



A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

PORTABLE EQUIPMENT FOR EARTHING OR EARTHING AND SHORT-CIRCUITING OF AC AND DC TRACTION, HV TRANSMISSION AND TIE-STATION BUSBARS

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LIST OF AMENDMENTS TO THE SPECIFICATION

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1.0 SCOPE

- 1.1 This specification details Transnet's requirements for earthing and short-circuiting devices for use on AC and DC traction networks, HV transmission and tie-station busbars.
- 1.2 This specification contains a schedule of requirements (Appendix A) which must be completed by a Transnet representative.

2.0 NORMATIVE REFERENCES

- 2.1 Unless otherwise specified all materials used, equipment developed and supplied shall comply with the latest edition of the relevant International Electro-technical Commission (IEC), American Society for Testing and Materials (ASTM), South African National Standards (SANS) or Transnet publications.

2.2 IEC standards:

IEC 61138 Cables for portable earthing and short-circuiting devices.

2.3 ASTM standard

ASTM F1826-00 Standard Specification for Live Line and Measuring Telescoping Tools.

ASTM F711 Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools.

2.4 SANS standard:

SANS 9001 Quality assurance.

SANS 61230 Live working – portable equipment for earthing or earthing and short-circuiting.

2.5 Transnet Drawing

CEE-TWH-0002 Typical Earthing Device.

3.0 SERVICE CONDITIONS

3.1 ENVIRONMENTAL CONDITIONS

Altitude: 0 - 1800 m above sea level.

Relative humidity: 10% to 90%.

Ambient temperature: -10°C to +55°C

Lightning conditions: 20 ground flashes/km² per annum.

Pollution: Heavily salt laden with industrial pollutants including diesel- electric locomotive emissions.

3.2 ELECTRICAL CONDITIONS

The devices must be able to continuously operate safely under the follow electrical condition: 6.6kV AC, 11kV AC, 25kV AC, 33kV AC and 3kV DC.

4.0 TECHNICAL REQUIREMENTS

4.1 AC and DC traction earthing and short-circuiting devices.

- 4.1.1 Line to rail jumper shall consist of a 15m long with a cross-sectional area of 70 mm² (+8 mm² upper tolerance) copper conductor or equivalent, with a minimum number of strands of 2250. The line clamp described in clause 6.0 should be attached on one end and a rail clamp described in clause 8.0 should be attached on the other end.
- 4.1.2 Line to line jumper shall consist of a 5m or 10m long with a cross-sectional area 35 mm² (+4 mm² upper tolerance) copper conductor or equivalent, with a minimum strands of 1120. A line clamp which is described in clause 7.0 should be attached on each end as per schedule of requirements.
- 4.1.3 Rail to rail jumpers shall consist of a 5m or 10m long with a cross-sectional area 70 mm² (+8 mm² upper tolerance) copper conductor or equivalent with minimum strands of 2250. A rail clamp described in clause 7.0 should be attached on each end.
- 4.1.4 All devices shall be designed in accordance to SANS 61230 and conductors shall be designed in accordance to IEC 61138.
- 4.1.5 The tenderer shall indicate what design steps were taken to prevent a negative galvanic reaction.
- 4.1.6 The equipment shall withstand a fault current of 27 kA for a period of 30 milli-seconds without being destroyed.
- 4.1.7 Each earthing set shall be supplied with a suitable heavy-duty storage/carry bag. The bag shall be durable and shall be provided with one or more handles for the easy carrying of the kit.

4.2 HV transmission line earthing and short-circuiting devices.

4.2.1 6,6 and 11kV Transmission:

These devices shall consist of a single jumper cable, 4m long connected with lugs and a locknut bolt, to three tails, each of length 9m with a cross-sectional area 35 mm² (+4 mm² upper tolerance), with a minimum strands of 1120. The three line clamps described in clause 6.0 should be attached on the ends of the three tails and a rail clamp described in clause 7.0 should be attached on the other end of the single 4m long cable.

4.2.2 33kV Transmission:

These devices shall consist of a single jumper cable, 14m long connected with lugs and a locknut bolt, to three tails, each of length 3m with a cross-sectional area 35 mm² (+4 mm² upper tolerance), with a minimum strands of 1120. The three line clamps described in clause 6.0 should be attached on the ends of the three tails and a rail clamp described in clause 7.0 should be attached on the other end of the single 14m long cable. The top assembly of three wires must be 3 meters each in length and the bottom single wire 14 meters in total 17meter.

5.0 CONDUCTORS

- 5.1 All the conductor cables shall be designed in accordance to IEC 61138.
- 5.2 Conductor material shall be of flexible strands class 5 or 6.
- 5.3 The conductor shall consist of annealed copper, aluminium or aluminium alloy, the wires of copper conductors may be plain or tinned. Tinned wires shall be covered with an effective layer of tin.
- 5.4 Conductor shall be covered with clear transparent PVC insulation.
- 5.5 The insulation thickness of 35 mm² (+4 mm²) copper conductor or equivalent shall be 1.2 mm (min) and the insulation thickness of 70 mm² (+8 mm²) copper conductor or equivalent shall be 1.5 mm (min).
- 5.6 Terminations shall be by means of hexagonally crimp. Lugs shall be connected in such a way that there is a positive lock between the lug and the clamp and all other terminations and should not be able to rotate.
- 5.7 Lugs should be without inspection holes.
- 5.8 The terminations shall be covered by a 200mm long, transparent, heavy-duty heat shrink tube.
- 5.9 A pre-production sample of the equipment, shall be submitted to Transnet Freight Rail, Technology Management's representative for approval before starting the production of the order.

6.0 LINE CLAMPS

Line clamps shall:

- 6.1 withstand a torque of 20Nm without breaking.
- 6.2 Be of a serrated connection to the conductor.
- 6.3 be fitted with a guiding aid to facilitate application from ground level.
- 6.4 be constructed of Cu-Ni-Si or aluminium alloy or similar tough conductive metal.
- 6.5 be of the screw-on type.
- 6.6 be capable of clamping conductors up to 38mm diameter for use on 3kV DC electrification and 23mm diameter for use on 25kV AC electrification and transmission lines.

7.0 RAIL EARTH CLAMPS

Rail earth clamps shall:

- 7.1 be constructed of Cu-Ni-Si or aluminium alloy or similar tough conductive metal.
- 7.2 ensure a positive electrical connection to the flange of heavily corroded rails even during short-circuit conditions.

8.0 EARTHING ROD

Earthing rod shall:

- 8.1 be constructed of fibre glass.
- 8.2 be complete with bell-mouthed operating sockets and all the necessary attachments.

- 8.3 be 6m long and consisting of 4 sections, each 1.5m long.
- 8.4 have a tough positive locking mechanism to lock the sections together.
- 8.5 be designed to withstand a head load of 80N.
- 8.6 not deflect more than 1m over the total length with a designed head load of 80N.
- 8.7 withstand an insulation test of 300kV per meter length for a period of 60 seconds.

9.0 TELESCOPIC LINK STICK (HOT STICK)

- 9.1 Telescopic link sticks shall be manufactured to ASTM F1826-00.
- 9.2 Top section must be solid or foam filled to ASTM F711.
- 9.3 Overlapping of sections should not be less than 150mm.
- 9.4 Bottom cap shall be securely fitted.
- 9.5 Shall be made of safety yellow fiberglass.
- 9.6 It shall lock positively as each section is extended, to prevent slipping when extended.
- 9.7 Shall be supplied in suitable carry bag.
- 9.8 Shall be supplied with all necessary attachment fittings and with universal rose and bell – mouthed socket.
- 9.9 For the operating voltages mentioned in clause 3.2, the dielectric test should be performed at 100kV/300mm length for a period of 60 seconds, and mechanical tests to ASTM F711.

10.0 TELESCOPIC LINK STICK AND EARTHING ROD FITTINGS

- 10.1 Fittings shall be constructed of Cu-Ni-Si or aluminium alloy or similar tough metal.
- 10.2 It shall lock securely to the socket of the link stick to allow the opening and closing of link
- 10.3 With regard to any deviation/improvement to the fittings shall be clearly stated as well as the advantages gained.

11.0 TESTING AND INSPECTIONS

- 11.1 Transnet Freight Rail reserves the right to be present at all tests and inspection of the equipment at any stage during manufacturing.
- 11.2 The responsibility of arranging the tests of this equipment and testing costs rests with the successful tenderer.
- 11.3 A Transnet Freight Rail, Technology Management (Electrical Technology) representative may request any additional test deemed necessary to ensure compliance.
- 11.4 Testing of a sample will be conducted in accordance to the test procedure provided in IEC 61138 and any relevant specification referred there in.
- 11.5 The earthing or short circuiting equipment shall have been type tested in accordance with the requirements of SANS 61230 clause 5.

12.0 MARKING

- 12.1 The markings shall be clearly readable, durable and not removable.
- 12.2 The cable shall be marked with the original manufacture's trade mark, nature of the insulation covering and the cross sectional area.
- 12.3 On the clamp itself or non-removable label, the manufactures name or trademark and model of the clamp shall be engraved.
- 12.4 The kA rating and year of manufacture should be marked on the clamps.
- 12.5 Each carry bag shall be marked with the Transnet Freight Rail logo and a description of the contents (type of earthing equipment, size and number of items in the complete set).

13.0 DOCUMENTATION REQUIREMENTS

- 13.1 Tenderer shall submit one soft copy and two hard copies of drawings and technical documentation with tender.
- 13.2 Each earthing or short circuiting equipment set shall be supplied with comprehensive instructions for use and a test certificates.
- 13.3 The tenderer must provide design and type test certificates to verify conformance to the requirements and these must be submitted with tender documents. Electrical type test and mechanical type test reports as detailed in SANS 61230.

14.0 TRAINING

- 14.1 Training on the correct handling, care and safe use of the earthing or short-circuiting equipment shall be quoted for separately. The number of people who require training needs to be indicated in the schedule of requirements.

15.0 QUALITY ASSURANCE

The successful tenderer shall maintain a Quality Management System (QMS) based on or certified to SANS 9001.

16.0 METHOD OF TENDERING

- 16.1 Tenderers shall indicate clause-by-clause compliance document with the specification. This shall take the form of a separate document listing each of the specification's clause and sub-clause numbers, indicating the individual statements of compliance or non-compliance.
- 16.2 Statement of non-compliance shall be motivated by the tenderer, as per clause 16.1.
- 16.3 Tenderers shall submit comprehensive literature consisting of detailed technical specifications, general constructional details and principal dimensions, maintenance schedules, datasheets, together with clear illustrations of the equipment offered.
- 16.4 Any items offered in accordance with other standards will be considered at the sole discretion of Transnet. The tenderer shall supply full details stating where the item differs from these

specifications as well as supplying a copy (in English) of the recognized standard specification(s) with which it complies. Any deviations must be approved by the relevant Transnet, Technology Management department in writing.

- 16.5 Failure to comply with clauses 16.1, 16.2, 16.3 and 16.4 could preclude a tenderer from being considered.
- 16.6 In the event of any conflict between the various submitted relevant documents, the order of precedence shall be, and in consultation with Technology Management:
- a) Legal and safety requirements.
 - b) This Specification.

END

APPENDIX A: SCHEDULE OF REQUIREMENTS

(To be filled by Transnet Representative)

1.0 AC AND DC TRACTION AND HV TRANSMISSION LINE DEVICES				
Component	No. of Rail Clamps	No. of Line Clamps	Without clamps	
1.1 Line to rail jumpers (15m)				
1.2 Line to line jumpers (5m)				
1.3 Line to line jumpers (10m)				
1.4 Rail to rail jumpers (5m)				
1.5 Rail to rail jumpers (10)				
1.6 HV transmission line devices				
1.7 Telescopic Link stick	yes		no	
1.8 Earthing Rod	yes		no	
1.9 Fittings (Rod/link stick)	yes		no	
1.10 Line clamp	yes		no	
1.11 Rail earth clamp	yes		no	
2.0 3kV DC TRACTION SUBSTATION AND TIE-STATION BUSBAR DEVICES (IN ACCORDANCE TO CEE-TWH-0002)				
2.1 DC earth leakage to main 3kV DC bus-bar jumpers (item 1)	yes		no	
2.2 DC earth leakage bus-bar to 3kV DC feeder jumpers (item 2)	yes		no	
2.3 Clamp (item 5)	yes		no	
2.4 Earthing rod (item 6)	yes		no	
3.0 TRAINING				
3.1 Training required	yes		no	

Completed by

Capacity

Signature

Date