

	Specification	NTCSA
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Title: User Requirement Specification for DC Production Equipment

Document Identifier: Specification

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Area of Applicability: **National Transmission Company South Africa SOC Ltd**

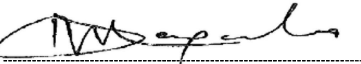
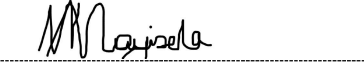
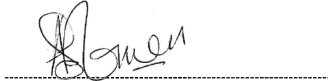
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1 Introduction

This user requirement technical specification forms part of NTCSA enquiry process for DC production equipment required for Secondary plant DC personnel to carry out maintenance, installation, and commissioning activities on DC systems plant i.e., lead acid batteries and battery chargers.

2 Supporting Clauses

2.1 Scope

This specification defines the technical requirements for the supply and support of DC production equipment as outlined in this document.

2.2 Purpose

The purpose of this document is to specify the minimum requirements for DC production equipment. This is to ensure that the purchased equipment is according to NTCSA requirements and conforms to the desired standards. The objective is to acquire latest and modern DC production equipment that will enhance the performance of maintenance, installation and commissioning activities with best accuracy and functionality.

2.3 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions/ National Transmission Company South Africa SOC Ltd Reg No 2021/539129/30, particularly Secondary Plant and Telecommunications departments DC Sections.

2.4 Effective date

This document shall be effective from the authorisation date.

2.5 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.5.1 Normative

ISO 9001 Quality Management Systems

240-91177160: DC Technician Tools, Test Equipment and Accessories.

ISO 15212-1: Oscillation-type density meters – Laboratory instruments

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2.5.2 Informative

1. 240-61182045: Maintenance Engineering Standard for Batteries and Chargers
2. 240-118705836: Maintenance of Batteries
3. 240-51999453: Standard Specification for Valve Regulated-Regulated Lead Acid Cells.
4. IEC 61326-1:2005, Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 1: General requirements
5. IEC 61010-1:2001, Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements

2.6 Definitions

2.6.1 General

Definition	Explanation
Specific gravity	Measure of the density of an object in comparison to the density of water at an exact.
IrDA	Infrared Data Association – Wireless Communication Protocol for data transfer.
Hydrometer	An instrument used for measuring the relative density of a liquid.
Impedance	It is a combination of internal resistance and reactance where internal resistance + reactance, or (L+C), equals impedance when using an AC stimulus. The internal resistance of a battery is made up of two components: electrical or ohmic resistance and ionic resistance.
Conductance	The reciprocal of impedance, admittance, measured by the tester by injecting an AC signal through the battery.

2.7 Abbreviations

Abbreviation	Explanation
DC	Direct Current
SG	Specific gravity
LCD	Liquid Crystal Display
IrDA	Infrared Data Association
RMS	Root Mean Square
OEM	Original Equipment Manufacturer
NETD	Noise Equivalent Temperature Difference
IP54	Protection class: Dust and splash proof.

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2.8 Roles and Responsibilities

The responsibility to implement this document lies with all parties within Eskom and its subsidiaries that are directly affected by it, especially those responsible for procuring the DC production equipment.

2.9 Process for Monitoring

Not applicable.

2.10 Related/Supporting Documents

Not applicable.

3 DC Production Equipment Requirements

The table below indicates the list of minimum DC production equipment required for personnel to perform their operational tasks of which the specific requirement for each item is detailed on the subsequent subheadings.

Table 1: DC production equipment list

No	Item	Description
1.	Battery Data Logger	Test instrument to measure and record battery and cell voltages.
2.	Digital Density meter	Handheld measuring and recording instrument for electrolyte SG and temperature of flooded lead acid battery.
3.	Battery state of health tester	Impedance or Conductance tester for lead acid batteries.
4.	Hydrometer	Analogue hydrometer for vented lead acid battery.
5.	Constant Current Battery discharge test unit	Electronic load bank unit for 50V, 110V and 220V DC system.
6.	Digital Multimeter	Handheld multimeter with high accuracy to measure various electrical properties.
7.	Digital Clamp-on meter	Handheld digital clamp on meter to measure current and other electrical properties.
8.	Digital Four Channel Oscilloscope meter	Oscilloscope meter with four galvanic isolated channels.
9.	DC earth fault locator	DC earth fault locator/tester. Usable on load.
10.	Infrared Thermometer	Digital laser thermometer to measure temperature on battery cells
11.	Thermal Image Scanner/Camera	Thermal scanner or camera to spot hot connection on battery connectors and installation.
12.	Battery lifting equipment	Portable lifting pallet jack or stacker.

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3.1 Battery Data Logger

- a) The maximum measurement voltage range shall be up to ± 600 V with a resolution of 1 mV.
- b) The equipment shall be configured for wireless data transfer and interface with an external digital density meter via Bluetooth communication or IrDA.
- c) Must have a battery data management software for data recording and analysis.
- d) The accuracy level shall be less than 1% of a reading value.
- e) Cell voltage, temperature, and SG recording capability.

3.2 Digital Density Meter

- a) Capable to measure density, specific gravity of lead acid and nickel cadmium batteries.
- b) Bluetooth or IrDA interface for data download.
- c) Configured for Specific Gravity measurement of electrolyte at 25°C.
- d) Minimum of 1000 measured results recorded.
- e) Sample ID configuration.
- f) IP54 protection class: Dust and splash proof and ISO15212:1 compliant.
- g) Identification of results outside recommended specified limits: 1,235 kg/l to 1,255 kg/l.

3.3 Battery state of health tester (Impedance or Conductance meter)

- a) Voltage and Conductance accuracy of $\pm 2\%$ across test range.
- b) Capable to test conductance of any battery or cell up to the maximum capacity of 4000 Ah.
- c) Pin type probes set.
- d) Test data storage of 240 test results or more.
- e) Wireless battery monitoring capability.

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- f) Capability of downloading data to a local computer with applicable software.

3.4 Hydrometer

- a) The device shall be calibrated at a reference temperature of 25 °C.
- b) The accuracy of the hydrometer shall be within $\pm 0,005$ kg/l of the sub-standard reference, over the range of 1,100 kg/l to 1,300 kg/l.
- c) The length shall be 265 mm with diameters of 21,5 mm and 28,5 mm.
- d) The material and form shall comply to an approved analogue hydrometer standard on document 240-51999453.
- e) In addition, the hydrometer should come with an extension hose made of rubber, with a minimum length and diameter of 100 mm and 7 mm respectively.

3.5 Constant Current Battery Discharge Test Units: 50 VDC, 110 VDC and 220 VDC

- a) The 50VDC: battery discharge unit shall draw a constant current with a minimum of 300 A ranging up to a maximum of 1000 A where possible.
- b) The 110 VDC: battery discharge test unit shall draw a constant current of 200 A minimum.
- c) The 220 VDC: battery discharge test unit shall draw a constant current of 200 A minimum.
- d) Discharge current accuracy shall be $\pm 1\%$ with a decimal resolution of 0.1 A.
- e) Current, voltage, capacity, time, and alarm parameters setting configuration.
- f) Ability to connect with external slave units, coupled with control wires for instantaneous trip from a master unit.
- g) Parameters settings display screen.
- h) Provided with an external clamp-on, current feedback probe.
- i) Supported with PC software for real-time data monitoring and analysis.
- j) PC communication port to download data for report compilation.
- k) Compatible with wireless battery monitoring system devices and USB port for data transfer.

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- l) Spark free terminals including fully insulated cables and clamp jaws.
- m) Provided with transport case with wheels.
- n) Battery discharge test units shall be compliant to IEC 61010-1:2001 standard for general electrical safety requirements.

3.6 Digital Multimeter

- a) DC and AC voltage range and resolution of 50.000 mV, 500.00 mV, 5.0000 V, 50.000 V, 500.00 V and 1000 V.
- b) DC and AC voltage basic accuracy of 0.025% and 0.4% respectively.
- c) DC mV resolution of 1 μ V.
- d) Event logging with up to 15000 recordings.
- e) Wireless and PC connectivity compatible.
- f) Provided with a soft carry case and accessories including magnetic hanger.
- g) Auto/touch hold.
- h) Multiple readings display on screen.
- i) Electromagnetic compatibility as per EMC EN 61326-1.
- j) At least 1 meter drop shock absorbent as per IEC 61010-1:2001.

3.7 Digital Clamp-on Meter

- a) DC and AC current measurement up to 2000 A true rms value.
- b) DC and AC voltage measurement up to 1000 V.
- c) Accuracy of 1.5% of DC current reading value.
- d) Large jaw capacity with a minimum of 58mm suitable for large or multiple conductors.
- e) At least 1 meter drop shock absorbent as per IEC 61010-1:2001.

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f) Provided with a soft carry case and accessories.

3.8 Digital Four Channel Oscilloscope Meter

a) Four independent floating isolated channels rated up to 1000 V.

b) Safety category CAT III 1000 V / CAT IV 600 V.

c) Minimum bandwidth of 100 MHz

d) DC voltage accuracy of $\pm 0.5\%$.

e) Real-time sample rate of minimum 1.25 GS/s.

f) Trend plotting and recorder function.

g) Glitch capture of 8 ns.

h) USB port for data transfer and supported with software application to compare data.

i) Provided with accessories inside a carry case including hanging strap and supporting components.

3.9 DC earth fault locator

a) Signal analyzer range of 50 VDC, 110 VDC and 220 VDC system for substation application.

b) Both online and offline testing capability without causing a trip of circuit breakers.

c) Low frequency output not more than 10 Hz.

d) Current detect sensitivity of ≥ 0.5 mA.

e) Output current range ± 100 mA.

f) Wireless communication between the signal analyzer and signal detector.

g) Forward or reverse direction indication with an arrow for ground fault detection.

h) Clamp jaw size of 30 mm minimum.

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- i) Provided with case and necessary supporting accessories.

3.10 Infrared Thermometer

- a) Dual laser infrared for improved accuracy.
- b) Accuracy of $\pm 1\%$ temperature measurement.
- c) Display resolution of 0.1 °C.
- d) Distance to spot ratio minimum of 12:1.
- e) Backlight LCD display.
- f) Up to 3 meters drop shock absorbent as per IEC 61010-1:2001.

3.11 Thermal Image Scanner / Camera

- a) Field of view minimum angle of 30°.
- b) Detector resolution of 320 x 240 (76,800pixels).
- c) Thermal sensitivity (NETD) less than 50mK.
- d) Accuracy of $\pm 2^{\circ}\text{C}$ or $\pm 2\%$.
- e) Fixed focus with minimum focus distance of 0.5 m.
- f) Spectral range of 8 μm to 14 μm .

3.12 Battery Lifting Equipment

- a) Minimum 500 kg capacity.
- b) Electric operated lifting jack.
- c) Minimum lifting height of 1300 mm

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3.13 Additional Requirements

- a) All DC production equipment as listed on table 1, shall meet and comply to both personnel and plant equipment safety standards.
- b) The equipment shall meet the metrology standards for accurate and precise measurement results.
- c) Equipment shall have local after sales support, with training provision where possible.
- d) The guarantee shall be a minimum of two years for each production equipment.
- e) Each production equipment shall be supplied with a carry case, inclusive of standard accessories and necessary documentation e.g., manuals, datasheets, etc.

4 Acceptance

This document has been seen and accepted by:

Name	Designation
Nelson Mayisela	DC Workshop Manager – Apollo & CS Secondary Plant
Anthea Solomon	Secondary plant Middle Manager - Apollo & CS

5 Revisions

Not applicable.

6 Development Team

The following people were involved in the development of this document:

- David Maganelwa
- Anthea Solomon

7 Acknowledgements

Not applicable.

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Appendix A – Schedule A: Schedule of technical compliance

A.1 Schedule of technical compliance

This must be completed by providing technical details of tendered equipment and Tenderer’s statement of compliance or non-compliance. The Tenderers statement of compliance (Schedule B) must be supported by additional information of a concise reference to the relevant submitted documents (e.g., file number, section number, page number, paragraph number). A failure to support the clause with the relevant reference will result in non-compliance.

Table A.1: Schedule for technical compliance

Spec. clause number	Description	Schedule A: Eskom’s minimum technical requirements	Schedule B: Supplier’s statements of compliance	Supplier’s Reference/Comment (State which equipment is offered and Supporting evidence)
3.	DC Production Equipment Requirements			
3.1	Battery Data Logger			
3.1.a)	The maximum measurement voltage range shall be up to ±600 V with a resolution of 1 mV.	State Compliance & Provide Evidence		
3.1.b)	Equipment configured for wireless data transfer and interface with an external digital density meter via Bluetooth communication or IrDA.	State Compliance & Provide Evidence		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.1.c)	Must have a battery data management software for data recording and analysis.	State Compliance & Provide Evidence		
3.1.d)	The accuracy level shall be less than 1% of a reading value.	State Compliance & Provide Evidence		
3.1.e)	Cell voltage, temperature, and SG recording capability.	State Compliance & Provide Evidence		
3.2	Digital Density Meter			
3.2.a)	Capable to measure density, specific gravity of lead acid and nickel cadmium batteries.	State Compliance & Provide Evidence		
3.2.b)	Bluetooth or IrDA interface for data download.	State Compliance & Provide Evidence		
3.2.c)	Configured for Specific Gravity measurement of electrolyte at 25°C.	State Compliance & Provide Evidence		
3.2.d)	Minimum of 1000 measured results recorded.	State Compliance & Provide Evidence		
3.2.e)	Sample ID configuration.	State Compliance & Provide Evidence		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.2.f)	IP54 protection class: Dust and splash proof and ISO 15212:1 compliant	State Compliance & Provide Evidence		
3.2.g)	Identification of results outside recommended specified limits: 1,235 kg/l to 1,255 kg/l.	State Compliance & Provide Evidence		
3.3	Battery state of health tester (Impedance or Conductance meter)			
3.3.a)	Voltage and Conductance accuracy of +/-2% across test range.	State Compliance & Provide Evidence		
3.3.b)	Capable to test conductance of any battery or cell up to the maximum capacity of 4000 Ah	State Compliance & Provide Evidence		
3.3.c)	Pin type probes set.	State Compliance & Provide Evidence		
3.3.d)	Test data storage of 240 test results or more.	State Compliance & Provide Evidence		
3.3.e)	Wireless battery monitoring capability.	State Compliance & Provide Evidence		
3.3.f)	Capability of downloading data to a local computer with applicable software.	State Compliance & Provide Evidence		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.4	Hydrometer			
3.4.a)	The device shall be calibrated at a reference temperature of 25 °C.	State Compliance & Provide Evidence		
3.4.b)	The accuracy of the hydrometer shall be within ± 0,005 kg/l of the sub-standard reference, over the range of 1,100 kg/l to 1,300 kg/l.	State Compliance & Provide Evidence		
3.4.c)	The length shall be 265mm with diameters of 21,5 mm and 28,5 mm.	State Compliance & Provide Evidence		
3.4.d)	The material and form shall comply to an approved analogue hydrometer standard on document 240-51999453.	State Compliance & Provide Evidence		
3.4.e)	In addition, the hydrometer should come with an extension hose made of rubber, with a minimum length and diameter of 100 mm and 7 mm respectively.	State Compliance & Provide Evidence		
3.5	Constant Current Battery Discharge Test Units: 50 VDC, 110 VDC and 220 VDC			
3.5.a)	The 50 VDC: battery discharge unit shall draw a constant current with a minimum of 300 A ranging up to a maximum of 1000 A where possible.	State Compliance & Provide Evidence		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.5.b)	The 110 VDC: battery discharge test unit shall draw a constant current of 200 A minimum.	State Compliance & Provide Evidence		
3.5.c)	The 220 VDC: battery discharge test unit shall draw a constant current of 200 A minimum.	State Compliance & Provide Evidence		
3.5.d)	Discharge current accuracy shall be $\pm 1\%$ with a decimal resolution of 0.1 A.	State Compliance & Provide Evidence		
3.5.e)	Current, voltage, capacity, time, and alarm parameters setting configuration.	State Compliance & Provide Evidence		
3.5.f)	Ability to connect with external slave units, coupled with control wires for instantaneous trip from a master unit.	State Compliance & Provide Evidence		
3.5.g)	Parameters settings display screen.	State Compliance & Provide		
3.5.h)	Provided with an external clamp-on, current feedback probe.	State Compliance & Provide		
3.5.i)	Supported with PC software for real-time data monitoring and analysis.	State Compliance & Provide		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.5.j)	PC communication port to download data for report compilation	State Compliance & Provide		
3.5.k)	Compatible with wireless battery monitoring system devices and USB port for data transfer.	State Compliance & Provide		
3.5.l)	Spark free terminals including fully insulated cables and clamp jaws.	State Compliance & Provide		
3.5.m)	Provided with transport case with wheels.	State Compliance & Provide		
3.5.n)	Battery discharge test units shall be compliant to IEC 61010-1:2001 standard for general electrical safety requirements.	State Compliance & Provide		
3.6	Digital Multimeter			
3.6.a)	DC and AC voltage range and resolution of 50.000 mV, 500.00 mV, 5.0000 V, 50.000 V, 500.00 V and 1000 V.	State Compliance & Provide		
3.6.b)	DC and AC voltage basic accuracy of 0.025% and 0.4% respectively.	State Compliance & Provide		
3.6.c)	DC mV resolution of 1 μ V.	State Compliance & Provide		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.6.d)	Event logging with up to 15000 recordings.	State Compliance & Provide		
3.6.e)	Wireless and PC connectivity compatible.	State Compliance & Provide		
3.6.f)	Provided with a soft carry case and accessories including magnetic hanger.	State Compliance & Provide		
3.6.g)	Auto/touch hold.	State Compliance & Provide		
3.6.h)	Multiple readings display on screen.	State Compliance & Provide		
3.6.i)	At least 1 meter drop shock absorbent as per IEC 61010-1:2001.	State Compliance & Provide		
3.7	Digital Clamp-on Meter			
3.7.a)	DC and AC current measurement up to 2000 A true rms value.	State Compliance & Provide		
3.7.b)	DC and AC voltage measurement up to 1000 V.	State Compliance & Provide		

CONTROLLED DISCLOSURE

Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.7.c)	Accuracy of 1.5% of DC current reading value.	State Compliance & Provide		
3.7.d)	Large jaw capacity with a minimum of 58mm suitable for large or multiple conductors.	State Compliance & Provide		
3.7.e)	At least 1 meter drop shock absorbent as per IEC 61010-1:2001.	State Compliance & Provide		
3.7.f)	Provided with a soft carry case and accessories.	State Compliance & Provide		
3.8	Digital Four Channel Oscilloscope Meter			
3.8.a)	Four independent floating isolated channels rated up to 1000V.	State Compliance & Provide		
3.8.b)	Safety category CAT III 1000 V / CAT IV 600 V.	State Compliance & Provide		
3.8.c)	Minimum bandwidth of 100 MHz	State Compliance & Provide		
3.8.d)	DC voltage accuracy of $\pm 0.5\%$.	State Compliance & Provide		

CONTROLLED DISCLOSURE

Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.8.e)	Real-time sample rate of minimum 1.25 GS/s.	State Compliance & Provide		
3.8.f)	Trend plotting and recorder function.	State Compliance & Provide		
3.8.g)	Glitch capture of 8 ns.	State Compliance & Provide		
3.8.h)	USB port for data transfer and supported with software application to compare data.	State Compliance & Provide		
3.8.i)	Provided with accessories inside a carry case including hanging strap and supporting components.	State Compliance & Provide		
3.9	DC earth fault locator			
3.9.a)	Signal analyzer range of 50 VDC, 110 VDC and 220 VDC system for substation application.	State Compliance & Provide		
3.9.b)	Both online and offline testing capability without causing a trip of circuit breakers.	State Compliance & Provide		
3.9.c)	Low frequency output not more than 10 Hz.	State Compliance & Provide		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.9.d)	Current detect sensitivity of ≥ 0.5 mA.	State Compliance & Provide		
3.9.e)	Output current range ± 100 mA.	State Compliance & Provide		
3.9.f)	Wireless communication between the signal analyzer and signal detector.	State Compliance & Provide		
3.9.g)	Forward or reverse direction indication with an arrow for ground fault detection.	State Compliance & Provide		
3.9.h)	Clamp jaw size of 30mm minimum.	State Compliance & Provide		
3.9.i)	Provided with case and necessary supporting accessories	State Compliance & Provide		
3.10	Infrared Thermometer			
3.10.a)	Dual laser infrared for improved accuracy.	State Compliance & Provide		
3.10.b)	Accuracy of $\pm 1\%$ temperature measurement.	State Compliance & Provide		

CONTROLLED DISCLOSURE

Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.10.c)	Display resolution of 0.1°C.	State Compliance & Provide		
3.10.d)	Distance to spot ratio minimum of 12:1.	State Compliance & Provide		
3.10.e)	Backlight LCD display.	State Compliance & Provide		
3.10.f)	Up to 3 meters drop shock absorbent as per IEC 61010-1:2001.	State Compliance & Provide		
3.11	Thermal Image Scanner / Camera			
3.11.a)	Field of view minimum angle of 30°.	State Compliance & Provide		
3.11.b)	Detector resolution of 320 x 240 (76,800pixels).	State Compliance & Provide		
3.11.c)	Thermal sensitivity (NETD) less than 50mK.	State Compliance & Provide		
3.11.d)	Accuracy of ±2°C or ±2%.	State Compliance & Provide		

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Spec. clause number	Description	Schedule A: Eskom's minimum technical requirements	Schedule B: Supplier's statements of compliance	Supplier's Reference/Comment (State which equipment is offered and Supporting evidence)
3.11.e)	Fixed focus with minimum focus distance of 0.5 m.	State Compliance & Provide		
3.11.f)	Spectral range of 8 μm to 14 μm .	State Compliance & Provide		
3.12	Battery lifting equipment			
3.12.a)	Minimum 500 kg capacity.	State Compliance & Provide		
3.12.b)	Electric operated lifting jack.	State Compliance & Provide		
3.12.c)	Minimum lifting height of 1300 mm.	State Compliance & Provide		

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