



A division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

SPECIFICATION FOR PORTABLE GLASS REINFORCED POLYESTER (GRP) EXTENTION TRESTLE LADDER FOR Ohte

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Three handwritten signatures are shown, each on a horizontal line. The first signature is for W Schoeman, the second for S Smit, and the third for L Borchard.

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**DOCUMENT HISTORY:****SPECIFICATION FOR PORTABLE GLASS REINFORCED POLYESTER (GRP) EXTENTION TRESTLE LADDER
FOR OHTE**

Dates Amended	Author	Amendments
25/08/2005	WF Mans	Old Spoornet specification.
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1.0 SCOPE

This specification covers Transnet's requirements for portable glass reinforced polyester (GRP) extension ladders for use on high voltage electrical equipment. The ladders are to be used for 3kV DC live working and on earthed OHTE on all other traction electrification types.

2.0 REFERENCES

Unless otherwise specified all materials used and equipment developed and supplied shall comply with the current edition of the relevant ANSI, SANS or Transnet Freight Rail publications where applicable.

The following publications/specifications (latest editions) are referred to herein:

2.1 AMERICAN NATIONAL STANDARD INSTITUTE

ANSI A14.5:2017 Safety requirements for portable reinforced plastic ladders.

2.2 SOUTH AFRICAN NATIONAL STANDARDS (SANS)

SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods.
SANS 943	Man-made fibre ropes.
SANS 1304	Standard Specification for light ladders.
SANS 9001	Quality management systems - Requirements

3.0 TENDERING PROCEDURES

- 3.1.1 Tenderers shall indicate clause by clause compliance document 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. This document can be used by tenderers to elaborate on their response to a clause.
- 3.1.2 A statement of non-compliance shall be motivated by the tenderer.
- 3.1.3 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general manufacturing details and principal dimensions, together with clear illustrations of the equipment offered.
- 3.1.4 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 Transnet Freight Rail-Technology Management's Electrical department in writing.
- 3.1.5 Failure to comply with clauses 3.1.1, 3.1.2, 3.1.3 and 3.1.4 could preclude a tenderer from consideration.

4.0 SERVICE CONDITIONS

4.1 ENVIRONMENTAL CONDITIONS

Altitude:	0 - 1800 m above sea level
Relative humidity:	10% to 90%
Ambient temperature:	-10° C to +50° C
Wind pressure:	750 Pa
Lightning conditions:	20 ground flashes/km ² per annum

Pollution:	Heavily salt laden with industrial pollutants including diesel-electric locomotive emissions.
Ultra violet radiation:	Severe – equipment is intended for outdoor use.

4.2 MECHANICAL SERVICE CONDITIONS

- 4.2.1 Ladder equipment will be transported on gravel service roads and must be designed to withstand the vibrations associated with transportation.

4.3 ELECTRICAL SERVICE CONDITIONS

- 4.3.1 Ladder equipment will be used for OHTE work on “live” 3kV DC lines and on earthed OHTE on all other traction systems.

5.0 QUALITY CONTROL

- 5.1.1 The successful tenderer shall establish a quality control system, the requirements of which shall be in accordance with ISO 9001, to assure conformance to requirements of this specification.
- 5.1.2 The successful tenderer shall demonstrate compliance to Appendix C of ANSI A14.5 with regards to the quality of “GRP” materials.

6.0 GENERAL REQUIREMENTS

The following requirements are for a collapsible extension ladder of “Type I” or “Type 1A” in accordance to ANSI A14.5. This specification is also applicable to ladders fixed to trestle trolleys.

6.1 DESIGN

- 6.1.1 The design shall comply, generally, with the specification ANSI A14.5, heavy duty Type I and extra heavy duty Type 1A. Specific requirements of Transnet are however included in this specification.
- 6.1.2 The working length of a fully extended ladder shall be 9,75 m with at least 1,22 m overlap or 10,97m with at least 1,48 m overlap as required by the purchase order.
- 6.1.3 The collapsed ladder shall have a profile height when viewed from the side of not more than 145mm with an overlap of 1220mm for the "Type I" and 180mm for the "Type 1A" in order that it may take up minimum space during transport.
- 6.1.4 The width between stiles of the fly section shall be 295 ± 5 mm and the width of the base section shall suit that of the fly section.
- 6.1.5 Rung spacing shall be $275\text{mm} \pm 5$ mm centre to centre.
- 6.1.6 A polypropylene rope shall be fitted to the ladder by the manufacturer to be used with a pulley system to extend the ladder. Pulley must be in accordance to ANSI A14.5 clause 6.2.8 and the rope is specified in clause 6.2 of this specification.
- 6.1.7 Locks shall be fitted to the extension ladder to lock the extended section into position.
- 6.1.8 Robustly constructed galvanised steel feet shall be fitted to the bottom section and shall be pointed to ensure proper anchoring in the ground when the ladder is in use. The steel feet will also be fixed with an 8mm tie-rod.
- 6.1.9 All steel parts, including bolts, nuts and rivets shall be hot dip galvanised in accordance with specification SANS 121 or manufactured from a corrosion resistant material such as stainless steel. (Verification tests may be called for).
- 6.1.10 All steel fittings must be at least 5 mm thick, and bolted with 6mm bolts (M6).

6.2 ROPE

- 6.2.1 The polypropylene rope must be to SANS 943, be 12mm in diameter with 3 strands, have a breaking load of minimum 16kN.
- 6.2.2 The rope shall be located out of the way of the user and to the side of the ladder in such a manner that loose rope will not pile up at the base when the ladder is extended.
- 6.2.3 The length of the rope must suite the application and allow for clause 6.2.2.

6.3 LOCKS

- 6.3.1 Locks shall be tested in accordance with ANSI A14.5.
- 6.3.2 The locks shall not damage the stiles with extensive use.
- 6.3.3 Locks shall be reliable, user friendly and extremely robustly constructed. Parts shall not bend easily when the ladder is handled in a rough manner.

6.4 STILES

- 6.4.1 The ladder stiles shall be manufactured from "GRP" material complying in all respects with ANSI A14.5 clause 7.
- 6.4.2 The mechanical properties of the "GRP" shall be in accordance to table 1 below.

Table 1: Mechanical properties of "GRP" material

Material Property	Position of sample	Condition	Orientation *	Units	Required
Flexural Strength	Flange	Dry	LW	Mpa	304
Flexural Modulus	Flange	Dry	LW	Mpa	18 623
Flexural Strength	Web	Dry	LW	Mpa	317
Flexural Modulus	Web	Dry	LW	Mpa	17 244
Flexural Strength	Web	Dry	CW	Mpa	97
Flexural Modulus	Web	Dry	CW	Mpa	6 898
Tensile Strength	Flange	Dry	LW	Mpa	317
Tensile Strength	Web	Dry	LW	Mpa	241

*LW= Lengthwise or CW=Crosswise of pultrusion direction.

- 6.4.3 The stiles shall have additional weather and ultra violet radiation protection in the form of a surface veil of acceptable material and shall be fully described when tendering.
- 6.4.4 The surface of the stiles shall be painted with at least one coat of a special polyurethane paint, for extra ultra violet protection. Currently approved paint Plascon Glatex No 8. Plascodure or an exact equivalent.
- 6.4.5 The stiles of the fly section shall be protected against abrasion damage when sliding over the rungs and through the guides.
- 6.4.6 The flange of the stiles of the fly section which can be slid along the overhead conductor shall be protected by means of sacrificial hard wearing, long lasting material preferably with some adhesion to prevent excessive wear when the ladder is slid along the overhead.
- 6.4.7 This material shall be easy to replace or renew before it is worn away to such an extent that the stiles are damaged.
- 6.4.8 The bottom ends of the stiles of the fly and base sections, both inside and outside shall be strengthened for at least 300 mm with snug fitting galvanised or corrosion resistant flat sheet sections to prevent damage to the glass fibre material.

- 6.4.9 The bottom ends of the fly section shall be supplied with suitable robust impact resisting end fittings, which will be able to protect the ends against damage when the fly section is dropped at speed.
- 6.4.10 All other ends of stiles shall be finished off with suitable durable metal caps of sufficient strength.
- 6.4.11 Prismatic fluorescent yellow green reflective tape with rounded corners shall be applied between stiles, not more than 1m apart, 50 mm wide by 150 mm long and coated with a clear varnish. The warranty of the reflective tape shall be at least 7 years.
- 6.4.12 Electrical properties of material shall be designed to requirements in clause 7.10 of ANSI A14.5.

6.5 RUNGS

- 6.5.1 Rungs may be of the metal type.
- 6.5.2 Rungs shall have a suitable flat top surface for greater comfort and be suitably dimpled or serrated to prevent slipping.
- 6.5.3 The rungs shall be fitted to the stiles so that the top flat surface is horizontal when the ladder is standing at an angle of 75 ± 1 degree to the horizontal.
- 6.5.4 The bottom rung of the fly section shall be arranged in such a manner that it will not injure a person's foot placed against the bottom rung on the base section to stabilise the ladder when the fly section is lowered or dropped.
- 6.5.5 Rungs must comply to the loading requirements of the ladder.

7.0 TESTS AND INSPECTIONS

7.1 GENERAL

- 7.1.1 Transnet Freight Rail reserves the right to be present at all tests and inspections as called for in this clause.
- 7.1.2 The responsibility for arranging the tests called for in this clause rests with the successful tenderer.
- 7.1.3 All tests will be witnessed by Transnet Freight Rail's Technology Management Electrical Quality Assurance Section. Inspections will take place at the manufacturers premises or suitable test facility, and must be organized well in advance (minimum 2 weeks prior).
- 7.1.4 The ladders shall be subjected to type tests as specified under clause 7.2 hereunder and sample tests as per clause 7.3 hereunder.
- 7.1.5 Transnet Freight Rail, Technology Management Electrical representative may request any additional test deemed necessary to ensure the compliance of the component.
- 7.1.6 Tenderers who are not an approved supplier shall submit a pre-production ladder for evaluation purposes. Manufacturing should not commence before written approval has been granted by Transnet Freight Rail's Technology Management Electrical department. The approved sample ladder shall be retained and be available during final inspection of the produced batch.

7.2 TYPE TESTS

- 7.2.1 The complete ladder shall be subjected to the tests applicable as described in section 8 of ANSI A14.5 and shall not fail any of the tests.
- 7.2.2 Rung fixing and strength shall comply with the tests in accordance with specification ANSI A14.5 table 17 clause 8.3.7.2 (rung torque in service test) with a minimum of 1000 inch pounds (113Nm).
- 7.2.3 The complete ladder shall be tested in a horizontal position to determine the maximum permissible deflection and should not exceed the values as laid down in table 2 of SANS 1304.

7.3 ROUTINE TESTS

- 7.3.1 Data will be recorded on each ladder for the horizontal bending test and deflection tests as per ANSI A14.5 clause 8.

7.4 SAMPLE TESTS

- 7.4.1 Sample testing of the "GRP" material shall be done in accordance with specification SANS 1304 clause 6.

8.0 MARKING

- 8.1.1 The ladders shall be permanently marked with the following:
- 8.1.1.1 TRANSNET or the Transnet logo.
 - 8.1.1.2 A dated batch number.
 - 8.1.1.3 Manufacturers name or logo.
 - 8.1.1.4 Manufacturers serial number.
 - 8.1.1.5 A label that should read "APPROVED BY TRANSNET FREIGHT RAIL TECHNOLOGY MANAGEMENT ELECTRICAL"
 - 8.1.1.6 Service load mass. 113 kg on "Type 1" 136 kg on "Type1A" ladders.
- 8.1.2 The lettering shall not be less than 5 mm in height.
- 8.1.3 Safety and instructive labelling is specified in ANSI A14.5, the appropriate "Danger" and "Warning" markings should appear on the ladder.

9.0 TECHNICAL DATA

- 9.1.1 Tenderers who have not previously supplied "GRP" ladders to Transnet shall furnish full details of their previous experience in the manufacture of similar equipment, together with one representative sample ladder, which can be tested to destruction if considered necessary.
- 9.1.2 The technical data requested in the annexure of this specification shall be furnished for each type of ladder offered.
- 9.1.3 The following data shall be submitted to Transnet Freight Rail's Technology Management:
- 9.1.3.1 Properties of the "GRP" used for the stiles tested as per clause 6.4.2 and clause 7 of ANSI A14.5.
 - 9.1.3.2 Results of the type tests as per clause 7.2 and 7.3.
- 9.1.4 All tests shall be done by an accredited test authority such as SABS, a University with the necessary laboratory equipment or other institutions acceptable to Transnet and results shall be presented in the form of an official test certificate.
- 9.1.5 Manuals for Inspection, Proper Set-up and use, Transport and storage should accompany each ladder. An digital copy may be requested per order.

10.0 PACKAGING

- 10.1.1 Ladders shall be packed in suitable way to prevent damages during transport.
- 10.1.2 Each container shall have firmly attached thereto a water resistant label, on which the following shall be designated:
- 12.2.1 Stores item number.
 - 12.2.2 Contract order number.
 - 12.2.4 Such other information as detailed in the Supply Chain Services (SCS) order.

END**Appendix 1- Technical Data Sheet**

(Shall be completed by Tenderer for each type offered)

1. Original Equipment Manufacturer _____
2. Type

Type I	Type IA
--------	---------
3. Mass _____ kg
4. Electrical test results of "GRP" material. _____
5. Water absorption of "GRP" material as per ANSI A14.5 (0.75% maximum). _____
6. Method of manufacture of "GRP" material for stiles. _____
7. Percentage glass in "GRP" material used in stiles, (by mass) _____ % (51% min)
8. Description of method and material for preventing wear of stiles when being slid along the wire. _____
9. Material used for protection against weather and ultra violet radiation.
10. _____
11. Deflection as per SANS 1304 Table 2 _____ mm.