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TITLE	<b>SPECIFICATION FOR PORTABLE CABLE FAULT LOCATION MACHINE</b>	REFERENCE <b>CP_TSSPEC_385</b>	REV <b>0</b>
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		PAGE:	<b>1 OF 14</b>

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## TABLE OF CONTENTS

	Page
INTRODUCTION.....	3
1. SCOPE.....	3
2. NORMATIVE REFERENCES.....	3
3. DESIGN.....	3
4. REQUIREMENTS.....	3
5. (0 – 16kv) Portable Surge Generator.....	3
6. Cable fault pin pointer.....	4
7. TRAINING.....	5
8. DOCUMENTATION.....	5
9. QUALITY MANAGEMENT.....	5
10. HEALTH AND SAFETY.....	5
11. ENVIRONMENTAL MANAGEMENT.....	6
<b>ANNEXURE A - BIBLIOGRAPHY.....</b>	<b>7</b>
<b>ANNEXURE B - REVISION INFORMATION.....</b>	<b>8</b>
<b>ANNEXURE D – Stock Items.....</b>	<b>14</b>

## FOREWORD

Recommendations for corrections, additions or deletions should be addressed to the:

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2016

## INTRODUCTION

City Power requires a compact cable fault locating portable machine that is rugged and portable to be used for testing, pre-locating, and pin-pointing conductor and insulation faults of low and high resistance, intermittent or flashing nature in PVC, PILC and XLPE medium voltage underground power cables.

### 1. SCOPE

The scope of this specification covers supply, delivery with training for a compact and portable cable fault locating portable machine, which includes all accessories that are detailed but not limited to this document. Nothing in this specification shall lessen the obligation of the supplier. The supplier shall be fully responsible for the cable fault location machine, installations and satisfactory performance in service.

### 2. NORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

DIN VDE 0104 (EN50191): *Erection and operation of electrical test equipment*

DIN VDE 0105 (EN 50110): *Operational of electrical installations-Part 100: General requirements*

SANS 20055: *Uniform provisions concerning the approval of mechanical coupling components of combinations of vehicles*

VC 8026: *Category o1 and o2 vehicles (caravans and light trailers)*

### 3. DESIGN

The portable machine shall operate on 110 to 230 V, 50Hz  $\pm$  5%, and single-phase supply with standalone operation. All portable machine components shall be integrated together and there shall be only one control panel with LCD/VGA display for controlling the portable machine above with single button operation. The control of the portable machine shall be easy to operate and should be able to guide the operator in all aspects of cable fault location including Testing, Pre location, Sheath fault location and Pinpointing. The portable machine shall be suitable for testing (including insulation test), burning and surging for fault conditioning and pinpointing of faults. The portable machine shall be menu driven with single control display with choice of various modes for ease of operation.

### 4. REQUIREMENTS

#### 4.1 General requirements

- Working temperature:-10 to 50oC
- Working humidity:40oC (20-90) % RH
- Storage temperature:-20 to 50oC
- Protection class:IP65

### 5. (0 – 16kv) Portable Surge Generator

#### 5.1 Functional requirements

5.1.1 The portable surge generator shall locate faults in power cables in conjunction with the listening set.

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- 5.1.2 All modes including insulation testing, DC testing, breakdown recognition, fault conditioning/burning, surge generator, insulation testing etc. with their individual set-ups shall be selectable and operable from this unit.
  - 5.1.3 It shall include checking ground loop resistance, step potential, internal emergency-OFF button, over temperature, over current/voltage shut-off features.
  - 5.1.4 It shall have LCD display of sufficient size with one rotary control button and emergency switch. Display shall guide user through the complete testing and cable fault locating modes and shall also give status information, inputs (to surge generator, DC tester, insulation tester etc. with regard to their individual set-up) and results.
  - 5.1.5 All necessary safety interlocks / safety loops with warning / error message shall be incorporated.
  - 5.1.6 Portable machine shall not raise any voltage in case it found wrong with the safety loops / interlocks.
  - 5.1.7 Storage of the recorded data shall happen automatically to a suitable medium (e.g. USB stick).
  - 5.1.8 It shall incorporate Earthing for automatic discharged.
  - 5.1.9 It shall be compact and portable
  - 5.1.10 The output voltage shall be adjustable in the ranges of 0-4kV, 0-8kV and 0-16kV, with an energy peak of 1000J.
  - 5.1.11 Automatically determining breakdown voltage,
  - 5.1.12 Power supply 220 VAC/50Hz

## **5.2 Accessories**

- 5.2.1 220 VAC power cable.
- 5.2.2 ≥20m HV shielded cable.
- 5.2.3 ≥20m protective ground cable.

**NOTE:** During HV Testing leakage current shall be auto ranging and the portable machine should be capable of auto shutdown and display of breakdown voltage during testing on control panel.

## **6. Cable fault pin pointer**

### **6.1 Functional requirements**

- 6.1.1 The pin pointer shall be used, in conjunction with a surge generator, to pinpoint the location of an underground power cable fault.
- 6.1.2 The pin pointer shall use an electromagnetic field and acoustic sound coincidence technique, together with an intuitive user interface, to enable quick and accurate fault location.
- 6.1.3 The display shall have two modes;
  - a) The Operator mode provides an intuitive indication of the position of the cable, with an arrow showing the position of the fault relative to the user's position.
  - b) The Waveform Analysis mode allows the user to diagnose the fault position from the magnetic field and audio waveforms.
- 6.1.4 The portable pin pointing instrument shall consist of a receiver and combined sensor that shall measure electromagnetic and acoustic signals associated with flashovers in cables.
- 6.1.5 It shall be equipped with noise cancelling earphones to enable operation in a noisy environment
- 6.1.6 The instrument shall pinpoint the fault with direction when used in conjunction with surge generator by combination of acoustic and magnetic signal.
- 6.1.7 It shall be portable and battery operated with colour LCD display facility to indicate various parameters.

### **6.2 Features**

Fault location by the magnetic field and sound signal fluke method with the following capabilities:

- 6.2.1 The electromagnetic field and acoustic sound coincidence technique locates the fault with an accuracy of 0.2m.
- 6.2.2 Position indicator, showing cable location
- 6.2.3 Ergonomic, lightweight pin pointer, designed to reduce environmental noise and improve sound capturing capability
- 6.2.4 Integral sound filters cater for different ground and soil conditions.
- 6.2.5 Waveform recognition, using machine learning technology, distinguishes the fault discharge sound signal from background noise.

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- 6.2.6 Automatic earphone sound muting, to protect the operator
  - 6.2.7 Consisting of a receiver and ground sensor with accessories, headphones, connection cables and transport box or mountings,
  - 6.2.8 High acoustic and magnetic field sensitivity,
  - 6.2.9 High performance electronic suppression of external noise and interference,
  - 6.2.10 Operating frequency range;
    - a) Sound channel 100Hz—1500Hz
    - b) Magnetic field channel 160Hz—50000Hz
  - 6.2.11 Measurement of magnetic field and sound coincidence with automatic selection and calibration of the measuring range,
  - 6.2.12 Indication of cable position in respect to the sensor,
  - 6.2.13 Indication of the direction to the fault,
  - 6.2.14 Built in adjustable filters for the suppression of interference range 100Hz - 1500Hz,
  - 6.2.15 Comparison of last and the new measurement on screen,
  - 6.2.16 Graphical indication of the magnetic field on colourful display,
  - 6.2.17 Peak hold of the magnetic field value,
  - 6.2.18 Indication of the acoustic signal detection,
  - 6.2.19 Indication of all adjustments and settings,
  - 6.2.20 Distance Measurement,
  - 6.2.21 The unit shall have a floating microphone suspension to reduce body sounds of the sensors and provide a solid standing even on sloped surfaces and
  - 6.2.22 The unit shall have a filter setting as follows; no pass (0 to 100Hz), for Low Pass (100 to 400Hz), Band Pass (150 to 600Hz) and high pass (200 to 1500Hz)

## **7. TRAINING**

- 7.1 The following approved training courses, for City Power's staff, shall be provided:
  - a) Operating, and
  - b) Maintenance.
- 7.2 The associated costs for an approved training course in 7.1 shall be given per person.
- 7.3 The suppliers shall provide technical support on portable machine and equipment queries for the duration of the contract.

## **8. DOCUMENTATION**

The following documents shall be provided:

- 8.1 Technical product catalogue
- 8.2 operating manual and
- 8.3 maintenance manuals
- 8.4 The service provider shall make available documentation in both hard and soft copy

## **9. QUALITY MANAGEMENT**

A quality management portable machine shall be set up in order to assure the quality during manufacture, installation, removal, transportation and disposal. Guidance on the requirements for a quality management portable machine may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

## **10. HEALTH AND SAFETY**

A health and safety plan shall be set up in order to ensure proper management and compliance during removal, transportation and disposal of scrap. Guidance on the requirements of a health and safety plan shall be found in ISO 45001:2018 standards. The details shall be subject to agreement between City Power and the Supplier.

## **11. ENVIRONMENTAL MANAGEMENT**

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance is adhered to during, removal, transportation and disposal of scrap. Guidance on the requirements for an environmental management portable machine shall be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ Policy.

**ANNEXURE A - BIBLIOGRAPHY**

None

**ANNEXURE B - REVISION INFORMATION**

<b>DATE</b>	<b>REV. NO.</b>	<b>NOTES</b>
March 2023	0	First issue

**Annex C - Technical Schedules A and B**

**ITEM No. 1:(0 – 16kv) Portable Surge Generator**

**Schedule A: Purchaser's specific requirements**

**Schedule B: Guarantees and technical particulars of equipment, material or material offered**

Item	Sub-clause of CP_TSSPEC_385	Description	Schedule A	Schedule B
	5.1	Functional requirements	Required	
	5.1.1	The portable surge generator shall locate faults in power cables in conjunction with the listening set.	Required	
	5.1.2	All modes shall be selectable and operable from this unit as to 5.1.2.	Required	
	5.1.3	It shall include features as to 5.1.3	Required	
	5.1.4	It shall have LCD display of sufficient size with one rotary control button and emergency switch as to 5.1.4	Required	
	5.1.5	All necessary safety interlocks / safety loops with warning / error message.	Required	
	5.1.6	Portable machine shall not raise any voltage should any wrong be found as to 5.1.6	Required	
	5.1.7	Automatic storage of the recorded data on suitable medium (e.g. USB stick).	State	
	5.1.8	Earthing for automatic discharged.	Required	
	5.1.9	It shall be compact and portable	Required	
	5.1.10	The output voltage shall be adjustable in the ranges of 0-16kv as to clause 5.1.10	Required	
	5.1.11	Automatically determining breakdown voltage,	Required	
	5.1.12	Power supply	220 VAC/50Hz	
	5.2.1	Power cable.	220 VAC	
	5.2.2	Shielded cable.	≥20m HV	
	5.2.3	Protective ground cable.	≥20m	

NOTE: TICKS [✓✗], ASTERISK [\*], WORD [NOTED], OR TBA [TO BE ADVISED] SHALL NOT BE ACCEPTED.

Tender Number: \_\_\_\_\_

Service Provider's Authorised Signatory: \_\_\_\_\_

Name in block letter \_\_\_\_\_ Signature \_\_\_\_\_

Full name of company: \_\_\_\_\_

**Deviation schedule  
ITEM No. 1:(0 – 16kv) Portable Surge Generator**

**Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.**

Item	Sub clause of CP_TSSPEC_385	Proposed deviation

Tender Number: \_\_\_\_\_

Tenderer's Authorised Signatory: \_\_\_\_\_  
Name in block letters                      Signature

Full name of company: \_\_\_\_\_

**Annex C - Technical Schedules A and B**

**ITEM No. 2: Cable fault pin pointer**

**Schedule A: Purchaser's specific requirements**

**Schedule B: Guarantees and technical particulars of equipment, material or material offered**

Item	Sub-clause of CP_TSSPEC_385	Description	Schedule A	Schedule B
	6.1.1	The pin pointer shall be used, in conjunction with a surge generator as to 6.1.1	Required	
	6.1.2	The pin pointer shall use an electromagnetic field and acoustic sound coincidence technique as to 6.1.2	Required	
	6.1.3	The display shall have two modes;	Required	
	a)	The operator mode provides an intuitive indication of the position of the cable, with an arrow as to 6.1.3 a)	Required	
	b)	The Waveform Analysis mode allows the user to diagnose the fault position as to 6.1.3 b)	Required	
	6.1.4	The portable pin-pointing instrument shall consist of a receiver and combined sensor as to 6.1.4	Required	
	6.1.5	It shall be equipped with noise cancelling earphones as to 6.1.5	Required	
	6.1.6	The instrument shall pinpoint the fault by combination of acoustic and magnetic signal as to 6.1.6	Required	
	6.1.7	It shall be portable and battery operated with colour LCD display facility to indicate various parameters as to 6.1.7	Required	
	6.2.1	The electromagnetic field and acoustic sound coincidence technique shall have accuracy of	0.2m.	
	6.2.2	Position indicator, showing cable location	Required	
	6.2.3	Ergonomic, lightweight pin pointer, designed to reduce environmental noise and improve sound capturing capability	Required	
	6.2.4	Integral sound filters to cater for different ground and soil conditions.	Required	
	6.2.5	Waveform recognition, using machine learning technology, as to 6.2.5	Required	
	6.2.6	Automatic earphone sound muting, to protect the operator as to 6.2.6	Required	

**NOTE: TICKS [✓✗], ASTERISK [\*], WORD [NOTED], OR TBA [TO BE ADVISED] SHALL NOT BE ACCEPTED.**

Tender Number: \_\_\_\_\_

Service Provider's Authorised Signatory: \_\_\_\_\_

Name in block letter \_\_\_\_\_ Signature \_\_\_\_\_

Full name of company: \_\_\_\_\_

**Annex C - Technical Schedules A and B Loop Isolators**

**ITEM No. 2: Cable fault pin pointer set (continued)**

**Schedule A: Purchaser's specific requirements**

**Schedule B: Guarantees and technical particulars of equipment, material or material offered**

Item	Sub-clause of CP_TSSPEC_385	Description	Schedule A	Schedule B
	6.2.7	Consisting of a receiver and ground sensor with accessories, as to 6.2.7	Required	
	6.2.8	High acoustic and magnetic field sensitivity,	Required	
	6.2.9	High performance electronic suppression of external noise and interference,	Required	
	6.2.10	Operating frequency range	Required	
	a)	Sound channel	100Hz—1500Hz	
	b)	Magnetic field channel	160Hz—50000Hz	
	6.2.11	Measurement of magnetic field and sound coincidence with automatic selection and calibration of the measuring range,	Required	
	6.2.12	Indication of cable position in respect to the sensor,	Required	
	6.2.13	Indication of the direction to the fault,	Required	
	6.2.14	Built in adjustable filters for the suppression of interference range	100Hz - 1500Hz,	
	6.2.15	Comparison of last and the new measurement on screen,	Required	
	6.2.16	Graphical indication of the magnetic field on colourful display,	Required	
	6.2.17	Peak hold of the magnetic field value,	Required	
	6.2.18	Indication of the acoustic signal detection,	Required	
	6.2.19	Indication of all adjustments and settings,	Required	
	6.2.20	Distance Measurement,	Required	
	6.2.21	The unit shall have a floating microphone suspension as to 6.2.21	Required	
	6.2.22	The unit shall have all filter setting as to 6.2.22	Required	

**NOTE: TICKS [✓✗], ASTERISK [\*], WORD [NOTED], OR TBA [TO BE ADVISED] SHALL NOT BE ACCEPTED.**

Tender Number: \_\_\_\_\_

Service Provider's Authorised Signatory: \_\_\_\_\_

Name in block letter \_\_\_\_\_ Signature \_\_\_\_\_

Full name of company: \_\_\_\_\_

**Deviation schedule**  
**ITEM No. 2:(0 – 16kv) Cable fault pin pointer set**

**Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.**

Item	Sub clause of CP_TSSPEC_385	Proposed deviation

Tender Number: \_\_\_\_\_

Tenderer's Authorised Signatory: \_\_\_\_\_  
Name in block letters                      Signature

Full name of company: \_\_\_\_\_

### **ANNEXURE D – Stock Items**

It is not intended that City Power should keep stock of these items.