GUJARAT ENERGY TRANSMISSION CORPORATION LTD.
SARADAR PATEL VIDYUT BHAVAN,
RACE COURSE, BARODA – 390 007.

TECHNICAL SPECIFICATIONS
FOR

400 kV EARTHING SWITCH
SPECIAL INSTRUCTIONS TO BIDDER

Please read following instructions carefully before submitting your bid.

1. All the drawings, i.e. elevation, side view, plan, cross sectional view etc., in AutoCAD format and manuals in PDF format, for offered item shall be submitted. Also the hard copies as per specification shall be submitted.

2. The bidder shall submit Quality Assurance Plan with the technical bid.

3. The bidder shall have to submit all the required type test reports for the offered item. In absence of this, the evaluation shall be carried out accordingly as non-submission of type test reports.

4. The bidder must fill up all the points of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in.

5. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.

6. The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by GETCO, in the event of an order, free of cost. The cost of logistics will be bear by GETCO.

7. Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.

8. The bidder shall bring out all the technical deviation/s only at the specified annexure.
QUALIFYING REQUIREMENT DATA
(For Supply)

Bidder to satisfy all the following requirements.

1) The bidder shall be Original Equipment Manufacturer (OEM). The offered equipment have to be designed, manufactured and tested as per relevant IS/IEC with latest amendments.

2) The minimum requirement of manufacturing capacity of offered type, size and rating of equipment shall be FIVE times tender/ bid quantity. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).

3) Equipment proposed shall be of similar or higher rating and in service for a minimum period of THREE (3) years and satisfactory performance certificate in respect of this is to be available and submitted.

4) The bidder should clearly indicate the quantity and Single Value Contract executed during last FIVE (5) years, for the offered equipment. Bidder should have executed one single contract during last five years for the quantity equivalent to tender / bid.

The details are to be submitted in following format,

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>ITEMS SUPPLIED TO</th>
<th>ORDER REFERENCE No. &amp; DATE</th>
<th>ITEMS</th>
<th>QUANTITY</th>
<th>ORDER FULLY EXECUTED. YES/NO</th>
<th>STATUS, IF ORDER UNDER EXECUTION</th>
<th>REMARK</th>
</tr>
</thead>
</table>

e) Equipment offered shall have Type Test Certificates from accredited laboratory (accredited based on ISO/IEC Guide 25 / 17025 or EN 45001 by the National accreditation body of the country where laboratory is located), as per IEC / IS / technical specification. The type test reports shall not be older than FIVE years and shall be valid up to expiry of validity of offer.
SECTION – I

SPECIFIC TECHNICAL REQUIREMENT AND SYSTEM PARTICULARS

1.0 SCOPE :

This section covers the design, manufacture, testing at manufacturer’s works, supply of 400 kV Earthing Switch with accessories, suitable for bus bar earthing as detailed here in.

1.1 CLIMATIC & ISOCEARAUNIC CONDITIONS :

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

i) Maximum ambient temperature of air 50 in shade (°C)
ii) Minimum ambient temperature of air 05 in shade (°C)
iii) Max. daily average ambient temperature 40
iv) Max. Yearly average temperature °C. 30
v) Maximum relative humidity (%) 95
vi) Average number of thunder storm 15 days/annum
vii) Maximum annual rain fall in mm. 1500 mm
viii) Maximum wind pressure Kg/Mt². 150
ix) Height above Mean Sea Level Not exceeding 1000 M
x) Earthquake acceleration (G) 0.08 x 2g.

1.1.2 All electrical devices shall be given tropical and fungicidal treatment shall be capable of satisfactory operation under the severe climatic conditions that would prevail at site as described above. The Kiosk shall conform to IP-55 for proper air circulation.

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

1.1.4 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.
1.1.5 The equipment offered shall be suitable for hot line maintenance techniques.

1.2 **SYSTEM PARTICULARS:**

1.2.1 Nominal System voltage : 420 KV rms.

1.2.2 Highest system voltage : 420 KV rms.

1.2.3 System frequency : 50 Hz.

1.2.4 No. of phases : Three (3).

1.2.5 System Neutral : Effectively earthed.

1.3 **AUXILIARY POWER SUPPLY:**

1.3.1 Auxiliary electrical equipment shall be suitable for operation on the following supply system:

i) Power devices (like drive motors etc.) : 440 Volts, 3 Phase 4 wire, 50 Hz. Neutral grounded AC supply.

ii) AC control and Protective lighting fixture space heaters : 240 Volts, 1 phase 2 wires, 50 Hz, AC supply with one lead grounded.

iii) D.C. alarm, control and Protective Devices : Two separate 220 volts two wires under grounded D.C. supply from station batteries.

1.3.2 In the above supply, voltages may vary as follows:

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

i) A.C. supply : 10% variation, in voltage. Frequency variation ± 3%

ii) D.C. Supply : (-)15% to (+)10% variation

1.3.3 Each of the foregoing supplies will be made available by the purchaser at one terminal point for each Earthing switch for operation of the accessories and auxiliary equipment. Bidder’s scope shall include distribution beyond the points of supply including supply of terminal blocks, HRC fuses, switches etc. Interconnection of poles will be done by purchaser.

1.2.0 **SPECIFIC TECHNICAL REQUIREMENTS:**
1.2.1 The E/S shall comply with the following technical requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Rated voltage/ Highest Voltage</td>
<td>400/ 420 KV</td>
</tr>
<tr>
<td>ii) Rated frequency</td>
<td>50 Hz.</td>
</tr>
<tr>
<td>iii) No. of phases</td>
<td>Three (3).</td>
</tr>
<tr>
<td>iv) Insulation</td>
<td>Outdoor</td>
</tr>
<tr>
<td>v) Rated short time current withstand</td>
<td>40 KA</td>
</tr>
<tr>
<td>vi) Rated duration of short circuit</td>
<td>3 second</td>
</tr>
<tr>
<td>vii) Rated peak short circuit current withstand</td>
<td>100 KA (Peak)</td>
</tr>
<tr>
<td>viii) 1.2/50 microsecond lightning impulse</td>
<td></td>
</tr>
<tr>
<td>withstand voltage</td>
<td></td>
</tr>
<tr>
<td>a) To earth</td>
<td>1425 KV (Peak)</td>
</tr>
<tr>
<td>b) Across the open disconnector</td>
<td>1665 KV (Peak)</td>
</tr>
<tr>
<td>ix) 250/2500 micro seconds switching impulse</td>
<td></td>
</tr>
<tr>
<td>withstand voltage</td>
<td></td>
</tr>
<tr>
<td>a) To earth</td>
<td>1050 KV (Peak)</td>
</tr>
<tr>
<td>b) Across the open disconnector</td>
<td>1245 KV (Peak)</td>
</tr>
<tr>
<td>x) Power frequency withstand voltage</td>
<td></td>
</tr>
<tr>
<td>a) To earth</td>
<td>650 KV (rms)</td>
</tr>
<tr>
<td>xi) Minimum cantilever strength</td>
<td>8.0KN</td>
</tr>
<tr>
<td>xii) Minimum creepage distance of support</td>
<td>10,500 mm (total)</td>
</tr>
<tr>
<td>insulators</td>
<td></td>
</tr>
<tr>
<td>xiii) Operating mechanism of earth switch</td>
<td>Manual &amp; Motor operation shall be provided.</td>
</tr>
<tr>
<td>xiv) Radio interference voltage at 266 KV (rms)</td>
<td>Not to exceed 1000 micro volts.</td>
</tr>
<tr>
<td>xv) Corona extinction voltage</td>
<td>320 KV (rms)</td>
</tr>
<tr>
<td>xvi) Phase to phase spacing</td>
<td>7000 mm.</td>
</tr>
<tr>
<td>xvii) Ground clearance</td>
<td>8000 mm.</td>
</tr>
<tr>
<td>xviii) Interlocks with Centre Break or Pentograph</td>
<td>Mechanical as well Electrical interlocking</td>
</tr>
<tr>
<td>Isolators</td>
<td>required.</td>
</tr>
</tbody>
</table>

1.6.0 OTHER REQUIREMENTS:

1.6.1 The earthing switches should be able to carry the same fault current as assigned to the main disconnector and withstand the dynamic stresses.
1.6.2 The bidder is requested to quote individual pole operating mechanism for Earth Switch.

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

1.6.4 Each earthing switch will be electrically interlocked with the isolators as per the switchyard interlocking scheme. E/S 6 NO & 6 NC auxiliary contacts on each pole of earthing switch shall be provided for purchaser’s use.

1.6.5 Each earthing switch shall be provided with solenoid type electrical interlocking feature suitable for operation on purchaser’s 220 V.D.C. supply. The interlock shall comprise of two electro mechanical castle locks with earth switch closed and vice versa. The key can be released by energizing the coil when certain present conditions of purchaser’s interlock scheme are fulfilled, hence making the inter-lock feature “fail safe type”.

1.6.6 Flexible terminal connectors shall be supplied for connecting E/S terminals to purchaser’s conductor. Terminal connectors shall be suitable for twin ACSR moose conductor having space 450 mm.

1.6.7 The frame of each disconnect 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 size of the earthing conductor will be furnished to the successful bidder.

1.6.8 Earthing switches, including their operating mechanism shall be so designed / constructed that they can not come out of their open or closed position by gravity, wind pressure, vibrations, reasonable shocks or accidental touching of the connecting rods of their operating mechanisms. The reliability or current carrying capacity shall not be impaired due to such forces.

1.6.9 The earthing switches shall be capable to discharge trapped charges of 500 KM long 400 KV line.
SECTION - II

2.1 SCOPE :

2.1.1 This section covers design, manufacture, assembly, inspection and testing at manufacturer’s works, supply and delivery at site, 420 kV high voltage earthing switches, suitable for outdoor use. Also, at the discretion of the Purchaser, the bidder may have to undertake erection, supervision of erection, testing and commissioning of the equipment included in his scope of supply. Bidder shall quote for these items as required in the price schedule.

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 upto seller’s Guarantee in a manner acceptable to the Purchaser, who will interpret the meaning of drawings and specifications and shall have the power to reject any work or material which in his opinion are not in full accordance therewith.

2.1.3 Bidder shall separately set out in his proposal, all deviations from this specification in the “Annexure 12”.

2.10.0 CODES AND STANDARDS :

2.2.1 The design, manufacture and performance of high voltage earthing switches 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 constructed to relieve vendor of this responsibility.

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC : 129</td>
<td></td>
</tr>
<tr>
<td>IS : 2544</td>
<td>Specification for porcelain post insulators (3.3 KV and above).</td>
</tr>
</tbody>
</table>
2.2.3 In case equipment conforms to other internationally acceptable standards which ensures equivalent or better performance than that specified under Class 2.2.2, then English version of such standards or relevant extracts of the same shall be forwarded with the bid and the salient features of comparison shall be brought out separately in the bid.

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

2.10.0 **DRAWINGS:**

2.3.1 As apart of the proposal, the bidder shall/furnish relevant descriptive and illustrative literature and the following drawings for preliminary study.

   i) Drawing showing plan and elevation of isolator and earthing switch incorporating mounting dimensions, overall dimensions, weight etc.

   ii) Dimensional drawing for the line and earth side terminals of the Earthing Switch.

   iii) Mounting details of operating handle and operating devices.

   iv) Details of jaw contacts and Earthing Switch blades.

   v) Drawings of Earthing switch supporting structures.

   vi) Copies of type test certificate and relevant oscillograms.

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 the following drawings for approval of the purchaser as per terms and conditions of the order.

   i) Assembly drawing showing plan and elevation of earthing switch incorporating mounting dimensions, detailed dimensions, shipping weight, net weights, etc.

   ii) Schematic control wiring diagram and interlocking scheme.
iii) Dimensional drawing for the live and earth side terminals of the Earthing Switch. 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 to be mounted on Earthing Switch supporting structure.

vi) Details of jaw contacts and man isolator blades.

vii) Detail of terminal stud.

viii) Drawings necessary for design and fabrication of Earthing Switch supporting structure, if structures are not included in the scope of supply.

ix) Drawing showing various positions (close and open) of the Earthing Switch.

x) Drawing of corona rings.

xi) Drawings of supporting insulators and operating rods insulators.

xii) Name plate details.

xiii) Bill of materials.

2.3.4 Drawings, diagrams, instructions and reports 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.

2.3.5 Bidder shall furnish requisite number of copies of all the approved and revised drawings pertaining to the equipment along with reproducible print for each as the final submission. Required number of copies of approved drawings will be furnished at the time of approval of drawings.

2.3.7 All the drawings in AutoCAD format and in PDF format, for offered item shall be submitted with the bid and during detailed engineering.

2.10.0 **GENERAL CONSTRUCTION DETAILS**

2.4.1 The earthing switch shall be complete with all parts that are necessary or essential for efficient operation. Such parts 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 channels and other structural steel members such as operating pipes, phase coupling rods or pipes, bolts etc. shall be hot dip galvanized. Operating mechanism boxes, shall be hot dip galvanized from outside and inside. All castings except current carrying parts shall be made of malleable cast iron or cast steel. Grey iron shall not be used in the manufacture of any part. Manual operating handles shall be of galvanized steel.

2.4.4 Live metal parts shall be of non/rusting and non corroding metal. Current carrying parts shall be of non/ferrous material such as aluminum or copper. Bolts, screws and pins shall be provided with lock, washers, keys or equivalent locking facilities, and current carrying parts shall be made of non/rusting and non/corroding metal, such as copper silicon alloy or equivalent.

2.4.5 The design of Earthing Switch shall be such that no lubrication of any part is required except at very infrequent intervals.

2.4.6 During the course of normal operation, it is likely that the earth switch may be left in the open / closed position for long periods of time. They shall be designed to operate satisfactorily even after being kept in one position for long periods.

2.4.7 The earth switches shall be designed to withstand stresses corresponding to short circuit duties specified.

2.4.8 Earth switches shall be able to bear on the terminals the total forces including wind loading and electro dynamic forces on the attached conductor without impairing reliability or current carrying capacity.

2.10.0 **BASE:**

The position of movable contact system of each of the earthing switches shall be indicated by a mechanical indicator at the lower end of the vertical rod or shaft for the earthing switch. The indicator shall be of metal and shall be visible from operating level.

2.10.0 **BLADES:**

All live metal parts shall be designed to eliminate sharp points, edges and other corona producing surfaces. Where this is imprafticable adequate corona shields shall be provided.

2.10.0 **INSULATORS:**

2.7.1 The insulators of the earthing switch shall conform to the latest editions of IS:2544. Porcelain used for the manufacture of insulators shall be homogenous, free from flaws or imperfectic quality. They shall be thoroughly vitrified, tough and impervious to moisture. The glazing of the porcelain shall be of uniform brown colour free from blisters, burns and other similar defects.
2.7.2 Insulators of the same rating and type shall be interchangeable.

2.7.3 The porcelain and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and the porcelain parts throughout the range of temperature variation shall not loosen the parts or create undue internal stresses which may affect the electrical or mechanical strength and rigidity. Each cap and base shall be of high grade cast steel or malleable steel casting and they shall be machined faced and smoothly galvanized. The cap and base of the insulators shall be interchangeable with each other.

2.7.4 The insulators shall be so arranged that leakage current will pass to earth and not between terminals of the same pole or between phases.

2.7.5 Pressure due to the contact shall not be transferred to the insulators after the main contact fully close.

2.7.6 Solid core insulators shall be acceptable.

2.10.0 **EARTHING SWITCH FOR BUS BAR EARTHING:**

Gang operated earthing switch to earth the bus bar during bus bar maintenance shall be supplied. These earth switches shall be manually operated. Each earth switch shall be provided with adequately rated flexible copper braids for connection to grounding mat. These earth switches are to be installed at both extreme ends of the bus bars. The earth switches shall be so manufactured that adequate electrical clearances are maintained from adjacent live parts when the blades are in open position. Counter contacts for connecting to the bus bar with earth switches shall also be supplied. These switches shall carry the same fault current (i.e. 40 kA) as specified for isolator and shall withstand the dynamic stresses. The earth switches shall be complete with all accessories such as operating shaft, operating rods, locking arrangement, counter contact assembly, on-off indicator, earthing arrangements, mounting structure etc.

2.9.0 **OPERATING MECHANISM AND CONTROL:**

2.9.1 The operating mechanism shall provide a quick, simple and effective operation. One man shall be able to operate the earthing switch without undue effort.

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 earthing switch shall have individual drive for earth switch.
2.9.3 It shall not be possible, after final adjustment has been made, for any part of the mechanism to be displaced at any point in the travel sufficient enough to allow improper functioning of the earthing switch, when the earthing switch 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 slack and lost motion in the entire mechanism.

2.9.4 All 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.

2.9.5 All bearings wherever provided shall be of reputed make. Bearings shall be provided with required numbers of nipples for lubrication.

2.9.6 The control cabinet shall be sheet steel enclosed and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick and properly braced to prevent wobbling. Control cabinet shall be with double hinged doors with padlocking arrangement. Control cabinet shall be of free standing, floor mounting type or wall mounting type or pedestal mounting type as applicable.

2.9.7 All doors, removable covers and plates shall be gasketed all around with neoprene or suitable rubber gaskets, louvers shall have screens and filters. The screens shall be of fine wire mesh made of brass or G.I. wire.

2.9.8 Cable entries shall be from bottom. Suitable removable cable gland plate (3 mm thick, hot dip galvanised) shall be provided on the cabinet for this purpose. Necessary number of cable glands shall be supplied fitted on to this gland plate. Cable glands shall be screw-on-type and made of brass.

2.9.9 Suitable heaters shall be mounted in the cabinet to prevent condensation. Heaters shall be controlled by differential thermostat so that the cubicle temperature is always maintained approximately 10ºC above the outside air temperature. On – off switch and fuse shall be provided. Heater shall be suitable for 240 V AC supply voltage.

2.9.10 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 block arrangements shall be such as to provide maximum accessibility to all conductor terminations and any arrangement preventing ready access to other terminal screws shall not be accepted.

2.9.11 The terminal block to be provided shall be fully enclosed with removable covers and made of molded, non/inflammable plastic material with boxes and barriers molded integrally. Such block shall have washer and binding screws for external circuit wire connections, a white marking strip for
circuit identification and molded plastic cover. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. All the terminal blocks shall be stud type only. 20% spare terminal blocks shall also be provided.

2.9.12 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.

2.9.13 The enclosure of the control cabinets shall provide a degree of protection of not less than IP 55 (as per IS:21).

2.9.14 All cabling from operating mechanism and auxiliary contacts to control cabinet shall be in the scope of supply and shall be carried out using 1100V grade. 2.5 mm stranded copper conductor, PVC insulated, armoured, multi core cables or single core wires. Interpol cabling will be done by purchaser.

2.9.15 The control cabinet shall be provided with a 240 V, 1-Phase 50 Hz. 40 W lighting fixture for interior illumination controlled by a ‘ON-OFF’ switch. Power source for this interior lighting shall be completely independent of control power source.

2.10.0 INTERLOCKING

2.10.1 Earthing switches shall be provided with padlocking facility to lock them in fully open or fully closed position. Operating mechanisms shall also be provided with facility for padlocking of the front door.

2.10.2 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.

2.10.3 Each Earthing switch shall be electrically interlocked with its associated breaker/s, such that the isolator can not be operated unless the associated circuit breaker/s is in open position.

2.10.4 Electrical interlocking arrangement shall be fail safe type.

2.11.0 ACCESSORIES:

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

2.11.2 GROUNDING PADS:

Each pole of the earthing switch 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 connectors shall be provided for connecting operating handles of earthing switches to the grounding system.
2.11.3 **Current Density:**

Current density to be adopted for all part of the Earthing switch and terminal connector shall not exceed the following limits:

(a) Hollow tube section: Copper – 2.0 A/mm²  
Aluminium – 1.25 A/mm²
(b) Other sections & terminal connectors: Copper – 1.60 A/mm²  
Aluminium – 1.0 A/mm²

2.11.4 **Name Plate:**

A weather-proof and corrosion-proof name plate conforming to the requirements of IEC shall be provided. The name plate shall incorporate all the details including year manufacture.

2.11.5 **Earthing Switch:**

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

2.11.6 **Operating Mechanism & Control Cubicle:**

Operating mechanism and control shall be provided as specified in clause No.2.9.0.

2.11.7 **Clamps & Connectors:**

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

i) For connecting AAC/ACSR conductors.
   - Aluminum alloy casting.
ii) For connecting equipment terminals made of copper or brass to AAC/ACSR Conductor.
   - Bimetallic connectors made from aluminum alloy casting with 2 mm thick cast copper liner.
iii) For connecting G.I. shield wire.
   - Malleable iron casting.
iv) Bolts, nuts plain washers & spring washers for item (i) to (ii) above.
   - Hot dip galvanized mild steel of ultimate strength.

v) For copper to copper brass and brass to brass.
   - Copper alloy having composition of:
     - Zinc - 2 to 3%
     - Lead - 2 to 2.5%
     - Tin - 0.6 to 1.5%
     - Iron - 0.5 to 1.0%
     - Copper - 92 to 95%

vi) Bolts & nuts for item (v) above.
   - Rolled brass rods.

vii) Spring crasher for item (v) above.
   - Phospher bronze.
2.11.7.1 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

2.11.7.2 No part of clamp or connector shall be less than 10 mm thick. Bolts and nuts shall have hexagonal heads.

2.11.7.3 For bimetallic clamp and connectors, copper alloy liner of minimum thickness 2 mm shall be cast integral with the aluminum alloy body.

2.11.7.4 Flexible connectors, shall be made from AAC conductors.

2.11.7.5 All current carrying connectors shall be designed so that hysterises and eddy current losses are small.

2.11.7.6 Bolts shall have M12 thread.

2.12.0 TESTS AND INSPECTION:

2.12.1 The earthing switch along with its operating mechanism shall be type tested in accordance with the latest edition of IS:9921/IEC-129. The type tests on the equipment offered should have been repeated once in 5 years. All the type test reports should be furnished along with the offer.

2.12.2 The purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser’s representative. For this purpose, the bidder shall quote unit rates for carrying out each type test. For any change in design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of tests without any extra cost. In case the equipment have not been type tested earlier or type tested older than 5 years and not valid till validity of offer, all the type tests as per relevant standards shall be carried out by the successful bidder in the presence of purchaser’s representative without any extra cost.

2.12.3 Bidder shall submit the following Type test reports along with Technical Bid.

a. Lightning impulse withstand test
b. Corona Inception and Extinction voltage test
c. Power freq. voltage test on aux & control circuit
d. Temperature rise test
e. Short time current withstand test
f. Short circuit making performance of Earthing switch
g. Operating and Mechanical Endurance test
h. Operating and Mechanical Endurance test on ES
i. Partial Discharge & other test on Solid core PI
j. RIV test
k. Terminal Connector & STC Test
l. IP 55 on Motor Operating Mechanism
m. IP 55 on Manual Operating Mechanism
n. Blocked rotor test,
o. Switching Impulse voltage test
2.12.4 All the routine and acceptance tests shall be performed on each earthing switch in presence of purchaser’s representative.

2.12.5 Power frequency voltage withstand test shall be performed on at least one completely assembled earthing switch.

2.12.6 The purchaser will have the right of having at his own expense any other test(s) of reasonable nature carried out at contractor’s works or at site or in any other place in addition to the aforesaid type and routine tests, to satisfy that the material comply with this specification. The Purchaser reserves the option for getting any or all the type tests to be conducted on the equipment.

2.12.7 Inspections may be made at any stage of manufacture at the option of the purchaser and the equipments, if found unsatisfactory as to workmanship or quality of material, is liable to be rejected. Contractor shall grant free access to the places of manufacture to purchaser’s representative at all times when the work is in progress. The contractor shall keep the purchaser informed well in advance about the progress of manufacturer of the equipment under this specification so that arrangement can be made for inspection.

2.12.8 After the aware of the contract, the supplier shall prepare a comprehensive programme for detailed stage inspection and testing of the various components and equipment, such a programme shall be submitted to the purchaser for his approval.

2.12.9 All the test reports including test records, oscillographs, curves etc. shall be submitted to the purchaser for his approval prior to the dispatch of equipment. No equipment shall be dispatched without approval of respective test reports.

2.13 **PACKING AND TRANSPORT INSTRUCTIONS :**

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

2.13.2 Loose material e.g. bolts, nuts etc. shall be packed in gunny bags and sealed in polythene bags with proper taggings. Components containing glass shall be carefully covered with shock absorbing protective material such as ‘Thermocol’.

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

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

2.13.5 All spare parts shall be packed and treated for long storage condition at site.
2.13.6 Any material found short inside the intact packing cases shall be supplied by the Vendor / Contractor at no extra cost to the purchaser.

2.13.7 No material shall be dispatched without prior consent of the purchaser or his authorized representative.
### SECTION - III

**GENERAL TECHNICAL PARAMETERS**

**EARTH SWITCH**

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maker’s Name</td>
<td>-</td>
</tr>
<tr>
<td>Manufacture’s type and designation</td>
<td>Bus bar Earth switch. Type: (Vertical Lift (VL))</td>
</tr>
<tr>
<td>Reference standards</td>
<td>IS:1818/IS:9921/IEC:129</td>
</tr>
<tr>
<td>Rated voltage K.V.</td>
<td>400</td>
</tr>
<tr>
<td>Maximum design voltage K.V. at which the isolator can operate.</td>
<td>420</td>
</tr>
<tr>
<td>Frequency Hz</td>
<td>50</td>
</tr>
<tr>
<td>Derating factor, if any for specified site conditions.</td>
<td>No derating factor</td>
</tr>
<tr>
<td>Short time rating</td>
<td></td>
</tr>
<tr>
<td>a) For 3 seconds.</td>
<td>40 KA</td>
</tr>
<tr>
<td>b) Rated peak short time current</td>
<td>100 KA</td>
</tr>
<tr>
<td>Insulation tests</td>
<td></td>
</tr>
<tr>
<td>a) One minute power frequency: wet withstand voltage:</td>
<td></td>
</tr>
<tr>
<td>i) Across the isolation Distance KV (rms)</td>
<td>730</td>
</tr>
<tr>
<td>ii) To earth and between poles KV (rms)</td>
<td>650</td>
</tr>
<tr>
<td>b. 1.2x50/Micro second impulse withstand voltage (+&amp; -Polarity)</td>
<td></td>
</tr>
<tr>
<td>i) Across the isolating distance KV (Peak)</td>
<td>1665</td>
</tr>
<tr>
<td>ii) To earth and between poles KVP.</td>
<td>1425</td>
</tr>
<tr>
<td>c. 250/2500 micro second impulse withstand voltage.</td>
<td></td>
</tr>
<tr>
<td>a) To earth KV (Peak)</td>
<td>1050</td>
</tr>
<tr>
<td>b) Across open disconnect voltage applied to –</td>
<td></td>
</tr>
<tr>
<td>i) One terminal switching impulse</td>
<td>1245 KV (Peak)</td>
</tr>
<tr>
<td>ii) Opposite terminal power frequency</td>
<td>1245 KV (Peak)</td>
</tr>
<tr>
<td>Clearance</td>
<td></td>
</tr>
<tr>
<td>a) Between poles</td>
<td>7000 mm</td>
</tr>
<tr>
<td>b) Between live parts and earth</td>
<td>3600 mm</td>
</tr>
<tr>
<td>c) Between live parts and when the switch is open:</td>
<td></td>
</tr>
<tr>
<td>i) On the same pole</td>
<td>3600 mm</td>
</tr>
<tr>
<td>ii) Between adjacent poles</td>
<td>4500 mm.</td>
</tr>
</tbody>
</table>
12.0 Whether suitable for specified phase spacing?  Yes
13.0 Type of interlocks  Electrical & Mechanical
14.0 Torque required to operate the gang operated isolator.  35 Kgm.
15.0 Insulator Data:
   a. Type  Solid core
   b. Number of units for 3poles.  Three
   c. Height of the stack (mm)  3910 alternatively 3650
   d. Bolt circle diameter (mm)  TOP-127, Bottom-300
   e. Tensile strength  9,000 Kg.
   f. Compressive strength  25,000 Kg.
   g. Torsional strength  600 Kg.
   h. Cantilever strength upright.  816 Kg.
   i. Power frequency dry flash over voltage.  890 KV (Peak)
   j. Power frequency wet flash over voltage.  820 KV (rms)
   k. Impulse flashover positive wave (1.2/50µs)  1850 KV
   l. Impulse withstand KV (1.2/50 micro sec.)  1550 KV
   m. Power frequencies puncture voltage.  Puncture proof.
   n. Creep age distance
      i) Total  10,500 mm
      ii) Protected  Shield profiles as per IEC:815
   o. Visual discharge voltage  320KV (rms)
   p. Dry arcing distance  Min. 3400 mm
16. Switch design
   a. Rotating/tilting/lifting  Lifting.
   b. Horizontal /vertical break  Vertical.
18. Terminal stud:
   a. Material of connector
   b. Material of bolts.  Fixed on casting
   c. Range of diameter of conductors that can be received.  40x40 fixing centre
19. Terminal connectors
   a. Material of connector  Aluminum
   b. Material of bolts.  M.S. Galvanised
   c. Range of diameter of conductors that can be received.  21-36mm
   d. Maximum temperature rise when carrying rated current at 50°C ambient temperature  35 Deg. Over ambient
   e. Weight of each type of connector  To be furnished by bidder
   f. Whether horizontal / vertical take off  Horizontal/vertical
   g. Flexible/rigid  Flexible
22. Visual discharge voltage for complete earth switch with fittings.  320KV (rms)
23.0 RIV for complete E/W with fittings.  Less than 1000 micro volt at 266KV.
GUARANTEED TECHNICAL PARTICULARS
(TO BE FILLED IN BY BIDDER INVARIBLY. WITHOUT WHICH BID CANNOT BE CONSIDERED VALID FOR ACCEPTANCE)

EARTH SWITCH

1.0 Maker’s Name : 

2.0 Manufacture’s type and designation : 

3.0 Reference standards : 

4.0 Rated voltage K.V. : 

5.0 Maximum design voltage KV at which the isolator can operate : 

6.0 Frequency Hz : 

7.0 Derating factor, if any for specified site conditions : 

8.0 Short time rating
   a) For 3 seconds. : 
   b) Rated peak short time current : 

9.0 Insulation tests :
   a) One minute power frequency:
       wet withstand voltage:

       i) Across the isolation distance KV (rms) : 
       ii) To earth and between poles KV (rms) : 

   b. 1.2x50/Micro second impulse withstand voltage (+& -Polarity)

       i) Across the isolating distance KV (Peak) : 
       ii) To earth and between poles KVP. : 


d. 250/2500 micro second impulse withstand voltage.

a) To earth KV (Peak)

b) Across open disconnect voltage applied to –

i) One terminal switching impulse

ii) Opposite terminal power frequency:

10.0 Clearance:

a) Between poles

b) Between live parts and earth

c) Between live parts and when the switch is open:

i) On the same pole

ii) Between adjacent poles

12.0 Whether suitable for specified phase spacing?

13.0 Type of interlocks

14.0 Torque required to operate the gang operated isolator.

15.0 Insulator Data:

a. Type

b. Number of units for 3poles.

c. Height of the stack (mm)

d. Bolt circle diameter (mm)

e. Tensile strength

f. Compressive strength

g. Torsional strength

h. Cantilever strength upright.

i. Power frequency dry flash over voltage.

j. Power frequency wet flash over voltage.

k. Impulse flash over positive wave (1.2/50 micro sec.)

l. Impulse withstand KV (1.2/50 micro sec.)

m. Power frequency puncture voltage.

n. Creep age distance

i) Total

ii) Protected

o. Visual discharge voltage
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>16</td>
<td>Dry arcing distance :</td>
</tr>
<tr>
<td>16</td>
<td>Switch design :</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Rotating/tilting/lifting :</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Horizontal /vertical break :</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Operating mechanism(Manual) :</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Terminal stud :</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Material of connector :</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Material of bolts. :</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Range of diameter of conductors that can be received. :</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Terminal connectors :</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Material of connector :</td>
<td></td>
</tr>
<tr>
<td>b</td>
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<td>c</td>
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<td></td>
</tr>
<tr>
<td>d</td>
<td>Maximum temperature rise when carrying rated current at 50 Deg.C ambient temperature :</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Weight of each type of connector :</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Whether horizontal / vertical take off :</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Flexible/rigid :</td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>Base :</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Size in mm :</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Weight in kg. :</td>
<td></td>
</tr>
<tr>
<td>21.0</td>
<td>Total weight of Earthing switch (excluding structure) :</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td>Visual discharge voltage for complete earth switch with fittings. :</td>
<td></td>
</tr>
<tr>
<td>23.0</td>
<td>RIV for complete E/W with fittings. :</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>List of descriptive literature and drawings as called for in clause 7 of specification enclosed. :</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Whether all type test reports as per latest IS:9921 are enclosed. :</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Whether all routine/acceptance tests as per latest applicable standard will be carried out on each earthing switch. :</td>
<td></td>
</tr>
</tbody>
</table>