



A Division of Transnet SOC Limited

# TECHNOLOGY MANAGEMENT

## SPECIFICATION

### LIVE LINE TESTER (HIGH VOLTAGE DETECTOR) USED ON 25 KV AC AND 50 KV AC OVERHEAD TRACK EQUIPMENT.

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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 the supply of a portable live line tester (High Voltage Detector) for use on 25 kV AC and 50 kV AC overhead track equipment.
- 1.2 This specification contains a schedule of requirements (Appendix A) which must be completed by the relevant Transnet Representative.
- 1.3 This specification contains a technical datasheet (Appendix B) which must be completed by the tenderer and must be submitted as part of the tender documents.
- 1.4 This specification contains an example figure of a voltage detector in Appendix C.

## **2.0 BACKGROUND**

A live line tester is a device used to provide an indication of the presence or the absence of the high live line voltage. The live line tester utilized by Transnet on the 25 kV AC and 50 kV AC overhead track equipment are used to determine the state ("live" or "dead") of the overhead line before earthing the line for maintenance purposes among others.

## **3.0 NORMATIVE REFERENCES**

Unless otherwise specified all materials used, equipment developed and supplied shall comply with the latest edition of the relevant South African National Standards (SANS).

### **3.1 SANS STANDARD:**

- 3.1.1 SANS 9001 : Quality management systems — Requirements.
- 3.1.2 SANS 60529 : Degrees of protection provided by enclosures (IP Code)
- 3.1.3 SANS 61243-1 : Live working - Voltage detectors Part 1: Capacitive type to be used for voltages exceeding 1 kV AC

## **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 +55° C
Wind pressure:	750 Pa
Lightning conditions:	20 ground flashes/km <sup>2</sup> /annum
Pollution:	Heavily salt laden with industrial pollutants including diesel- electric locomotive emissions.

### **4.2 MECHANICAL SERVICE CONDITIONS**

The design of the live line tester shall be robust enough to withstand rough handling and the shock and vibration which is present when it is being transported within its case over. Transportation will take place on tarred and extremely rough gravel roads.

### 4.3 ELECTRICAL SERVICE CONDITIONS

The design of the live line detector must be able to continuously operate safely under the following electrical conditions.

#### 25 kV Traction systems

4.3.1	Maximum system voltage	43.3 kV
4.3.2	Nominal system voltage	25 kV
4.3.3	Minimum system voltage	1 kV
4.3.4	Frequency	50 Hz $\pm$ 2 Hz

#### 50 kV Traction System

4.3.5	Maximum system voltage	86.6 kV
4.3.6	Nominal system voltage	50 kV
4.3.7	Minimum system voltage	1 kV
4.3.8	Frequency	50 Hz $\pm$ 2 Hz

The Voltage to be detected can also have harmonics superimposed on the 50Hz power frequency component. The Total Harmonic Distortion (THD) on the Voltage can be up to 27% comprised of lower order (below 1 kHz) harmonics.

### 5.0 TECHNICAL REQUIREMENTS

The provision of a complete live line tester with storage bag/container that shall;

- 5.1 comply with SANS 61243-1, unless stated otherwise in this specification.
- 5.2 operate safely when in direct contact with the equipment under investigation. Including arc protection when live line tester makes contact with equipment to be investigated.
- 5.3 make contact with the equipment under investigation via the contact electrode. The user shall be fully isolated from any live equipment which makes contact with the contact electrode.
- 5.4 be an outdoor type with an IP65 or higher rating, in accordance of SANS 60529.
- 5.5 be a capacitive type with an internal power supply for self-test purposes.
- 5.6 have visual indication. A green light which indicates absence of operating voltage and a flashing red light which indicates the presence of any potential unsafe voltage. An additional audible signal shall be used.
- 5.7 the indicators shall be clearly visible when viewed from ground level in bright daylight conditions or be able to store the reading until the equipment is returned to ground.
- 5.8 have an on/off switch and auto on/off feature. It shall automatically turn off after two (2) minutes of not detecting high live line voltage (1 kV – 86.6 kV). It shall automatically turn on when it detects high live line voltage (1 kV – 86.6 kV).
- 5.9 have a self-testing element to test the functionality of the live line tester. An alert light shall light up to indicate a fail of the self-test.
- 5.10 have a fail-safe feature which keeps measuring equipment on the safe side if a malfunction or problem occurs
- 5.11 indicate its battery conditions or status.

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- 5.12 be able to operate for a minimum of eight (8) hours with continuous use. (Should be usable for roughly one day's worth of work).
  - 5.13 have batteries which are easily replaceable and shall be rechargeable.
  - 5.14 have a battery housing which prevents battery leakage from damaging electronic parts or switching components.
  - 5.15 not experience interference due to adjacent electrified infrastructure (rail or other).
  - 5.16 be reliable and have a minimum life expectancy of 5 (five) years, with minimum maintenance required.
  - 5.17 be safe for use under all harmonic conditions of the voltage to be detected.

## **6.0 MECHANICAL CONSTRUCTION AND CHARACTERISTIC REQUIREMENTS OF THE EQUIPMENT**

- 6.1 The basic mechanical assembly of the live line tester shall include a contact electrode, indicator and adaptor as illustrated in Fig 1b of SANS 61243-1.
- 6.2 The supply of an insulating pole, handle, hand guard and limit mark that conforms to SANS 61243-1 is optional. A figure of the assembled voltage detector is found in Appendix C, the figure is taken from SANS 61243-1.
- 6.3 When a complete set is provided a carry and storage case must be provided.
- 6.4 If an insulating pole/rod material is supplied it shall be constructed from reinforced fibre glass.
- 6.5 For the case that the insulating pole, handle, hand guard and limit mark is not supplied the adaptor shall be of such nature that it can fit into a 'Rose' type end fitting.
- 6.6 The insulating pole shall be of such a length that the test electrode can make physical contact with a conductor 7m above the rail level. A locking mechanism shall be present to ensure when a length is selected it cannot be adjusted without unlocking the mechanism.
- 6.7 The minimum adjustable operation length shall be at least 3m.
- 6.8 The length of the handle shall be such that it can safely be operated by two hands.
- 6.9 The contact electrode shall be of suspension hook type to allow for easy contact with overhead track equipment.
- 6.10 The size of the suspension hook shall be such that a conductor of maximum diameter of 50 mm can be tested.
- 6.11 The fully assembled live line tester shall have a maximum weight of 5 kg.
- 6.12 The equipment shall be of robust design to withstand rough handling.
- 6.13 The equipment shall withstand shock and vibration.
- 6.14 The tester construction shall be such that overhaul and maintenance can be easily undertaken.

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**7.0 TESTING AND INSPECTIONS**

- 7.1 Transnet reserves the right to be present at all tests and inspections as called for in this clause. A sample should be submitted to Technology Management for approval prior to the initial order of live line testers being made.
- 7.2 The responsibility of arranging the tests called for in this clause rests with the successful tenderer.
- 7.3 A Transnet Freight Rail, Technology Management (Electrical Technology) department representative may request any additional test deemed necessary to ensure compliance.
- 7.4 Live line tester detector to be designed, manufactured and tested to SANS 61243-1 for capacitive type contact voltage detector. All test certificates and test results to be supplied prior to the evaluation of the device.
- 7.5 The live line tester shall comply with all tests stated in SANS 61243-1. Test values/parameters shall be according to SANS 61243-1 unless the values differ from the ones stated in this specification. The live line tester shall be evaluated and approved in accordance to SANS 61243-1 by Technology Management quality assurance representative.

**8.0 MARKING AND INSTRUCTION LABELS**

- 8.1 Ratings, instructions and markings shall be in English.
- 8.2 Marking of the equipment shall be in accordance to SANS 61243-1.
- 8.3 Labels of switches and indicators shall be clearly and permanently marked.
- 8.4 Voltage range e.g. "25 kV AC – 50 kV AC".
- 8.5 State that the live line tester is "Transnet BBB3007 Approved"
- 8.6 Have the manufacture's name, symbol and serial number of the live line tester permanently marked on the live line tester.
- 8.7 Include date of manufacture on live line tester.

**9.0 SPECIAL TOOLS, SERVICING AIDS AND SPARE PARTS LIST**

- 9.1 Accessories and auxiliary equipment required for operation in accordance with this specification, shall be accounted for in the tendered price.
- 9.2 Special tools or servicing aids required for maintenance/repair shall be quoted for separately.
- 9.3 Maintenance and calibration intervals shall be prescribed by the tenderer. Each new live line tester shall be supplied with a calibration certificate.

**10.0 DOCUMENTATION REQUIREMENTS**

- 10.1 Drawings and technical documentation shall be submitted with tender.
- 10.2 The manufacturer must provide one soft copy and two hard copies of the technical specification.
- 10.3 The manufacturer must provide one soft and two hard copy of the instruction manual.
- 10.4 The manufacturer must provide one soft copy and two hard copies of maintenance manual.

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- 10.5 The manufacturer must provide design and type test certificates to verify conformance to the requirements and these must be submitted with tender documents.
- 10.6 Supplier shall advise how to proceed with the equipment at the end of its operating life, taking into consideration environmental requirements and regulations.

## **11.0 QUALITY ASSURANCE**

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

## **12.0 PACKAGING, STORAGE AND HANDLING**

- 12.1 An appropriate carry case, capable of sufficiently protecting the live line tester from damage due to vibrations during transport under severe service road conditions, shall be provided.
- 12.2 In the case where multiple units are ordered, they should be packaged together. Ensuring that they can be transported in a manner which prevents damage.

## **13.0 GUARANTEE AND DEFECTS**

- 13.1 The appointed tenderer shall guarantee that the supplied live line tester conforms to Transnet's requirements.
- 13.2 The appointed tenderer shall accept liability for makers' defects, which may appear in design, material and workmanship.
- 13.3 The appointed tenderer shall provide all information regarding guarantees and warranties in writing.

## **14.0 TRAINING**

- 14.1 Training in the use of the live line tester shall be quoted for separately. The number of people who require training needs to be indicated in the schedule of requirements.

## **15.0 METHOD OF TENDERING**

- 15.1 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.
- 15.2 Statement of non-compliance shall be motivated by the tenderer, as per 15.1.
- 15.3 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.
- 15.4 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 (Electrical Technology) department in writing.
- 15.5 Failure to comply with clauses 15.1, 15.2, 15.3 and 15.4 could preclude a tenderer from consideration.



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- 15.6 In the event of any conflict between the various submitted relevant documents, the order of precedence shall be, and in consultation with Transnet Freight Rail, Technology Management (Electrical Technology) department:
- a) Legal and safety requirements.
  - b) This Specification.

**END**

## 16.0 APPENDIX A: SCHEDULE OF REQUIREMENTS

(To be completed by Transnet Representative)

16.1	Quantity Required	
16.2	Depot and Address Required for	
16.3	System Voltage (25 kV AC or 50 kV AC)	
16.4	Insulation pole/rod required (Yes/No)	
16.5	Training in the use of the live line tester required (Yes/No) If yes, for how many people?	

Completed by:

.....

Capacity

.....

Signature

.....

Date

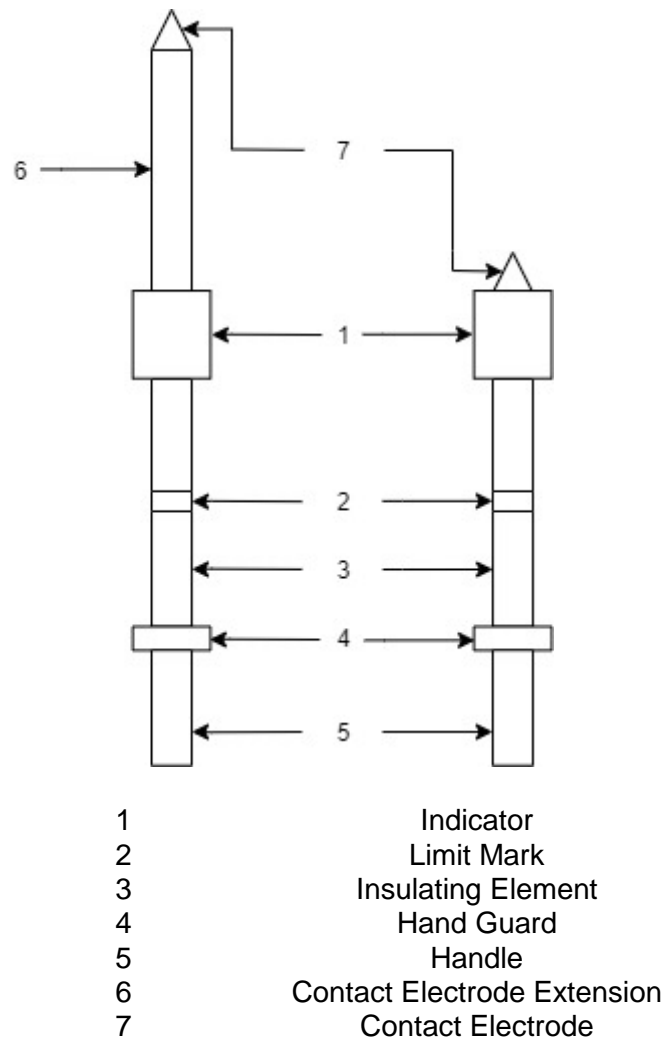
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## 17.0 APPENDIX B: TECHNICAL DATA SHEET

(To be completed by the tenderers and submitted as part of their tender)

<b>17.1</b>	<b>TENDER INFORMATION</b>	
17.1.1	Tenderer	
17.1.2	Tender No.	
17.1.3	Date	
<b>17.2</b>	<b>GENERAL</b>	
17.2.1	Type (Indoor/ Outdoor)	
17.2.2	Conductor Material	
17.2.3	Insulating Material	
17.2.4	Wet and dry voltage insulation rating	
<b>17.3</b>	<b>BATTERY</b>	
17.3.1	Internal/External battery	
17.3.2	Operating battery voltage (Volt)	
17.3.3	Battery Type	
17.3.4	Expected service life of battery (hours continuous)	
<b>17.4</b>	<b>PHYSICAL APPEARANCE</b>	
17.4.1	Is the insulating pole of such a length that the test electrode can make physical contact with a conductor 7m above the rail level?	
17.4.2	Is a locking mechanism to ensure when a length is selected it cannot be adjusted without unlocking the mechanism present?	
17.4.3	Is the contact electrode a hook type? If yes, what is the maximum diameter cable that it can test?	
17.4.4	Physical dimensions of carrying case (mm)	
17.4.5	Does all accessories fit into carrying case?	
17.4.6	Maximum height live line tester can reach with extension (m)	
17.4.7	Mass of live line tester (kg)	
17.4.8	Mechanical lifetime	
<b>17.5</b>	<b>ELECTRICAL</b>	
17.5.1	Maximum detection voltage (kilovolt)	
17.5.2	Minimum detection voltage (kilovolt)	
17.5.3	Leakage current under dry conditions (Ampere)	
17.5.4	Leakage current under wet conditions (Ampere)	

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**18.0 APPENDIX C: VOLTAGE DETECTOR FIGURE****Figure 1: Voltage detector**