



A Division of Transnet SOC Limited

# TECHNOLOGY MANAGEMENT

## SPECIFICATION

### LIVE LINE TESTER (HV VOLTAGE DETECTOR) TO BE USED ON 3 KV DC OVERHEAD TRACK EQUIPMENT ONLY

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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 3 kV DC overhead track equipment.
- 1.2 This specification contains schedule of requirements (Appendix A) which must be completed by the relevant Transnet Representative.
- 1.3 This specification contains 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

- 2.1 A live line tester is a device used to provide a clear indication of the presence or the absence of high live line voltage. The live line tester utilized by Transnet on the 3 kV DC 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 61243-2 : Live working - Voltage detectors Part 2: Resistive type to be used for voltages of 1 kV to 36 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> per 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.

- 4.3.1 Maximum system voltage 10.5 kV
- 4.3.2 Normal system voltage 3 kV
- 4.3.3 Minimum system voltage 1 kV

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## 5.0 TECHNICAL REQUIREMENTS

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

- 5.1 comply with SANS 61243-2, 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 have an insulation level for all live parts with a safety factor rating of 2.5 or higher, with live parts being marked with a warning sign.
- 5.4 not cause a flash over or breakdown between live parts of an installation or between a live part of an installation and earth.
- 5.5 have a pick-up voltage of 1 kV DC.
- 5.6 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 – 10.5 kV). It shall automatically turn on when it detects high live line voltage (1 kV – 10.5 kV).
- 5.7 have a maximum circuit current of 3 mA through the tester when the rated voltage is applied to the contact electrode.
- 5.8 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.
- 5.9 have a maximum length of 25 mm for the bare portion of contact electrode.
- 5.10 be designed in such a way that the indicator cannot be damaged or shut off due to spark discharge.
- 5.11 not experience interference due to adjacent electrified or earthed infrastructure (rail or other).
- 5.12 have visual indication. A green light which indicates absence of operating voltage and a red light which indicates the presence of any potential unsafe voltage. An additional audible signal shall be used.
- 5.13 give a continuous indication when in direct contact with a live part. The indications shall be of group I type, from IEC 61243-2 clauses 4.2.2.
- 5.14 have indicators which are 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.
- 5.15 be an outdoor type with an IP65 or higher rating, in accordance of SANS 60529.
- 5.16 be a climatic category normal (N), -25 to +55 degrees Celsius and 20 to 96 percent humidity.
- 5.17 have an internal power supply for self-test purposes. The self-testing element will test the functionality of the live line tester. An alert light shall light up to indicate a fail of the self-test.
- 5.18 have a fail-safe feature which keeps measuring equipment on the safe side if a malfunction or problem occurs.
- 5.19 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).
- 5.20 indicate its battery conditions or status.
- 5.21 have batteries which are easily replaceable and shall be rechargeable, with a minimum life expectancy of five years.
- 5.22 have a battery housing which prevents battery leakage from damaging electronic parts or switching components.

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- 5.23 be reliable and have a minimum life expectancy of 5 (five) years, with minimum maintenance required.

## **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 (line and rail), indicator and adaptor.
- 6.2 The supply of an insulating pole, handle, hand guard and limit mark that conforms to SANS 61243-2 is required. A figure of the assembled voltage detector is found in Appendix C, the figure is taken from SANS 61243-2.
- 6.3 In all instances the live line tested is to be provided with a carry and storage case.
- 6.4 The insulating pole shall be of such a length that the test electrode can make physical contact with a conductor 6 m 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.
- 6.5 The length of the handle shall be such that it can safely be operated by two hands.
- 6.6 The contact electrode shall be of suspension hook type to allow for easy contact with overhead track equipment.
- 6.7 The size of the suspension hook shall be such that it can be used on a 170 mm<sup>2</sup> thick conductor.
- 6.8 The fully assembled live line tester shall have a maximum weight of 5 kg.
- 6.9 It shall be ensured that the rail connection can be safely made when the tester is in contact with a live conductor.

## **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 61243-2. 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 61243-2. Test values/parameters shall be according to SANS 61243-2 unless the values differ from the ones stated in this specification. The live line tester shall be evaluated and approved in accordance to SANS 61243-2 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 61243-2.
- 8.3 Labels of switches and indicators shall be clearly and permanently marked.
- 8.4 Voltage range e.g. "1 kV DC – 10.5 kV DC only".
- 8.5 State that the live line tester is "Transnet BBC 2076 Approved"
- 8.6 Have the manufacture's name, symbol and serial number of the live line tester permanently marked on the live line tester.
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- 8.7 Include date of manufacture on live line tester.
- 8.8 State that the live line tester is "Climatic category normal (N)".
- 8.9 Have a warning notice "Earth lead must be connected to earth before use".
- 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 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 copies of the instruction manual.
- 10.4 The manufacturer must provide one soft copy and two hard copies of maintenance manual.
- 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.
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**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.
- 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	Is training in the use of the live line tester required? If yes, for how many?	

Completed by:

.....

Capacity

.....

Signature

.....

Date

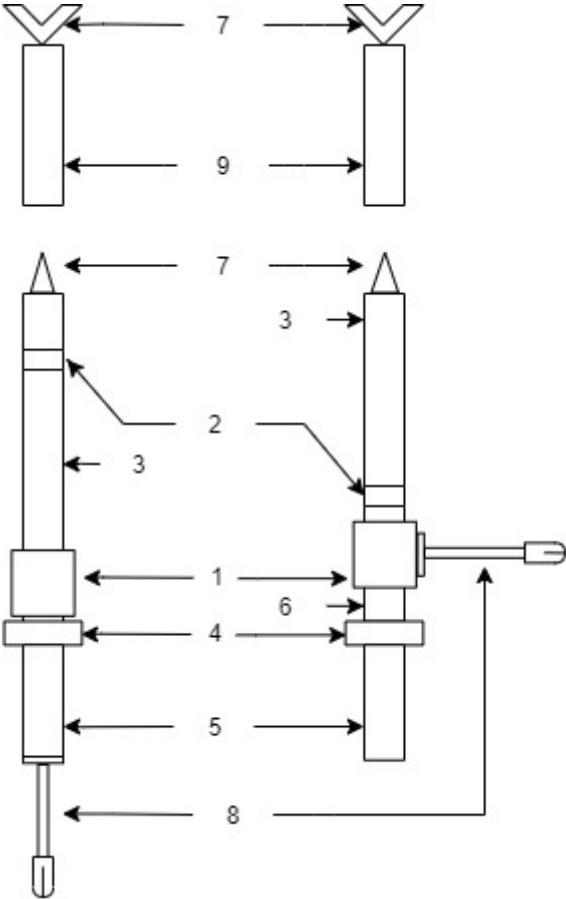
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## 17.0 APPENDIX B: TECHNICAL DATA SHEET

(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	Life expectancy of device	
17.2.3	IP Rating	
17.2.4	Climatic category	
17.2.5	Indication Group	
<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 5.5 m 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	Mass of live line tester (kg)	
17.4.7	Mechanical lifetime	
<b>17.5</b>	<b>ELECTRICAL</b>	
17.5.1	Maximum detection voltage [kilovolt (DC)]	
17.5.2	Minimum detection voltage [kilovolt (DC)]	
17.5.3	Leakage current under dry conditions (Ampere)	
17.5.4	Leakage current under wet conditions (Ampere)	
17.5.5	Insulation level	

18.0 APPENDIX C: VOLTAGE DETECTOR FIGURE



- 1 Indicator
- 2 Limit Mark
- 3 Resistive Element
- 4 Hand Guard
- 5 Handle of Insulating Pole
- 6 Insulating Element
- 7 Contact Electrode
- 8 Earth Lead
- 9 Contact Electrode Adaptor

Figure 1: Voltage detector