



A Division of Transnet Limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

PORTABLE EQUIPMENT FOR EARTHING OR EARTHING AND SHORT-CIRCUITING OF AC AND DC TRACTION, HV TRANSMISSION LINES AND 3kV DC TRACTION SUBSTATION AND TIE-STATION BUSBARS

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1.0 SCOPE

This specification covers Transnet's requirements for earthing devices for use on AC and DC traction, HV transmission lines and 3kV DC traction substation and tie-station busbars.

2.0 STANDARDS AND PUBLICATIONS

2.1 Unless otherwise specified all materials and equipment supplied shall comply with the applicable and latest editions of SANS, IEC and Transnet's publications.

2.2 The following publications are referred to in this specification:

2.2.1 SOUTH AFRICAN NATIONAL STANDARDS

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

2.2.2 INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

2.2.3 TRANSNET

CEE.0224 - Drawings, Catalogues, Instruction Manuals and Spares Lists for Electrical Equipment Supplied Under Contract.

TRANSNET DRAWING

CEE-TWH-0002 - Typical Earthing Device. Busbar chambers, 3kV DC traction substations and tie-stations.

3.0 METHOD OF TENDERING

3.1 Tenderers shall indicate clause-by-clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.

3.2 A statement of non-compliance shall be motivated by the tenderer.

3.3 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.

3.4 Failure to comply with clauses 3.1, 3.2 and 3.3 could preclude a tender from consideration.

4.0 APPENDIX

The following appendix forms an integral part of this specification:

Appendix 1: Schedule of requirements.

5.0 SERVICE CONDITIONS

The earthing devices shall be designed to operate under the following environmental conditions:

Ambient temperature : Minus 5°C to plus 50°C.

Air pollution : Heavy saline laden industrial and locomotive fumes.

6.0 DRAWINGS AND INSTRUCTION MANUALS

Drawings and / or instruction manuals shall be supplied in accordance with Transnet's specification No. CEE.0224.

7.0 AC AND DC TRACTION EARTHING AND SHORT-CIRCUITING DEVICES

These devices shall have conductor sizes in accordance to clause 10.1 and shall consist of the following: -

- 7.1 Line to rail jumper shall consist of a 15m long jumper cable to clause 10.1.1.2, a line clamp in accordance to clause 10.2 on one end and a rail clamp to clause 10.3 on the other end.
- 7.2 Line to line jumper shall consist of a jumper cable, 5m or 10m long to clause 10.1.1.1 with a line clamp in accordance to clause 10.2 on each end.
- 7.3 Rail to rail jumpers shall consist of cables 5m or 10m long to clause 10.1.1.2 with a rail clamp in accordance to clause 10.3 on each end.

8.0 HV TRANSMISSION LINE EARTHING AND SHORT-CIRCUITING DEVICES

8.1 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, all being in accordance to clause 10.1.1.1 with three line clamps in accordance to clause 10.2 on the ends of the three tails and a rail clamp in accordance to clause 10.3 on the other end of the single 4m long cable.

8.2 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, all being in accordance to clause 10.1.1.1 with three line clamps in accordance to clause 10.2 on the ends of the three tails and a rail clamp in accordance to clause 10.3 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.

9.0 3kV DC TRACTION SUBSTATION AND TIE-STATION BUSBAR DEVICES.

These devices shall be supplied in accordance with Transnet drawing No CEE-TWH-0002.

10.0 MATERIALS

10.1 CONDUCTORS: - Cables for portable earthing and short-circuiting equipment shall be supplied in accordance to IEC 61138

- 10.1.1 The conductor sizes shall be:
- 10.1.1.1 35 mm² plus 4 mm² / minus 0 mm² (1120 strands minimum).
- 10.1.1.2 70 mm² plus 8 mm² / minus 0 mm² (2250 strands minimum).
- 10.1.2 Conductor material shall be at least 99,95% pure copper.
- 10.1.3 Conductors shall be covered with transparent PVC insulation. The insulation thickness of item 10.1.1.1 shall be 1,2 mm (min) and the insulation thickness of item 10.1.1.2 shall be 1,5 mm (min).
- 10.1.4 Terminations shall be by means of hexagonally crimped lugs and be designed such that there is a positive lock between the lug and the clamp. The terminations shall be covered by a 200mm long, transparent, heavy-duty heat shrink tube.
- 10.1.4.1 Any deviation/improvement to the terminations shall be clearly stated as well as the advantage gained.
- 10.1.5 A pre-production sample of the cable, 500mm in length, fully terminated at one side, shall be submitted to the responsible Transnet representative for approval.

10.2 LINE CLAMPS: -

Line clamps shall:

- 10.2.1 withstand a torque of 20Nm without breaking.
- 10.2.2 offer a serrated connection to the conductor.
- 10.2.3 be fitted with a coupling aid to facilitate application from ground level.

- 10.2.4 be constructed of Cu-Ni-Si or aluminium alloy or similar tough conductive metal.
- 10.2.5 be of the screw-on type.
- 10.2.6 be capable of clamping conductors up to 38mm diameter for use on 3kV DC electrification and 23mm diameter for use on 25/50kV AC electrification and transmission lines.
- 10.2.7 withstand a fault current of 27 kA for a period of 30 milli-seconds without being destroyed.

10.3 RAIL EARTH CLAMPS: -

Rail earth clamps shall:

- 10.3.1 be constructed of Cu-Ni-Si or aluminium alloy or similar tough conductive metal.
- 10.3.2 ensure a positive electrical connection to the flange of heavily corroded rails even during short-circuit conditions.
- 10.3.3 withstand a fault current of 27 kA for a period of 30 milli-seconds without being destroyed.

10.4 OPERATING/EARTHING RODS: -

Operating rods shall:

- 10.4.1 be constructed of fibre glass.
- 10.4.2 be complete with bell-mouthed operating sockets and all the necessary attachments.
- 10.4.3 be 6m long and consisting of 4 sections, each 1 500mm long.
- 10.4.4 have a tough positive locking mechanism to lock the sections together.
- 10.4.5 be designed to withstand a head load of 80N.
- 10.4.6 not deflect more than 1000mm over the total length with a designed head load of 80N.
- 10.4.7 withstand an insulation test of 300kV per meter length for a period of 60 seconds.
- 10.4.8 with regard to any deviation/improvement to the rods shall be clearly stated as well as the advantages gained.

10.5 LINK EXTRACTION FITTINGS: -

Link extraction fittings shall:

- 10.5.1 be constructed of Cu-Ni-Si or aluminium alloy or similar tough metal.
- 10.5.2 lock securely to the socket of the operating rod to allow the opening and closing of links etc. using the rod.
- 10.5.3 with regard to any deviation/improvement to the fittings shall be clearly stated as well as the advantages gained.

11.0 TESTING

- 11.1 All tests referred to in SANS 61230: clause 5.0, are to be done in accordance with the relevant clauses, unless written exemption from these tests is obtained from Transnet.

12.0 MARKING

- 12.1 Each rail clamp, line clamp and operating rod shall be marked with the middle five figures of the contract number. The marking shall not affect the performance of the equipment what so ever.
- 12.2 Marking of devices shall further more fully comply with SANS 61230: clause 4.9, unless written exemption to deviate from the relative clauses is obtained from Transnet.

13.0 PACKING

13.1 Each item called for in the schedule of requirements shall be packed separately in portable packing cases or bags.

13.2 Packing cases or bags shall be marked: "Transnet" in large legible letters at least 30mm high.

APPENDIX 1*SCHEDULE OF REQUIREMENTS*

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
1.0	AC AND DC TRACTION AND HV TRANSMISSION LINE DEVICES:	
	Number of components required:	
1.1	Line to rail jumpers, clause 7.1:	
	(with clamps according to clauses 10.2 and 10.3)	.....
	(with one clamp according to clause 10.2)	.....
	(with one clamp according to clause 10.3)	.....
	(without clamps)	.....
1.2	Line to line jumpers, clause 7.2 (5m length):	
	(with one clamp according to clause 10.2)	.....
	(with two clamps according to clause 10.2)	.....
	(without clamps)	.....
	Line to line jumpers, clause 7.2 (10m length):	
	(with one clamp according to clause 10.2)	.....
	(with two clamps according to clause 10.2)	.....
	(without clamps)	.....
1.3	Rail to rail jumpers, clause 7.3 (5m length)	
	(with one clamp according to clause 10.3)	.....
	(with two clamps according to clause 10.3)	.....
	(without clamps)	.....
	Rail to rail jumpers, clause 7.3 (10m length)	
	(with one clamp according to clause 10.3)	.....
	(with two clamps according to clause 10.3)	.....
	(without clamps)	.....

1.4 HV transmission line devices, clause 8.0 (8.1 and 8.2)

(Locknut bolt and lug)	
(with clamps according to clauses 10.2 and 10.3)	.....
(with three clamps according to clause 10.2)	.....
(with one clamp according to clause 10.3)	.....
(without clamps)	.....

HV transmission line devices, clause 8.0

(Exothermically welded)	
(with clamps according to clauses 10.2 and 10.3)	.....
(with three clamps according to clause 10.2)	.....
(with one clamp to clause 10.3)	.....
(without clamps)	.....

1.5	Operating rods (link sticks), clause 10.4	.....
1.6	Link extraction fittings, clause 10.5	.....
1.7	Line clamp, to clause 10.2	.....
1.8	Rail earth clamp, to clause 10.3	.....

2.0 3kV DC TRACTION SUBSTATION AND TIE-STATION BUSBAR DEVICES:

Number of components required in accordance with drawing No. CEE-TWH-0002 :

2.1	DC earth leakage busbar to main 3kV DC busbar jumpers (item 1)	.....
2.2	DC earth leakage busbar to 3kV DC feeder jumpers (item 2)	.....
2.3	Clamp (item 5)	.....
2.4	Operating rod (item 6)	.....

END