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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

DISCHARGE/EARTHING POLE ASSEMBLY FOR 25 KV AC TRACTION

Specification No. ETI/OHE/51 (9/87) Rev.-1

(For official use only)

ISSUED BY

TRACTION INSTALLATION DIRECTORATE
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SPECIFICATION FOR DISCHARGE/EARTHING POLE ASSEMBLY FOR 25KVAC TRACTION**1. SCOPE:**

- 1.1 This Specification covers the requirements of Discharge/Earthing pole assembly for **Conventional & High Rise** 25kV AC traction overhead equipment, switching station and substation. It supersedes RDSO's Specification No.ETI/OHE/51(9/87). **Purchaser shall indicate Discharge rod is required for Conventional or High rise OHE.**
- 1.2 The assembly shall be complete with all parts and accessories required for its proper functioning, all such parts and accessories shall be deemed to be within the scope of this specification whether specifically mentioned or not.

2. SERVICE CONDITIONS:

- 2.1 The Discharge/Earthing pole assembly is intended for outdoor use and is meant for Discharging and Earthing the 25kV AC traction overhead line and concerned equipment of the switching station and substation after the line/equipment is isolated from source or supply, before the commencement of any maintenance work on them, and to drain to earth induced voltages from an adjacent line/equipment charged at 25kv, 50Hz ac. The Discharge/Earthing pole assembly shall also effectively conduct short circuit current of up to 6250Amps for 1 second without any damage to it in the event of accidental charging of the earthed line or accidental connection of the Discharge/Earthing pole assembly to a live line.

- 2.2 Weather condition: The weather conditions under which the discharge/earthing pole assembly is used vary widely. The limiting conditions which have to be withstood in service are indicated below:

Maximum temperature of air in the shade	-	45°C
Minimum temperature of air in the shade	-	0°C
Maximum Temperature attainable by an object exposed to sun	-	65.5°C
Maximum relative humidity	-	100%
Average annual rain fall	-	1750 to 6250mm
Number of thunder storm day per annum	-	85 days Max
Average number of dust storm day per annum	-	35 days max
Number of rainy days per annum	-	120 days max.
Maximum wind pressure	-	200 kg/sq.m.
Altitude	-	Not exceeding 1500m

- 2.3 In some areas there would be chemical pollution from the effluent gases of chemical/fertilizer plants and other industries and saline atmosphere near sea. The discharge/earthing pole assembly would also be used in such areas.

3. REFERENCE SPECIFICATIONS:

- 3.1 In preparation of this specification, reference has been made to the following specifications:
 i) IS: 1554 (Pt. I)-PVC insulated electric cables working voltage upto and including 1100V.
 ii) IS: 2071 (Pt. I, II & III)-Method of high voltage testing.
- 3.2 The material used for the components/parts of the assembly shall conform to the relevant Indian Standard Specifications whether or not specifically mentioned herein.

- 4. DEVIATION FROM SPECIFICATION:** Any deviation from this specification to improve the performance, efficiency and utility of the discharge/earthing pole assembly, proposed by the **manufacturer** will be given due consideration provided full particulars with justification therefore are furnished.

5. CONSTRUCTION:

- 5.1 The assembly shall be portable. It shall be as light as possible for ease of operation by one person. Its construction shall be robust as it will be used daily at different locations and under various weather conditions and should not be easily damaged during normal use.

- 5.2 The assembly shall be mechanically strong to withstand jerks and impacts in the process of its transportation and hooking it on to the overhead line equipment. The discharging/ earthing pole assembly shall satisfy the requirements of cantilever load test (cl 8.7), Impact test (CL. 8.6), Mechanical endurance test (Cl 8.5) for mechanical strength.
- 5.3 The pole shall be made of ~~densified wood~~, cast resin or resin-bonded glass fibre, coated with three coats of poly-urethane.
- 5.3.1 ~~deleted.~~
- 5.4 The discharge/earthing pole assembly shall have an overall length of not less than five metres in three equal sections **for Conventional OHE & not less than 6.7m in 4 equal parts for High Rise OHE**. In order to protect the lower end of the bottom section from damage while the assembly is being used, a rubber pad shall be provided at the lower end.
- 5.5 The jointing between the three/**four (as applicable)** constituent sections of the Earthing pole shall be through screwed splices in the form of ferrules made of steel suitably protected against corrosion. The ferrule shall be riveted to the pole at two places, the rivets being perpendicular to each other. Any other method for jointing may also be used provided it has been previously approved.
- 5.6 The top-most section of the pole shall be provided with a clamp made of copper or aluminium bronze. The clamps shall be spring loaded so that it is suitable for a sliding fit over round/stranded conductor of 10mm to 20mm diameter and/or circular bus bar of 36mm and of 50mm outer diameter. One end of the cable shall be fitted to the top clamp through cable lug which shall be crimped to the core of the cable. **The size of clamp required to be provided shall be obtained by the manufacturer from the purchaser.**
- 5.7 The length of cable from the Earthing clamp end to the top clamp shall be not less than 7.5 metres **for conventional OHE AND 9.5m for High Rise OHE**. In the Cable, an insulated Tee junction generally as per drawing No. ETI/OHE/SK/481 **with latest Rev** (Attached) shall be provided at a distance of about 1.5metres from the Earthing clamp. From this insulated Tee junction another piece of cable not less than 1.5 metres long shall be provided at the end of which the other earthing clamp shall be provided. The arrangement is shown in the above drawing. The ends of cable shall be fixed to the earthing clamps through lugs crimped to the core of cable.
- 5.8 The earthing clamps as per drawing No. ETI/OHE/SK/482 **with latest Revision**, shall be made of steel galvanized, for connection to the cable through cable lugs crimped to the core of cable. They shall be suitable for clamping firmly either to the bottom of rail of the track or steel structure in the vicinity. The earthing clamps shall be supplied along with earthing pole completely assembled.
- 5.9 All hardware and metallic components shall be suitably tin/chromium plated or galvanized to prevent deterioration due to rusting, sulphation etc.
- 5.10 In order to carry the entire discharge/earthing pole assembly conveniently, a suitable canvas carrying case with slings to carry it on the shoulders shall be supplied with each assembly.
- 6. RATING AND OTHER PARTICULARS:** The discharge/earthing pole assembly shall be designed for the following rating and other particulars:
- 6.1 Assembly:
- | | | | |
|-------|---------------|---|----------------------|
| (i) | Type | : | Portable, outdoor. |
| (ii) | Rated voltage | : | 25kV ac, 30kV max. |
| (iii) | Frequency | : | 50Hz at 3% variation |
- 6.2 Main insulating piece:
- | | | |
|------|--|--------------|
| (i) | One-minute wet power frequency withstand voltage in vertical position: | 100kV (rms) |
| (ii) | 1.2/50 micro-sec and impulse withstand Voltage positive and negative polarity: | 250kV (peak) |
- 6.3 Cable and clamps:
- | | | | |
|-------|---|---|---|
| (i) | Type | : | Single core, flexible Multi-strand annealed copper. |
| (ii) | Specification | : | IS:1554 (Pt.I)-1988 & IS 2071(Pt. 1 & III). |
| (iii) | Size | : | 248/9.45mm |
| (iv) | Type of insulation | : | Heat resistant PVC. |
| (v) | Voltage grade | : | 650/1100 |
| (vi) | Short Circuit Current Carrying capability for One second: | | 6250Amp |

7. TESTS:

7.1 All tests on the earthing pole assembly shall be carried out at the manufacturers' works. The electrical tests may, with the prior approval of purchaser, be carried out at any reputed laboratory where testing facilities are available. The manufacturer shall arrange for all the necessary equipment, staff etc. required to conduct all tests at his own cost.

7.2 Type tests & Acceptance Tests :

7.2.1 The following shall constitute the type tests and Acceptance tests:

S.N.	TESTs	Clause	Type test	Acceptance test
i	Visual examination	8.1	Yes	Yes
ii	Dimensional measurements	8.2	Yes	Yes
iii	Determination of weight of complete assembly	8.3	Yes	Yes
iv	Accelerated ageing test	8.4	Yes	Yes
v	Mechanical endurance test	8.5	Yes	Yes
vi	Impact test	8.6	Yes	Yes
vii	cantilever load test	8.7	Yes	
viii	One-minute wet power frequency voltage. Test positive polarity and negative polarity	8.8	Yes	-
ix	1.2/50 micro-second impulse withstand voltage test positive polarity and negative polarity	8.9	Yes	-
x	Short-circuit test	8.10	Yes	-

7.2.2 FOR TYPE TESTS: The tests on the complete assembly, for S.N. (v), (vi), (vii), (viii), (ix) & (x) above shall be conducted on the sample which has successfully passed the tests at S.N. (i), (ii), (iii), & (iv). The sample shall comply with the tests requirements.

7.3 ACCEPTANCE TESTS:

7.3.1 The complete assembly shall be inspected in lots of not more than 25 each. Each assembly shall be subjected to the test at serial No. (i), (ii), (iii) and (vii) given in clause 7.2.1. One sample assembly selected at random will be subjected to the tests at S.Nos. (vi) & (v) in clause 7.2.1 in that order.

7.3.2 Deleted

7.3.3 Acceptance criteria: If any of the samples selected fails to comply with the requirements of any of the tests at S.N. (i) to (iv) of clause 7.2.1, it will be rejected. If the sample subjected to the tests at S.N. (v) & (vi) fails, these tests shall be repeated on two more samples selected from the same lot. If in the re-test any sample fails, the lot from which the sample was chosen will be rejected and destroyed.

7.4 While no separate tests are specified for the clamps, ferrules etc., the purchaser/his inspector may at his discretion carry out any test to verify the dimensional requirement and other properties of the material etc. the purchaser/his inspector, at his discretion, may repeat the accelerated ageing test on any sample in any batch, if he so desires.

8. METHODS OF TESTS:

8.1 Visual examination: The assembly shall be visually examined carefully. The three/Four sections of the assembly shall be straight. There shall be no cracks or other defects. The uniformity of polyurethane coating over the sections shall be tested. The screwed splices shall be firm when the three/Four sections are coupled through the splices, the pole shall be straight without any play between the sections at the splices. The fixing of cable with top clamp and earthing clamp shall also be checked. The workability of rail camp screw and spring loaded jaw of top clamp shall be checked. The general construction of the earthing pole shall be checked with the approved drawings. The hardware shall be checked for proper protective coating.

8.2 Dimensional Measurements: The dimensions of various parts of the assembly including overall length in assembled condition and length of cable shall be checked in accordance with approved drawings.

8.3 Determination of weight of complete assembly: Each of the three/Four sections of discharge/earthing pole assembly shall be weighed separately. The weight shall be recorded.

- The complete assembly including cable, rail clamp and canvas carrying case shall be weighed and recorded.
- 8.4 Accelerated ageing test: The assembly shall be subjected for 24 hours to hot air (100⁰C) saturated with water vapour, or to saturated steam at 100⁰C. No streaks, cracks, flaws, bubbles and deformation shall appear after the test.
- 8.5 Mechanical endurance test:
- 8.5.1 The complete assembled earthing pole shall be tested for mechanical endurance by hooking and removing the same on to the conductor/bus bars of specified dimensions 2000 times. At the end of the test the jaw shall not have developed any defect such as looseness of springs/bolts etc. No surface defect in the pole or resin bonded glass fibre rod or loosening of screwed splices shall occur.
- 8.5.2 For the acceptance test, the number of operations may be limited to not more than 500.
- 8.6 Impact test: A load of 8kg shall be attached at the hock end of the complete assembled earthing pole. It shall be lifted to make the pole vertical. The top of the pole shall be swung over an angle of 45⁰C from vertical 20times. There should be no sign of cracking, distortion or damage at the end of the test.
- 8.7 Cantilever load test: The complete assembly together with grounding cable shall withstand a cantilever load of 2 kg. at the top end, the base being clamped horizontally at intervals of 300mm and 1000mm from the bottom end. The deflection of the top end from the horizontal level shall be measured and recorded. The Earthing pole should withstand the test successfully without any permanent deformation.
- 8.8 One minute wet power frequency voltage withstand test in vertical position :The resin bonded glass fibre piece shall withstand one-minute wet power frequency voltage of 100kV (rms) in vertical position between the ferrules clamped at either end. This test shall be conducted as per IS:2071 (Pt.I& III).
- 8.9 1.2/50 microsecond, impulse withstand voltage test: The resin bonded 1.2/50 microsecond, impulse voltage of both positive and negative polarity of 250kV peak between ferrules clamped at eid. The test shall be conducted as per IS: 2071 (Pt.I& III).
- 8.10 Short Circuit test:The complete assembly shall be tested for short time current carrying capability at 6250 Amps. For one second. There shall be no damage either to the cable or to the current-carrying metallic parts.
9. **MARKINGS:** The manufacturer shall provide the following markings in all the three/**four** sections of pole:
- (i) Manufacturer's name/monogram/brand,
 - (ii) Lot number and month/year of manufacture, and
 - (iii) Serial number of earthing pole assembly.
10. **TECHNICAL DATA AND DRAWINGS TO BE FURNISHED WITH TENDER OFFERS:**
- 10.1 The tenderer shall furnish the guaranteed performance, technical and other particulars for the discharge/earthing pole assembly offered (in the prescribed proforma at Annexure-A). The following drawings shall be submitted in standard size of 210mm x 297mm or any integral multiple thereof:
- (i) Assembly of discharge/earthing pole,
 - (ii) Rail clamp assembly and details of components.
 - (iii) Hook (Top clamp) assembly and details of components.
 - (iv) Details of the three/**Four** sections of the pole with screwed splices etc.
- The tenderer shall indicate the purchase order number on all the drawings and shall provide space for approval of approving authority. In addition to the technical particulars of the assembly, the part drawing numbers, material specification and quantity required for the assembly shall also be indicated on the assembly drawing. Manufacture of prototype shall be taken up only after clear approval of drawings by the purchaser.
- 10.2 The tenderer shall indicate their compliance or otherwise for each clause and sub-clause of this specification. The tenderer shall for this purpose enclose a statement giving his remarks against each clause and sub-clause. Wherever the tenderer deviates from the provisions of the specification, he shall furnish detailed remarks as to the difficulties in complying with the specification and/or the advantages offered by an alternative.

Enclosure: (1) Annexure –A (2) Drawings (Two Nos.)

Specification No.ETI/OHE/51(9/87)(Rev.1)**ANNEXURE-A****SCHEDULE OF GUARANTEED PERFORMANCE, TECHNICAL AND OTHER PARTICULARS**

S.No.	Description	
01.	Name of manufacturer	
02.	Manufacturer's monogram/brand	
03.	Standard Governing specification adopted for	
a)	Main insulating piece of resin bonded glass fibre	
b)	Poles	
c)	Cable :IS:1554(Pt.I)-1988	
d)	Polyurethane coating	
e)	Material for top hook	
f)	Material for rail clamp	
g)	Material for insulated 'Tee'-junction	
h)	Material for screwed splice	
04.	Rated voltage	25KV(Nominal),30KV(MAX)
05.	Nominal current carrying capacity of cable	
06.	Short circuit current carrying capability	6.25KA for 1 second.
07.	Insulation level of earthing pole:	
a)	One-minute wet power frequency voltage withstand in vertical position for resin bonded glass fibre piece.kV(rms)
b)	1.2/50 micro-second impulse withstand voltage for resin bonded glass fibre piece:	
	Positive polaritykVp
	Negative polarity	..kVp
08.	Particulars of resin bonded glass fibre piece:	
a)	Name of manufacturer	
b)	Manufacturer's type designation	
09.	Weight of complete Assembly including cable, clamps & canvas carrying bagsKg
10	Particulars of the cable	
a)	Name of the manufacturer	
b)	Manufacturer's type/Designation	
c)	Material of the conductor	Copper
d)	Size and make of the conductor	
e)	Material for cable insulation & thickness	PVC