transferred to the insulators after the main blades are fully closed.*

2.7.2 ***All isolators should be suitable for Solid core insulators in line with technical specifications for BPI attached as Annexure - B, shall be followed.***

2.8.3 All the necessary fixing bolts, nuts, washers etc. for insulators fixing in metallic part should be supplied by the bidders.

## 2.9.0 EARTHING SWITCHES

2.9.1 Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts. The earthing switches shall form an integral part of the Isolator. *It shall be mounted on the base frame of the Isolator. Earthing switch shall be manually operated.*

2.8.2 The earthing switches shall be ***mechanically and electrically*** interlocked with the isolator so that the earthing switches can be operated only when the isolator is open and vice versa. *The constructional interlocks shall be built in construction of isolator & shall be in addition to electrical & mechanical interlocks provided in the operating mechanism.*

2.9.3 The plane of movement and final position of the earth blades shall be such that adequate electrical clearances are obtained from adjacent live parts *in course of its movement between ON & OFF positions.*

2.9.4 Two independent grounding studs shall be provided on the ***frame/base channel*** stationary portion for connection to station ground mat. The stationary and moving portion shall be connected using flexible copper of adequate cross section to withstand the short time current same as that of the earth switch.

2.8.5 *Isolator design shall be such as to permit addition of earth switches at future date. It should be possible to interchange position of earth switch to either side.*

2.8.6 *The earth switches shall also comply with the requirements of IEC-60129, (amendment up to date) in respect of induced current switching duty as defined for class 'B' earthing switches.*

## 2.9.0 OPERATING MECHANISM

2.9.1.1 The isolators and isolator-cum-earthing switches shall be suitable for electrical motor operated mechanism and manual operation and the mechanism shall be easy to operate by a single person ***without undue effort.*** The height of the handle above the ***plinth*** shall be *1000 mm*. The operating mechanism shall have smooth movement and shall be designed for simultaneous manual operation of all three single pole units through single operating rod of adjustable length and operating mechanism mounted on one end of switch only. Operating mechanism of main switch

and earth switch shall be on opposite ends.

- 2.9.1.2 The rotating insulators stacks shall be provided with double roller or double ball bearings and shall be adjustable *as per clause 2.4.3.3* and shall be easily accessible for dismantling in the field. *The vertical operating shaft of requisite length shall be supported on ball or roller thrust bearing.* Bearing housing shall be weather and dust proof, *designed to operate without lubrication or maintenance. Nipples for periodical greasing are not allowed.*
- 2.9.1.3 Position indicators shall be provided near the operating mechanism for open and close position.
- 2.9.1.4 Provision shall be made for pad locking the mechanism of isolators and earthing switches in both the close and open positions.
- 2.9.1.5 The isolator and isolator-cum-earthing switch shall be *provided with "over centre" device in the operating mechanism to prevent accidental opening* by such that its stack position will not be affected by wind pressure, vibration, reasonable shocks, *short circuit forces, movement of structure, etc.*
- 2.9.1.6 Auxiliary switches shall be mounted in weather proof housing which shall have provision of entry of conduits of proper size and for fixing of cable glands.
- 2.9.1.7 *The operating mechanism shall provide a quick, simple and effective operation. One man shall able to operate the isolator, earthing switch without undue effort with about 20 (twenty) revolutions of crank.*
- 2.9.2 The Bidder shall offer the operating mechanism as specified. The design of operating mechanism shall be such that minimum energy is required for operation. Each pole of isolator shall have individual drive for main blade and earth switch. The operating mechanism of the three poles shall be well synchronized and interconnected.
- 2.9.3 The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes end 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 torsion and bending stresses due to operation of the isolator. *Where ever supported the operating rod/pipes shall be provide with bearings. The operating rods/pipes shall be provided with suitable universal couplings to account for any angular misalignment. All the operating pipes shall be of minimum diameter of 50 mm respectively.*
- 2.9.4 After final adjustment has been made there should not be any displacement at any point to allow improper functioning of the isolator during opening and closing operation at any speed. All holes in cranks, linkages and drives through shafts of MOM should be provided with Bearing to minimize slack and lost motion in the entire mechanism.  
*The design shall be such as to provide maximum reliability under all service condition. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and Inter pole operating rods shall be capable of adjustment by means of screw thread which can be locked with a lock nut after an adjustment has been made.*
- 2.9.5 All isolators and earth switches shall be provided with detachable type operating handles with padlocking arrangements. All brackets, angles or other members necessary for attaching the operating mechanism to the isolator supporting structure shall be supplied.
- 2.9.6 All bearings wherever provided shall be of reputed make. The type of bearing shall be stated.

*Bottom bearing assembly of the base frame shall be sealed such that there cannot be in grease of dust/water etc. Whole assembly shall be lubricated for life long service.*

- 2.9.7.1 The control cabinet shall be dust, water and vermin proof. Control cabinet shall be of free standing, floor mounting type or wall mounting type or pedestal mounting type as applicable.
- 2.9.7.2 *The control cabinet shall be made of 3 mm Aluminum sheet with powder coating OR of 3 mm stainless steel sheet. The control cabinet shall have single door with pad locking arrangement.*
- 2.9.7.3 *The size of mechanism box for main and earth switch shall not be less than 550 (H) x 550 (W) x 300 (D) mm. The height of operating handle shall be maintained at 1000 mm from plinth level.*
- 2.9.8 All doors, removable covers and plates shall be gasketed all round with continuous gaskets **to maintain degree of protection of IP55.**
- 2.9.9 Cable entries shall be from bottom. Suitable removable cable gland plate **of 3mm thickness** shall be provided with the cabinet for this purpose. **All necessary** number of cable glands shall be supplied fitted with gland plate. Cable glands shall be of Brass. 2.10.10 Cable entries shall be from bottom. Suitable removable cable gland plate shall be provided on the cabinet for this purpose. Necessary number of cable glands shall be supplied fitted on to this gland plate. Cable gland shall be screw-on-type and made of Brass.
- 2.9.10 Suitable heaters shall be mounted in the cabinet to prevent condensation. Heaters shall be controlled by differential thermostat so that required temperature is maintained in the cubicle. ON/OFF switch and fuse shall be provided. Heater shall be suitable for 240 V AC supply voltage.
- 2.9.11 The terminals shall be so staggered that the connection of external cable to any terminal block should be possible without disturbing the rest of the connections. The terminals blocks arrangements shall be such as to provide maximum accessibility to all conductor terminals and any arrangement preventing ready access to other terminal. **Only stud type terminals shall be provided..**
- 2.9.12 The terminal blocks to be provided shall be fully enclosed with removable covers and made of molded, non-inflammable plastic material with boxes and berries molded integrally. Such block shall have washer and binding screws for external circuit wire connections.
- 2.9.13 The arrangement shall be such that it is possible to safely connect or disconnect terminals on live circuits and replace fuse-links when the cabinet is live.
- 2.9.14 The enclosure of the control cabinets shall provide a degree of protection of not less than IP:55 (as per IS:2147).
- 2.9.15 A 'local/remote' selector switch and a set of open/close push buttons shall be provided on *each* control cabinet of the isolator & *earth switch* to permit its operation through local or remote push buttons. **Electrical ON / OFF indication shall be provided.**
- 2.9.16 Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.
- 2.9.17 All cabling from operating mechanism and auxiliary contacts to control cabinet shall be in the scope of supply and shall be carried out using 1100 V grade, 2.5 mm<sup>2</sup> stranded copper conductor. PVC

- insulated, armored, multi-core cables or single core wires. Inter pole cabling will be done by purchaser.
- 2.9.18 The control cabinet shall be provided with a 240 V, 1- $\phi$ , 50 Hz, 40 W lighting for interior illumination controlled by a ON/OFF switch. Power source for this interior lighting shall be completely independent of control power source.

## 2.10 MOTOR OPERATED MECHANISM

- 2.10.1 The motor shall be squirrel cage induction **motor** / *Permanent Magnet DC Motor (PMDC Motor)* and shall be totally enclosed, weather proof, out door type conforming to the latest edition of IS:325. *3 phase or 1 phase AC motor operated type operating mechanism shall be provided for operation of main blades of isolators and earthing switch of all class. All isolators and earthing switch shall be individual pole operated but the same shall be suitable for simultaneous 3 poles electrical operation. For this purpose, one master control cabinet and two slave control cabinets with all required electrical devices shall be provided. Each motor operated isolator and earth switch shall be provided with manual operating handle with padlocking arrangement.*
- 2.10.2 Suitable reduction gear shall be provided between the motor and the drive shaft of the isolator. The mechanism shall come to standstill *immediately* on switching OFF the power supply to the motor. *If necessary, electromechanical brake shall be fitted on the higher speed shaft to effect rapid breaking.*
- 2.10.3 Limit switches for motor control shall be fitted on the isolator / *earthing switch* shaft, within the cabinet, to sense the open and close positions of the isolator / *earthing switch*.
- 2.10.4 Motor operating mechanism to be supplied with the isolator / *earthing switch* shall be of reputed make to assure trouble free performance of the operating mechanism. Bidder should confirm to attend the defects if any without any extra charge within the guarantee period.

## 2.11.0 INTERLOCKING

- 2.11.1 Isolators and earthing switches shall be provided with padlocking facilities to lock them in full open or fully closed position. Operating mechanism shall also be provided with facility for padlocking of the front door.
- 2.11.2 Isolator and earthing switch shall be interlocked such that it will not be possible to close the earthing switch when the isolator is closed and vice-versa.
- 2.11.3 Each Isolator shall be electrically interlocked with its associated barkers, such that the isolators can not operated unless the associated circuit barkers is in open position.
- 2.11.4 Electrical interlocking arrangement shall be fail safe type.

## 2.12 ACCESSORIES

### 2.12.1 Position Indicator

A position indicating device shall be provided for each isolator/earthing switch irrespective of material at opposite ends, brazed to the channel base for connecting to the grounding system.



### 2.12.2 Grounding Pads

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

### 2.12.3 Name Plate

***A weather and corrosion-proof name plate conforming to the requirement of IEC shall be provided. The name plate shall also include all the details of ratings, year of manufacture, PROPERTY OF GETCO, order reference, Manufacturers name & address, etc. Name plate shall be of stainless steel of 2 mm thickness. All the letters shall be engraved on the name plate.***

### 2.12.4 Earthing Switch

Wherever specified, earthing switch shall be provided. It shall form an integral part of the isolator.

### 2.12.5 Operating Mechanism & Control Cable

Operating mechanism and control cable shall be provided as specified in Clause No.2.10.0.

### 2.12.6 Clamps & Connectors

Clamps and connectors shall be supplied as a part of the isolators. The clamps and connectors shall be made of materials listed below:

- |  |  |
|--|--|
| (i) For connecting AAAC/ACSR Connectors                                      | : Aluminum Alloy.  |
| (ii) For connecting equipment terminals made of Brass to AAAC/ACSR conductor | : Bimetallic connectors made from Aluminum alloy casting with 2 mm thick copper liner  |
| (iii) For connecting GI shield wire  | : Malleable Iron Casting   |
| (iv) Bolts, nuts, plain washers & spring for Item (i) & (ii) of above        | : Ultimate strength  |
| (v) For copper to copper and brass to brass                                  | : Copper Alloy having composition of<br>Zinc: 2 to 3 %<br>Lead: 2 to 2.5%<br>Tin: 0.6 to 1.5 %<br>Iron: 0.5 to 1.0 %<br>Copper: 92 to 95 % |
| (vi) Bolts and Nuts for item (v) above                                       | : Rolled brass rods  |
| (vii) Spring washer for item (v) above                                       | : Phosphor bronze  |

2.12.6.1 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

- 2.12.6.2 No part of clamp or connector shall be less than 10 mm thick. Bolts and nuts shall have hexagonal heads.
- 2.12.6.3 For bimetallic clamp and connectors, copper alloy liner of minimum thickness of 2 mm shall be cast integral with the Aluminum alloy body
- 2.12.6.4 All current carrying **path** / connectors shall be so designed that hysteresis and eddy current losses are small and all clamps and connectors must withstand 40 KA rms short time current for 3 seconds.
- 2.12.6.5 Bolts shall have M 10 or M 12 thread. Tightening torque shall be 45 Nm and 80 Nm for M10 and M12 respectively.
- 2.12.6.6 For tandem isolators specific care should be taken to provide terminal connectors. One side connector shall be straight run type and other side it will be compression/*flexible* type suitable for *conductor* / *pipe*. No connector should be obstacle to opening (or Operation) of the blade.

## 2.13 Tests and Inspection

### 2.13.1 Type Tests:

***All the Isolators, earthing switch along with Insulators and Structure offered shall be fully tested for following tests from NABL accredited laboratory shall be carried out in accordance with latest / amended / up to date IS/IEC. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. The type test reports from NABL approved laboratory shall not be older than TEN years. Type Test shall be valid as on the last date of submission of bid.***

**IMPORTANT NOTE:** *In case of non-submission/partial submission or type test reports of which validity is over, bidder shall submit pending type test report/s from NABL accredited laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid.*

#### **Following Type test reports shall be submitted.**

- i) **Lightning Impulse Voltage withstand test**
- ii) **Switching Impulse Voltage withstand test (for 400 kV)**
- iii) **Power Frequency Voltage withstand test on main circuit.**
- iv) **Power Frequency Voltage withstand test on auxiliary circuit**
- v) **Temperature rise test on main isolator**
- vi) **Short Time Current & peak withstand current test on isolator and earthing switch.**
- vii) **Short Circuit making performance test of earthing switch**
- viii) **Operating and mechanical endurance test on isolator and earthing switch**
- ix) **Measurement of Radio Interference level**
- x) **Corona Inception & extinction test**
- xi) **STC test on terminal connector**
- xii) **Degree of protection test on cubicle**
- xiii) **Blocked rotor test**

- xiv) Seismic test**
- xv) Mech & Elect Endurance test on Auxiliary switch**
- xvi) Tests on insulator (Dielectric and mechanical load tests)**
- xvii) Galvanizing test**
- xvii) Dielectric tests on insulating sleeve provided on operating handle.**

However the purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative.

#### **2.13.2 Routine / Acceptance tests:**

*For isolator/earthing switch to be supplied with structure, all the acceptance tests shall be performed on offered structure only. For isolator/earthing switch to be supplied without structure, all the acceptance tests shall be performed on dummy structure. All the acceptance tests shall be performed in presence of purchaser's representative.*

##### **2.13.2.1 Following Routine / Acceptance tests shall be carried out** on isolators and isolators-cum-earthing switches along with insulators offered for supply.

- i) Power frequency voltage dry withstand test on main circuit with offered insulators**
- ii) Voltage tests on control and auxiliary circuits**
- iii) Measurement of resistance of main circuit**
- iv) Mechanical operation test on isolator and earthing switch (50 operating cycles at rated auxiliary supply or hand operated & 10 operating cycles each at maximum and minimum auxiliary supply) on selected one sample out of every offered lot.**
- v) Block rotor test**
- vi) Temperature rise test at rated current on one selected sample out of every offered lot.*
- vii) List of additional tests on insulator**
  - (1) Bending load test in four direction of 50% min bending load guaranteed on all insulators as routine test*
  - (2) Bending load test in four directions at 100 % of min bending load guaranteed as special test on sample of insulator selected from each lot.*
  - (3) Tensional test on sample of insulator selected from each lot.*
  - (4) Ultrasonic test as routine test*

##### **2.13.4 Successful bidder shall offer PROTO isolator for inspection. On approval of this manufacturing clearance shall be given.** The purchaser reserve right of having at his own expense any other test(s) of responsible nature carried out at supplier's works or at site or in any other place in addition to the aforesaid type and routine tests, to satisfy that the material confirms to with this specification.

##### **2.13.5** Inspections may be carried out at any stage of manufacture at the discretion of the GETCO. If found unsatisfactory, as to workmanship or quality of material, equipment is liable to be rejected. Contractor shall grant free access to the places of manufacture purchaser's representative at all item when the work is in progress. The bidder shall keep the purchaser informed well in advance about the progress of the manufacture of the equipment under this specification so that urgent can be made for inspection.

##### **2.13.6** All the test reports including test records, oscillograms, curves etc. shall be submitted to the purchaser for approval prior to the dispatch of equipment. No equipment shall be dispatched without approval of respective test reports.

## **2.14 Erection and commissioning**

2.14.1 The Bidder shall quote for the services of an Erection Engineer who shall assure full responsibility for the erection, testing and commissioning of isolator. Skilled and unskilled labour and normal erection tools would be provided by the purchaser. All special erection tools required for the erection, testing and commissioning of the isolators, shall be provided by the bidder.

2.14.2 “After erection as required in clause NO 2.14.1 the supplier shall demonstrate & perform 50 Nos. of consecutive successful open close operation of isolator with motor operated mechanism on at least one isolator at every place of erection.

If during above 50No of operation any abnormality or difficulty is observed then after due rectification again 50 Nos of consecutive operations will be performed. This may be repeated till 50 Nos of consecutive operations are successful.”

2.14.3 Purchaser shall provide local workman as well as all ordinary tools required for erection, at his own expense. Apart from the above, the purchaser shall not be responsible for any other expenses incurred by the Bidder and expenses such Erector’s salary, insurance against personnel injuries to the Erector etc. which shall be to the Bidder’s account.

2.14.4 Bidder shall not be liable for any loss, damage or injury to property or person at the installation site unless such damage or injury is caused by any act or negligence of the supervising Erector.

## **2.15 PACKING AND TRANSPORT INSTRUCTIONS**

2.15.1 Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport and be packed in such a manner as to protect it from damage in transits. The Bidder shall be responsible for and make good at his own expense any or all damaged due to improper preparation and packing.

2.15.2 Loose material, e.g. bolts, Nuts etc. shall be packed in gunny bags and sealed in polythene bags with proper tagging.

2.15.3 Components containing glass shall be carefully covered with shock absorbing protective material such as ‘Thermocole’.

2.15.4 All opening in the equipment shall be tightly covered, plugged or capped to prevent dust and foreign material from entering in.

2.15.5 Wherever necessary, proper arrangements for attaching slings for lifting shall be provided.

2.15.6 All spare parts shall be packed and treated for long storage conditions at site.

2.15.7 Any material found short inside the intact packing cases shall be supplied by the bidder at no extra cost to the purchaser.

2.15.8 No material shall be dispatched without prior consent of the purchaser or his authorized representative.

## **2.17 Spare Parts**

A list of spare parts, with item-wise price required for five years of satisfactory operation of the isolator shall be furnished with the Bid. The purchaser will decide the actual quantity of spares to be ordered on the basis of the list and item-wised prices quoted.

## **2.18 INSTRUCTION MANUALS, MQP & FQP:**

Manufacturing Quality plan, Field Quality plan & operation and maintenance manuals shall be submitted for approval. The manuals shall be bound volumes in English language and shall contain all the drawings and information required for erection, maintenance and operation of the equipment supplied.

**2.19 GUARANTEED TECHNICAL PARTICULARS**

Bidder shall furnish all guaranteed technical particulars as called for in Schedule -‘A’. Bids lacking of information in this respect may not be considered.

**2.20 BAR CHART**

The bidder shall furnish a bar chart along with his Bid incorporating significant milestone dates, e.g. for completion of engineering and design of procurement of critical raw material of brought out items, of manufacturing and testing and of transportation to site and erection, as may be applicable. The total period for all the above activities as applicable should not exceed the completion period.

**SCHEDULE -A**  
**Guaranteed Technical Particulars for DB isolators**  
 (This shall be enclosed with Technical Bid)

**(I) ISOLATOR**

1. Maker's Name :
2. Manufacturer's Type and Designation :
3. Reference Standard :
4. Rated Voltage (KV) :
5. Maximum Design Voltage at which the Isolator can Operate (KV) :
6. Frequency (Hz) :
7. ***Seismic acceleration*** :
8. Maximum Current that can be safely interrupted by the Isolator (Amp rms and pf)
  - (a) Inductive :
  - (b) Capacitive :
9. Continuous Current rating
  - (a) Nominal :
  - (b) Under site conditions :
10. Rated Short time Current : Main Switch                      Earth Switch
  - (a) For 3 seconds :
  - (b) Rated peak short time current :
11. Current density at minimum cross section Of \_\_\_\_\_A/mm<sup>2</sup>

	<b><u>Main Switch</u></b>	<b><u>Earth Switch</u></b>
	current density and material and size of block/channel/ pipe etc.	current density and material and size of block/channel/ pipe etc.
(a) Moving blades	:	
(b) Terminal pad	:	
(c) Contacts	:	

- (d) Terminal connector :
12. (a) Maximum temperature of current carrying parts when carrying rated current continuously ( $^{\circ}\text{C}$ ) :
- (b) Maximum ambient temperature for which (a) is applicable ( $^{\circ}\text{C}$ ) :
13. (a) Whether all type test reports enclosed? :
- (b) If some of the reports not submitted, Submit confirmation as in **IMPORTANT NOTE** as per clause no. 2.13.1 :
14. Insulation Tests :
- (a) One minute power frequency wet withstand voltage :
- (i) Across the isolating distance (KV) :
- (ii) To earth and between poles (KV) :
- (b) 1.2/ 50 micro sec impulse withstand voltage: (+ and – polarity)
- (i) Across the isolating distance (KV) :
- (ii) To earth and between poles (KV) :
- 15 CONTACTS :
- a) Self aligned :
- b) Self cleaning :
- 15.1 MAIN CONTACT AT HING ENDS :
- a) Type :
- b) Swivel/ fixed :
- c) Nos of fingers :
- d) Size of finger :
- e) Material :
- f) Cross sectional area :

g) Thickness of silver plating (min) in micron:

h) Housing / cover on main contacts :

(i) Material and size of housing :

(ii) No. of bearings, location and size :

(iii) No. of bushes, joints, location and size :

15.2 MAKE BREAK CONTACTS of blade :

a) Type (spring less or reverse loop) :

b) Nos of fingers :

c) Size of finger :

d) Material :

e) Cross sectional area :

f) Thickness of silver plating (min) in micron:

15.3 No. of operation the isolator can make without deterioration of contacts :

15.4 Earth switches Contacts :

(a) Type of fixed contacts :

(b) Size of Contacts :

(i) Material and Grade :

(ii) Cross sectional area (mm<sup>2</sup>) :

(c) Thickness of silver coating (Micron) :

(d) Moving Blade :

(i) Material and Grade :

(ii) Cross sectional area (mm<sup>2</sup>) :

(g) Contact support (main and earth switch) :

(i) Material and size of channel/block :



- (ii) Material and size of plate :
- (h) (i) Material and size of housing :
- (ii) No. of bearings, location and size :
- (iii) No. of bushes, joints, location and size :
- 18. Clearances :
- (a) Between poles (mm) :
- (b) Between live parts and earth (mm) :
- (c) Between live parts when the switch is open :
- (i) On the same pole (mm) :
- (ii) Between adjacent poles (mm) :
- 19. Whether suitable for specified phase spacing : YES/NO
- 20. Type of Interlocks :
- a) Constructional :
- b) Mechanical :
- c) Electrical :
- 21. Torque required to operate the gang operated isolator :
- 22.a Switch design and type :
- (a) Rotating/tilting/lifting :
- (b) Horizontal/vertical break :
- 22.b Type of Auxiliary contacts :
- (i) For isolator (Normal) :
- (Spare)** :
- (ii) For earth switch (Normal) :

	<b>(Spare)</b>	:	
(iii)	MBB contacts Normal)	:	
	<b>(Spare)</b>	:	
22.c	No. of auxiliary contacts	:	
(i)	For isolator (Normal)	:	
	<b>(Spare)</b>	:	
(ii)	For earth switch (Normal)	:	
	<b>(Spare)</b>	:	
(iii)	MBB contacts Normal)	:	
	<b>(Spare)</b>	:	
23.	Operating mechanism	:	Manual & Electrical
24.	Terminal <i>pad</i>	:	
(a)	Whether horizontal or vertical (mm)	:	
(b)	Dimensions (mm)	:	
(c)	Thickness	:	
(d)	Details of cover of terminal pad	:	
25.	Terminal connectors	:	
(a)	Material of connector	:	
(b)	Material of Nut/Bolts	:	
(c)	Range of diameter of conductors that can be received	:	
(d)	Maximum temperature rise when carrying : rated current at 50 °C ambient temperature	:	
(e)	Weight of each type of connector (kg)	:	
(f)	whether horizontal/vertical take-off	:	

- (g) Flexible/rigid :
- (h) *Type of terminal connector* :  
*(In line with requirement of schedule –A or BOQ)*
26. BASE :
- (a) Size, mm
- (b) Weight (kg)
- (c) Hot dip galvanized :
27. Total weight of Isolator (kg) excluding structure :
- 28. Total weight of Isolator (kg) including structure :**
- 29. Manual Operating handle :**
- i) **Material**
- ii) **Class of G I pipe** :
- iii) **Size** :
- iv) **Height of handle from plinth level** :
- v) **Rating of HV insulating sleeve provided** :
- vi) **Thickness of HV insulating sleeve** :
30. ***Frequency of lubrication of any part*** :  
***(Min. 1000 operations or after 5 yrs)***
- 31) Time for opening and closing of main and earth switch :
- 32) No. of operation the isolator can make without deterioration of contacts :
- 33) Over Centre device in operating mechanism :
- 34) OPERATING PIPE :**
- i) **Material**
- ii) **Class of G I pipe** :
- iii) **Size** :
- iv) **Provision of bearing where supported** :

- v) Provision of Universal coupling for angular Misalignment :
  
- 35) BOTTOM BEARING ASSEMBLY :

  - I) Material :
  - II) Bearing type, make & number :
  - III) Lubricated for life long service :

  
- 36) CONTROL CABINET :

  - a) Material :
  - b) Thickness :
  - c) Size :
  - d) Electrical ON/OFF indication :
  - e) Type of motor :
  - f) Rating of motor :
  - g) Degree of protection :
  - h) Material & thickness of gasket :
  - i) Cable gland plate Material & thickness :

  
- 37) RATING/NAME PLATE :

  - a) Material :
  - b) Thickness :
  - c) Size :
  - d) Depth of engraving letters :

## **II Insulator**

- 1. Type of Insulator :
- 2. Standard to which insulators will confirm : IS 2544-1975 & IS 3350
- 3. Insulating material :
- 4. Diameter of largest shed (in mm) :
- 5. Height of Insulator (in mm) :

6. Weight (in kgs) :
7. Top metal fitting PCD (4 holes of M-16) :
- 8a.Bottom metal PCD for 132 kV (4 holes of M-18) :
- 8b.Bottom metal PCD for 220 kV (8 holes of M-18):
9. Total creepage distance (in mm) :
10. Protected creepage distance (in mm) :
11. Power frequency flashover voltage (in kV rms)
  - (a) Dry :
  - (b) Wet :
12. Power frequency withstand test voltage (in kV rms)
  - (a) Dry :
  - (b) Wet :
13. Impulse flashover (1.2/50 $\mu$ S wave (in kVp)
  - (a) Positive wave :
  - (b) Negative wave :
14. Impulse withstand (1.2/50 $\mu$ S wave (in kVp)
  - (a) Positive wave :
  - (b) Negative wave :
15. Nominal system voltage :
16. Highest system voltage :
17. Mechanical characteristics
  - (a) Cantilever strength :
  - (b) Tensile strength :
  - (c) Torsion strength :
  - (d) Compression strength :
18. All ferrous parts hot dip galvanized as per IS 2629 :
- 19. Provision of continuous adjustment / Alignment of insulators :**

**ANNEXURE – B****TECHNICAL PARAMETERS FOR SOLID CORE POST INSULATOR**

Sr. No.	Description	Unit	Solid core post insulator		
			400 kV	220 kV	132 kV
01	02	03	04	05	06
1	Highest system voltage	KV	420	245	145
2	Height of unit	mm	3910/3650	2300+3.5	1500+2.5
3	Bending strength (failing load): a) Upright	Kgf	800	800	600
4	Tensile strength	Kgf	17000	8000	7000
5	Compression strength	Kgf	33000	20000	14000
6	Torsion strength	KgfM.	460	450	300
7	a) Power frequency flashover voltage (dry)	KV	890	625	275
	b) -do- (wet)	KV	820	570	275
8	a) Impulse flashover voltage (Positive)	KV	1850	1210	650
	b) -do- (Negative)	KV	1850	1450	650
9	a) One min PF withstand voltage (dry)	KV	760 (w/o arcing horns)	510	275
	b) -do- (wet) (w/o arcing horns)	KV	680 (w/o arcing horns)	460	275
10	Impulse positive/negative withstand voltage	KV	1550	1050	650
11	Power frequency puncture voltage	KV	Puncture proof	Puncture proof	Puncture proof
12	RIV a) Test V to Ground KV rms b) at 1000 KHz with grading rings	mV	266 < 1000 mV	<500 mV	---
13	(a) Visible discharge	KV	320 with grading ring	154	105
	(b) Switching surge withstand volts	KVp	1080		
14	Creepage distance a) Total	mm	10500	6125	3625
	b) Protected		5250	3065	1815
15	Top metal fitting PCD	mm	4 holes of M16 PCD 127	4 holes of M16 PCD = 127	4 holes of M16 PCD = 127
16	Bottom metal fitting PCD	mm	8 Holes of M18 PCD 300	8 holes of M18 and PCD = 254	4 holes of o 18 and PCD = 225
17	All ferrous part should be hot dip galvanized to IS:2629/1966		Yes	Yes	Yes
18	Suitable for Hot line washing		Yes	Yes	Yes
19	Corona Extinction device		Aluminum Corona ring provided	--	--
20	Dry Arcing Distance 3400	mm.	3400	--	--