



Standard

Technology

Title: **THERMOGRAPHY EQUIPMENT
TECHNICAL SPECIFICATIONS**

Unique Identifier:

Gauteng Cluster

Alternative Reference Number: **<n/a>**

Area of Applicability:

Engineering

Documentation Type:

Standard

Revision:

0

Total Pages:

7

Next Review Date:

March 2024

Disclosure Classification:

**Controlled
Disclosure**

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1. Introduction

This technical specification outlines the minimum requirements for the Eskom Distribution Gauteng Cluster when purchasing thermography equipment, to ensure thermography inspections are carried out in accordance with all relevant Eskom standards and procedures.

2. Supporting clauses

2.1 Scope

This specification covers the Eskom Distribution Gauteng Cluster minimum requirements for the purchasing of thermography equipment.

2.1.1 Purpose

This document has been compiled to provide technical requirements for purchasing thermography equipment for Eskom Distribution Gauteng cluster.

2.1.2 Applicability

This document shall apply for Eskom Holdings Limited (Distribution) Gauteng cluster.

2.2 Normative/informative references

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

2.2.1 Normative

- [1] ISO 9001, Quality Management Systems
- [2] 240-124685516, Infrared thermography inspections for electrical equipment

2.2.2 Informative

- [3] 32-9: Definition of Eskom documents.
- [4] 32-644: Eskom documentation management standard.
- [5] 474-65: Operating manual of the Steering Committee of Technologies (SCOT).

2.3 Definitions

2.3.1 General

Definition	Description
Calibration	Is any act that involves comparing the measured result with a traceable reference value
Infrared camera (thermal imager)	A camera-like device that detects, displays and records the apparent thermal patterns across a given surface
Supplier/OEM	Supplier or original equipment manufacturer
Thermography	Is a non-contact, non-destructive test method that utilizes a thermal imager to detect, display and record thermal patterns and temperatures across the surface of an object

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
OEM	Original equipment manufacturer
Std.	Standard
m	meter
HV	High Voltage
MV	Medium Voltage
L	Litre
kg	Kilogram
%	Percentage
□	Emissivity
□T	Delta Temperature (temperature difference)
°C	degree Celsius
asap	as soon as possible
ASNT	American Society for Non-Destructive Testing
e.g.	for example
HV	High Voltage
IRT	Infrared Thermography
ISO	International Organization for Standardization
JPEG	Joint Photographic Experts Group
km/h	kilometre per hour
kVA	kilo Volt Ampere
ms	meters per second
MV	Medium Voltage
MVA	Mega Volt Ampere
na	Not applicable
NDT	Non-destructive Testing
OHL	Overhead Line
OU	Operating Units
PPE	Personal Protective Equipment
PPM	Power Plant Maintenance
ref	reference
SD card	Secure Digital Card

Abbreviation	Description
TAMB	Ambient temperature
TREFL	Reflected Temperature
sUAV	Small Unmanned Aerial Vehicles

2.5 Roles and responsibilities

All Eskom employees and/or appointed bodies involved in the procurement of thermography equipment and/or the associated accessories shall ensure that the product meets the minimum requirements of this specification. Any deviation from these requirements shall constitute non-conformance, unless it was in advance agreed to by a delegated specialist and is based on sound engineering judgement.

All suppliers of thermography equipment to Eskom must be conversant with the requirements of this standard, and shall comply with the requirements. No deviations will be accepted, and suppliers shall ensure that they obtain clarity where required and obtain all supporting information or documents necessary to comply with this document.

2.6 Process for monitoring

A technical evaluation criteria document will be used for process monitoring as per Eskom requirements.

2.7 Related/supporting documents

Refer to clause 2.2.

3. Requirements

3.1 General requirements

The supplier/OEM shall be responsible for the design, manufacture and supply of thermography equipment.

3.2 General Properties

The thermography equipment provided by the supplier shall be comply with the general properties and specifications in section 3.3.1 below.

- High detector resolution/image quality (i.e. 640x480 pixels);
- Comply with the ± 2 °C or $\pm 2\%$ of reading measurement accuracy

Note 1. This means that any camera, at any environment condition (within specification), at any time will give a reading within the accuracy specification.

- Offering a standard JPEG with full temperature analysis embedded;
- Wide temperature ranges;
- Telephoto lens for use on overhead lines;
- Ergonomic features – lightweight / interactive controls / at least two batteries;
- Compatible with software packages; and
- Adequate image fusion capabilities.

3.3 Thermography equipment

The thermography equipment shall be used for non-contact, non-destructive test methods that utilizes a thermal imager to detect, display and record thermal patterns and temperatures across the surface of an object with a camera-like device that detects, displays and records the apparent thermal patterns across a given surface.

3.3.1 Specifications

Imaging and optical data	
Infrared resolution	640 × 480 pixels
UltraMax (super-resolution) ¹	Yes
NETD	<40 mK @ +30°C (+86°F)
Field of view	24° × 18°
Minimum focus distance	0.15 m (0.49 ft.) - Macro mode 50 µm as option
Minimum focus distance with MSX	0.5 m (1.64 ft.)
Focal length	17 mm (0.67 in.)
Spatial resolution (IFOV)	0.66 mrad/pixel
Available extra lenses	42° (AutoCal) 14° (AutoCal) 6° (service calibration required)
Lens identification	Automatic
f number	1.3
Image frequency	30 Hz
Focus	- Continuous LDM - One-shot LDM - One-shot contrast - Manual
Field of view match	Yes
Digital zoom	1–8x continuous
Detector data	
Focal plane array/spectral range	Uncooled microbolometer/7.5–14 µm
Detector pitch	12 µm

Image presentation	
Resolution (display)	640 × 480 pixels (VGA)
Surface brightness (cd/m ²)	400
Screen size	4 in.
Viewing angle	80°
Color depth (bits)	24
Aspect ratio	4:3
Auto-rotation	Yes
Touchscreen	Optically bonded PCAP
Display technology	IPS
Cover glass material	Dragontrail®
Programmable buttons	2
Viewfinder	Yes
Image adjustment	• Automatic • Automatic maximum • Automatic minimum • Manual
Image presentation modes	
Infrared image	Yes
Visual image	Yes
MSX	Yes
Picture in picture	Resizable and movable
Gallery	Yes

Measurement	
Camera temperature range	• -40 to 120°C (-40 to 248°F) • 0 to 650°C (32 to 1202°F) • 300 to 2000°C (572 to 3632°F)
Object temperature range and accuracy (for ambient temp. 15 to 35°C (59 to 95°F))	• Range -40 to 120°C (-40 to 248°F): ◦ -40 to 5°C (-40 to 41°F): $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$) ◦ 5 to 100°C (41 to 212°F): $\pm 1^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$) ◦ 100 to 120°C (212 to 248°F): $\pm 1\%$ • Range 0 to 650°C (32 to 1202°F): ◦ 0 to 100°C (32 to 212°F): $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$) ◦ 100 to 650°C (212 to 1202°F): $\pm 2\%$ • Range 300 to 2000°C (572 to 3632°F): $\pm 2\%$

Measurement analysis	
Spotmeter	10 in live mode
Area	5 in live mode
Automatic hot/cold detection	Automatic maximum/minimum markers within area
Measurement presets	• No measurements • Center spot • Hot spot • Cold spot • User preset 1 • User preset 2
Difference temperature	Yes
Reference temperature	Yes
Emissivity correction	Yes, variable from 0.01 to 1.0 or selected from materials list

Measurement analysis	
Measurement corrections	Yes
External optics/windows correction	Yes
Alarm	
Color alarm (isotherm)	• Above • Below • Interval • Condensation (moisture/humidity/dewpoint) • Insulation
Measurement function alarm	Audible/visual alarms (above/below) on any selected measurement function
Set-up	
Color palettes	• Arctic • White hot • Black hot • Iron • Lava • Rainbow • Rainbow HC
Setup commands	Local adaptation of units, language, date, and time formats
Languages	21
Storage of images	
Storage media	• Removable memory: SD card
Time lapse (Periodic image storage)	10 seconds to 24 hours (infrared)
Remote control operation	Using USB cable or Wi-Fi
Image file format	Standard JPEG, measurement data included. Infrared-only mode.

Image annotations	
Voice	60 seconds with built-in microphone and speaker (and via Bluetooth) on still images and video
Text	Text from predefined list or soft keyboard on touchscreen
Visual image annotation	Yes
Image sketch	Yes: on infrared only
Sketch	From touchscreen
Compass	Yes
Laser distance meter information	Yes
Area measurement information	Yes
GPS	Location data automatically added to every still image and first frame in video from built-in GPS

Video recording in camera	
Radiometric infrared-video recording	RTRR (.csq)
Non-radiometric infrared-video recording	H.264 to memory card
Visual video recording	H.264 to memory card

Video streaming	
Radiometric infrared-video streaming (compressed)	Over UVC
Non-radiometric video streaming (compressed: IR, MSX, visual, Picture in Picture)	• H.264 (AVC) over RTSP (Wi-Fi) • MPEG4 over RTSP (Wi-Fi) • MJPEG over UVC and RTSP (Wi-Fi)
Visual video streaming	Yes

Digital camera	
Resolution	5 MP with LED light
Focus	Fixed
Field of view	53° × 41°
Video lamp	Built-in LED light

Laser pointer	
Laser alignment	Position is automatically displayed on the infrared image
Laser distance meter	Activated by dedicated button
Laser	Class 2, 0.05–40 m (0.16–131 ft.) $\pm 1\%$ of measured distance
Data communication interfaces	
Interfaces	USB 2.0, Bluetooth, Wi-Fi, DisplayPort
METERLiNK/Bluetooth	Communication with headset and external sensors
Wi-Fi	Peer to peer (ad hoc) or infrastructure (network)
Audio	Microphone and speaker for voice annotation of images
USB	USB Type-C: data transfer/video/power
USB standard	USB 2.0 High Speed
Video out	DisplayPort
Video connector type	DisplayPort over USB Type-C
Radio	
Operating frequency	Bluetooth + EDR/LE: 2402–2480 MHz WLAN 2.4 GHz: 2412–2462 MHz WLAN 5 GHz: 5150–5350 MHz (DFS: only slave mode) Note that frequency band 5150–5350 MHz is for indoor use only, see national regulations.
RF output (EIRP)	Bluetooth + EDR/LE: < 10 dBm WLAN: < 17 dBm
Antenna	Integrated PIFA antenna (gain: maximum 1.4 dBi)

Power system	
Battery type	Rechargeable Li-ion battery
Battery voltage	3.6 V
Battery operating time	> 4 hours at 25°C (77°F) with typical use
Charging system	In camera (AC adapter or 12 V from a vehicle) or two-bay charger
Charging time (using two-bay charger)	3.5 h to 90% capacity, on-screen indicator
Charging temperature	0°C to +45°C (+32°F to +113°F), except for the Korean market: +10°C to +45°C (+50°F to +113°F)
External power operation	AC adapter 90–260 V AC (50/60 Hz) or 12 V from a vehicle (cable with standard plug, optional)
Power management	Automatic shut-down and sleep mode
Environmental data	
Operating temperature range	–15 to +50°C (5–122°F)
Storage temperature range	–40 to +70°C (–40 to 158°F)
Humidity (operating and storage)	IEC 60068-2-30/24 hours, 95% relative humidity, 25–40°C (77–104°F)/2 cycles
EMC	- ETSI EN 301 489-1 (radio) - ETSI EN 301 489-17 - EN 61000-6-2 (immunity) - EN 61000-6-3 (emission) - FCC 47 CFR part 15 B, class B (emission)
Radio spectrum	- ETSI EN 300 328 - ETSI EN 301 893 - FCC 47 CFR part 15 C - FCC 47 CFR part 15 E
Encapsulation	IP 54 (IEC 60529)
Shock	25g (IEC 60068-2-27)
Vibration	2g (IEC 60068-2-6)
Safety	Camera: - IEC/EN 60950-1, IEC/EN 62368-1 Power supply: - IEC/EN 62368-1 - CSA/UL/KC/SAA/PSE 60950-1

Physical data	
Weight (including battery)	1.4 kg (3.1 lb.)
Size (L x W x H)	• Lens vertical: 164.3 x 201.3 x 84.1 mm (6.5 x 7.9 x 3.3 in.) • Lens horizontal: 164.3 x 201.3 x 167.3 mm (6.5 x 7.9 x 6.6 in.)
Battery weight	195 g (6.89 oz.)
Battery size (L x W x H)	59 x 66 x 94 mm (2.3 x 2.6 x 3.7 in.)
Tripod mounting	UNC ¼"-20
Housing material	PCABS with TPE, magnesium

Additional information to be submitted by tenderer

- Equipment calibration guidelines;
- Life expectancy;
- Warranty,
- List of supplies and accessories.

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Philip Armstrong	PPM Manager
Deon Boshoff	SpMS Manager

5. Revisions

Date	Rev	Compiler	Remarks
May 2023	0	T Mathiba	New document.

6. Development team

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

- Thapelo Mathiba: Engineer (PPM)
- Philip Armstrong: PPM Manager

7. Acknowledgements

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