Discharge cum Earthing Rod

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Engineering Department

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Technical Specification of Discharge cum Earthing Rod

(For Working on Transmission Lines & Substations)

1. SCOPE

- This specification covers design, materials, manufacture, testing at manufacturer's works; inspection, marking, packing and documentation for discharge cum earthing rod used by electricians and linemen for working at transmission towers & substations.

- The discharge cum earthing rod shall comply with highly insulated FRP telescopic type with all accessories suitable for 400 KV systems, 800 KV CPRI type tested as per IEC - 1230:1993 & IEC - 1235 with tested epoxy earthing rod for 10 KV/ft. for 1 min as per IEC-855.

- This specification outlines the requirements for portable equipment used for temporary earthing or earthing and short-circuiting in transmission network, as per **IEC 61230:2008**. The equipment shall be suitable for use in high-voltage (HV) and extra-high-voltage (EHV) installations, including overhead lines and substations, where applicable, ensuring worker safety during live or dead working procedures.

2. References

The equipment shall comply with the following standards (latest editions unless specified):

- **IEC 61230:2008** – Live working – Portable equipment for earthing or earthing and short-circuiting
- **IEC 61138** – Cables for portable earthing and short-circuiting equipment
- **IEC 60811-3-1** – Common test methods for insulating and sheathing materials
- **ASTM F855** – Standard specification for temporary protective grounds
- Indian Standards (IS) or equivalent, where applicable

3. Components

- **Earth clamp:** clamp forming part of an earthing or earthing and short-circuiting device for connecting an earthing cable, or a connecting cluster to an earthing conductor or an earth electrode or a reference potential
- **Earthing cable:**cable forming part of an earthing and short-circuiting device, which connects earth clamp to a line clamp of the electrical installation or earth clamp to connecting cluster
- **Earthing stick:** earth application stick insulating component equipped with a permanent or detachable end fitting for installing clamps, short-circuiting bars or conductive extension components onto the electrical installation
- **Connection point:** part of installation specially arranged for clamp connection (for example, ball pin, cylinder bolt, bow, hook, stirrup, stud)
- **Safety Distance**: Air clearance to prevent electrical hazards, as per installation voltage and working procedures.

- **Insulating stick:** insulating tool essentially made of an insulating tube and/or rod with end fittings
- **Line clamp:** clamp forming part of an earthing and short-circuiting device, which is attached to a short circuiting cable, a short-circuiting bar or conductive extension component, either directly or through connecting links, and used for the connection to line (line conductors, bus bars or current-carrying conductors), or to the connection point

4. Requirements

4.1 General

- The equipment shall be portable, robust, and designed for safe operation in 33 kV, 132 kV, 220 kV and 400 kV systems.
- Components (clamps, cables, bars, earthing sticks) shall withstand mechanical, electrical, and thermal stresses during normal use and fault conditions.
- The equipment shall be suitable for outdoor use in climatic conditions of West Bengal (temperature: -10°C to +50°C, humidity: up to 95%, heavy rainfall).

4.2 Electrical Rating

- Earthing and short-circuiting devices and their components shall be rated in terms of a short circuit current (Ir), a time (tr) and the corresponding peak factor.
- For d.c. applications, the values shall be the same.
- The rating of the complete device shall be expressed as rated current in kiloamperes, as rated time in seconds and rated peak factor.

4.3 Cables for Earthing and Short-Circuiting

- **Material**: Copper or copper equivalent (aluminum/aluminum alloy with equivalent conductivity).
- Cables shall have adequate mechanical, chemical, environmental and electrical properties to meet all the requirements of this standard.
- **Cross-Section**: For selection of the cable cross-section according to temperature rise during a short-circuit, curves or tables and guidance are given in Annex C. of IEC 61230.
- **Insulation**: PVC or EPR, complying with IEC 61138, resistant to mechanical shock, abrasion, and temperatures up to 300°C (short-circuit condition).
- **Flexibility**: Cables shall pass bending and twisting fatigue tests as per IEC 61138.

4.4 Clamps and Connection Points

- **Types**: Earth clamps, line clamps.
- **Design**: Resistant to mechanical and thermal stresses, easy to install/remove without damaging the conductor.
- **Connection Points**: Compatible with ball, cylinder, or bar shapes (as per Figure 5 of IEC 61230).
- **Material**: Corrosion-resistant.
- **Tightening**: Manual or gravity-based, ensuring secure contact.

4.5 Earthing Sticks

- No cable should permanently follow along the insulating element of the earthing stick, either outside or inside

- **Insulating Component**: Comply with IEC 60855 or IEC 61235, resistant to bending/torsion forces.
- **Length**: Adjustable to maintain safety distance for 33 kV to 400 kV systems.
- **Tests**: Pass bending test and torsion test (as per Annex B of IEC 61230).

4.6 Marking

- **Equipment**:
  - Manufacturer's name or trademark or end assembler's name
  - year of manufacture
  - Rated current, rated time, and peak factor.
  - IEC 61230:2008 compliance.
- **Cables**:
  - Origin, cross-section, insulation type (per IEC 61138).
- **Clamps/Bars**:
- manufacturer's name or trademark;
- model or type reference for the clamp

5. Tests

5.1 General

- Tests shall be conducted as per Clause 5 of IEC 61230:2008.
- Type tests are mandatory for design validation; routine tests for production units.
- Test reports shall be submitted for WBSETCL approval.

5.2 Type Tests

As per Annex E of IEC 61230:2008

5.3 Routine Tests

Visual verification-

- Check that components of the devices are suitable for the temperature conditions and fields of application
- Check the complete assembly of the connections and the complete device
- Check of marking
- Check that the manufacturer's or end-assembler's instructions are made in accordance with requirements

Manual checking

- Suitability of clamps to connection points

Testing

- Testing durability of marking

Verification

- Verify the insulating element

6. Conformity Assessment

- Compliance with IEC 61230:2008 shall be verified through type and routine test reports.
- WBSETCL reserves the right to witness tests at the manufacturer's facility.
- Non-conformance shall lead to rejection of the equipment.

7. Guidelines for Use

- **Selection**: As per Annex C of IEC 61230 (e.g., cable cross-section based on short-circuit current).
- **Verification Before Use**: Visual inspection for damage to clamps, cables, or insulation.
- **Maintenance**: Regular cleaning, storage in dry conditions, periodic resistance checks (per ASTM F2249). The manufacturer's or final assembler's instructions for use should be a reference document in that respect.

8. Packaging and Delivery

- Equipment shall be packed in weather-resistant cases to prevent damage during transport.
- Each unit shall include an instruction manual detailing installation, use, and maintenance.

9. Warranty

- Defective units shall be replaced free of cost.

10. Submission Requirements

- Technical datasheets and drawings.
- Type test certificates (not older than 5 years).
- Quality assurance plan.

- Compliance statement with this specification and IEC 61230:2008.