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Kenya Power

THERMAL IMAGING CAMERA

Part 1: HANDHELD THERMAL IMAGING CAMERA — SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd.

June 2018

TABLE OF CONTENTS

0.1 Circulation List 3
0.2 Amendment Record 4
FOREWORD 5
1. SCOPE 6
2. REFERENCES (NORMATIVE) 6
3. DEFINITIONS AND ABREVIATION 6
4. REQUIREMENTS 6
4.1. Service conditions 6
4.2. General Requirements 6
4.3. Special Features 8
4.4. Standard Accessories: 10
4.5. Warranty and Training 10
5. TEST REQUIREMENTS 11
6. MARKING AND PACKING 11
6.1. Marking 11
6.2. Packaging 11
APPENDICES 12
APPENDIX A: TESTS AND INSPECTION (NORMATIVE) 12
APPENDIX B: QUALITY MANAGEMENT SYSTEM (NORMATIVE) 12
APPENDIX C: TECHNICAL DOCUMENTATION (NORMATIVE) 13
APPENDIX D: GUARANTEED TECHNICAL PARTICULARS (GTPS) — NORMATIVE 14

0.1 Circulation List

COPY NO.	COPY HOLDER
1	Manager, Standards
Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)	

REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved Standards, addressed to the Manager, Standards Department, are welcome.

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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1 Rev 0	2018-06-11	New	Rotich Benard	Dr. Eng. P. Kimemia

FOREWORD

This specification has been prepared by the Standards Department in collaboration with Transmission Section (Network Management), both of the Kenya Power and Lighting Company Limited, here known as Kenya Power. It lays down requirements for a Handheld Thermal Imaging Camera herein called 'Camera'.

Thermal imaging cameras for electrical/mechanical applications are powerful and non-invasive tools for inspecting, monitoring and diagnosing the condition of electrical/mechanical installations and components. With a thermal imaging camera, one can identify problems early, allowing them to be documented and corrected before becoming more serious and costlier to repair.

A thermal image that includes accurate temperature data provides important information about the condition of the inspected equipment, scan distribution boards, fuse boxes, wires and connections terminals, connectors, cables, conductors, etc.

The other specification in this series is:

KP1/3CB/TSP/09/075: Specification for Infrared Camera. Date of issue: 2014-09-15

The specification stipulates the minimum requirements for a Handheld Thermal Imaging Camera acceptable for use in the company and it shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC, and exhibits good workmanship and good engineering practice in the manufacture.

The following are members of the team that developed this specification:

Name	Department
Ruth Mumbua Nzioka	Network Maintenance
Rotich Benard	Standards

1. SCOPE

This specification is for a handheld Thermal Imaging Camera for use in predictive maintenance of the transmission and distribution network.

2. REFERENCES (NORMATIVE)

The following standards contain provisions which through reference in this text constitute provisions of this specification. For dated editions, the cited edition shall apply; for undated editions, the latest edition of the referenced document shall apply.

ANSI/NETA ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

ANSI/NETA MTS: Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems.

IEC 60529: Degrees of protection provided by enclosures (IP Code)

3. DEFINITIONS AND ABREVIATION

For this specification, the definitions and abbreviations given in the reference standards shall apply.

4. REQUIREMENTS

4.1. Service conditions

The handheld Thermal Imaging Camera shall be suitable for continuous operation outdoors in tropical areas and harsh climatic conditions including areas exposed to:

a) Altitudes of up to 2200m above sea level

b) Humidity of up to 95%

c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,

d) *Isokeraunic* levels of up to 180 thunderstorm days per year.

4.2.2. The Camera shall offer both thermal and visual imagery, spot size resolution, and reliable temperature measurement accuracy.

4.2.3. The Camera shall have a built-in digital camera, voice annotation, laser target locator, GPS, etc.

4.2.4. The Camera shall be of rugged, ergonomic design and portable with the housing meeting the IP54 standard for protection of internal parts from shock, vibration, dust, and water as per IEC 60529.

4.2.5. The Camera shall be designed for heavy duty applications in the field.

4.2.6. The Camera shall be of such a design as to make it possible to access and test areas within a long distance.

4.2.7. The Camera shall withstand tough conditions to take images with speed and clarity.

4.2.8. The Camera shall have capacity to store multiple libraries per work site.

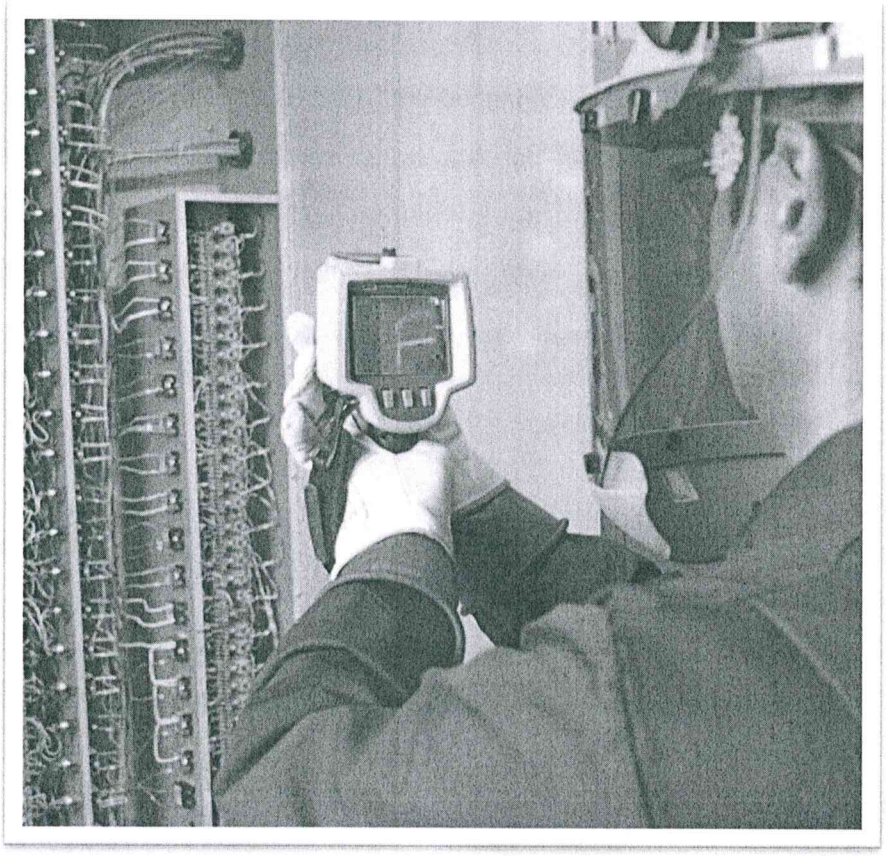


Figure 1: Typical inspection of circuits with Handheld Thermal Imaging Camera

4.3. Special Features

4.3.1. Software

4.3.1.1. The Camera shall be provided with a computer-based software that enables the user to analyse and report the findings. The software shall be compatible with the common operating systems e.g. Windows etc.

4.3.1.2. The software shall seamlessly store, retrieve, and analyse thermal images and temperature data directly from the camera, allowing in-depth and precise evaluation of thermal performance.

4.3.1.3. The software functions shall include temperature display, snapshot and video image analysis, isotherms, line profiles, area histograms, among others.

4.3.2. Multi Spectral Dynamic Imaging (MSX)

4.3.2.1. The Camera shall have on-board processor that provides extraordinary thermal image details in real time:

a) Real-time IR video enhanced with visible spectrum definition;

b) Exceptional thermal clarity to highlight exactly where the problem is;

c) Easier target identification without compromising radiometric data;

d) Quality images that won't require separate digital photos for reports.

4.3.2.2. In carrying out thermal fusion, the Camera's MSX shall emboss digital camera detail onto thermal video and stills.

4.3.3. Image Annotation

4.3.3.1. It shall be possible to clearly indicate on a saved image the location of the problem area both on the thermal and the visual image. This can be done immediately on the touch screen of the camera.

4.3.3.2. The annotation shall be in form of text comments or/and up to 30 seconds of digital voice commentary can be embedded with each IR image, eliminating the need to keep separate notes.

4.3.4. Data Transfer

Allows transfer of images from the thermal imaging camera to a tablet, PC or smartphone via USB, WIFI, Bluetooth etc.

4.3.5. **Continuous auto-focus**

The camera allows for continuous autofocus of the thermal images. As a result, the camera is fully automatic.

4.3.6. The Thermal Imaging Camera shall have the features in Table 1:

Table 1: Summary of Thermal Imaging Camera Requirements

Features	Requirements
1. Imaging and Optical Data	
Thermal Resolution	Range between 76800 (320 X 240) Pixel and 786,432 (1024 X 768) Pixel
Thermal Sensitivity	<0.05° C at 30°C
Temperature range	At least -20°C to 650°C
Minimum Focus Distance	0.2m
Spectra Range	7.5-14µm
Build in Visual Camera	At least 3.1MP
Digital Zoom	4X continuous and above
Focus	Manual, Automatic, and Continuous
2. Image Presentation Modes	
MSX,	Embosses visual details on full resolution thermal image, for clear text and location identification
Thermal	Yes
Visual	Yes
Image gallery	Yes
Display Screen	4.3" LCD touch screen
3. Measurement	
Accuracy	±2°C or 2% whichever is greater
4. Measurement Analysis	
Measurement Tools	3 and above Spotmeters, 3 and above Area boxes (full image with min/max/ average)
Emissivity Correction	Variable from 0.01 to 1.0 or selected from material list
Measurement Correction	Emissivity, Reflected temperature, relative humidity, Atmospheric temperature, Object distance
Colour Palettes	Yes
5. Media Storage	
Storage media	2GB SD memory card (Class 10) or better
Image format	Standard JPEG, Including Digital Photo and Measurement Data
6. Digital Camera	
Digital Camera	FOV adopts to the IR lens
Video Lamp	Built-in LED light

4.4. Standard Accessories:

The following accessories shall be supplied with the Camera:

a) SD memory card
b) 2 Li-ion rechargeable batteries
c) 2-bay battery charger
d) Power supply
e) Bluetooth headset
f) USB and video cables
g) Tripod adapter
h) Lens cap
i) Hard carrying case

4.5. Warranty and Training

4.5.1. The Thermal Imaging Camera shall be backed by a minimum 24-months factory warranty that covers all parts, a 5-year warranty on the battery, and a 10-year warranty on the thermal detector.

4.5.2. Technical support, servicing of the camera and software upgrades, where applicable, shall be provided free of charge to Kenya Power for a period of not less than 24 months.

4.5.3. Though using a thermal imaging camera could be as easy as using a camcorder, the manufacturer shall conduct a one-day (full day) training on the use of the camera to Kenya Power engineers/Technicians, in Nairobi Kenya to ensure they get the most out of the thermal imaging camera. The supplier shall meet the cost of the trainer and any materials required for the training.

4.5.4. The training shall include theory on how the camera works followed by practical demonstrations on operation, protection and control configuration and parameter settings. All the operational and control features of the camera shall be exhaustively explained and demonstrated, including the operation of the software.

4.5.5. The training shall be considered to have been successful once the Engineers/Technicians are able to: -

a) Competently use the camera;
b) Establish communication between the camera and computer, export data, download and analyse data/images;
c) Trouble shoot, analyse and rectify any minor breakdowns that may occur.

5. TEST REQUIREMENTS

The Thermal Imaging Camera shall be manufactured and tested in accordance with the requirements of this specification and applicable standards.

6. MARKING AND PACKING

6.1. Marking

The Thermal Imaging Camera shall be marked in a permanent manner with the following information (in English Language):

a) Standard to which the Thermal Imaging Camera complies

b) Name of manufacturer and Trademark/Logo

c) Year and month of manufacture and serial number

d) The words "**Property of The Kenya Power & Lighting Co. Ltd.**"

6.2. Packaging

6.2.1. The Thermal Imaging Camera shall come packed in a standard-size shoulder lightweight case that protects the camera and constructed of heavy duty nylon.

6.2.2. The case shall offer protection to the camera while performing extended inspections, without the added bulk of the hard case. This case shall include a shoulder strap and can be used together with a tool belt.

THIS SPACE IS LEFT INTENTIONALLY BLANK

APPENDICES

APPENDIX A: TESTS AND INSPECTION (NORMATIVE)

A.1. It shall be the responsibility of the manufacturer to perform or to have performed the tests normally performed.

A.2. Copies of previous test certificates and test reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted.

A.3. During delivery of the Camera, Kenya Power shall inspect them and may perform or have performed any of the relevant tests to verify compliance with the specification. The supplier shall replace/rectify without charge to Kenya Power, Camera or accessories which upon examination, test or use fail to meet any or all the requirements in the specification

APPENDIX B: QUALITY MANAGEMENT SYSTEM (NORMATIVE)

B.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the Thermal Imaging Camera will fulfil the requirements stated in this specification and standards, regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008/2015.

B.2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications, including copy of valid and relevant ISO 9001: 2008 or 2015 certificate, shall be submitted with the tender for evaluation.

B.3. The manufacturer shall indicate the delivery time of the Camera, manufacturer's monthly and annual production capacity and experience in the production of the items. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the Thermal Imaging Camera sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

APPENDIX C: TECHNICAL DOCUMENTATION (NORMATIVE)

C.1. The bidder shall submit its tender complete with technical documents required for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs) - Appendix D - stamped and signed by the manufacturer.

b) Copies of the Manufacturer's catalogues, brochures and technical data for the camera;

c) Details of the manufacturer's experience; Sales records for the last five years and at least four customer reference letters.

d) Copies of previous test certificates and test reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language);

e) Marking & Packaging details.

C.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer **(these are not the ones submitted with the tender)**;

b) Manufacturer's catalogues, brochures and Technical details of the Thermal Imaging Camera to be manufactured/supplied to Kenya Power.

c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the specification and applicable standards.

C.3. Routine and sample test reports for the Camera to be supplied shall be submitted to Kenya Power for approval before shipment/delivery of the goods.

C.4. Each camera package shall be supplied with detailed user's manual printed in English language. All information shall be unambiguous.

APPENDIX D: NORMATIVE GUARANTEED TECHNICAL PARTICULARS (GTPS) —

(To be filled, stamped and signed by the Supplier and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete test certificates and test reports for tender evaluation or approval, all in English Language)

Tender No. .....

Bidder's name and Address.....

Clause number	KPLC requirement	Bidder's offer
Manufacturer's Name and address		Specify
Country of Manufacture		Name
Bidder's Name and address		Name
Name of Equipment offered		Name
Model no of the camera		Name
1.	Scope	State
2.	Applicable Standards	Specify
3.	Definitions and abbreviation	Specify
4.	**REQUIREMENTS**	
4.1	Service conditions	Specify
4.2.1	Applicable standards to be conformed to	State
4.2.2	What the Thermal Imaging Camera offers	State
4.2.3	Thermal Imaging Camera features	List
4.2.4	Thermal Imaging Camera design and protection class	Specify
4.2.5	Camera designed for heavy duty applications in the field	Specify
4.2.6	Camera design makes it possible to access and test areas within a long distance	Specify
4.2.7	Camera withstands tough conditions to take images with speed and clarity	Specify
4.2.8	Camera has capacity to store multiple libraries per work site	Specify

Clause number	KPLC requirement		Bidder's offer
4.3	**Special Features**		
4.3.1	**Software**		
4.3.1.1	Camera has on-board processor that provides extraordinary thermal image details in real time		Specify
4.3.1.2	The camera software seamlessly stores, retrieves, and analyses thermal images and temperature data directly from the camera		Specify
4.3.1.3	Thermal Imaging Camera software functions includes		List
4.3.2	**Multi Spectral Dynamic Imaging (MSX)**		
4.3.2.1	The Test Thermal Imaging Camera provides current sources of varied outputs		Specify
4.3.2.2	Camera's MSX embosses digital camera detail onto thermal video and stills		Specify
4.3.3	**Image Annotation**		
4.3.3.1	It is possible to clearly indicate on a saved image the location of the problem area both on the thermal and the visual image		Specify
4.3.3.2	Forms of annotation		List
4.3.4	**Data transfer** Allows for transfer of images		Specify
4.3.5	**Continuous auto-focus** The camera allows for continuous autofocus of the thermal images		Specify
4.3.6	**Thermal Imaging Camera features**		
4.3.6	**1. Imaging and Optical Data**	Thermal Resolution	Specify
		Thermal Sensitivity	Specify
		Temperature range	Specify
		Minimum Focus Distance	Specify
		Spectra Range	Specify
		Build in Visual Camera	Specify
		Digital Zoom	Specify
		Focus	Specify
	2. Image Presentation Modes	MSX,	Specify
		Thermal	Specify
		Visual	Specify
		Image gallery	Specify
		Display Screen	Specify
	3. Measurement	Accuracy	Specify

Clause number	KPLC requirement		Bidder's offer
	4. Measurement Analysis	Measurement Tools	Specify
		Emissivity Correction	Specify
		Measurement Correction	Specify
		Colour Palettes	Specify
	5. Media Storage	Storage media	Specify
		Image format	Specify
	6. Digital Camera	Digital Camera	Specify
		Video Lamp	Specify
4.4	**Accessories supplied with the camera**		List
4.5	**Warranty and Training**		
4.5.1	Thermal Imaging Camera warranty		No of months
	Battery warranty		No of months
	Thermal detector warranty		No of months
4.5.2	Period of free technical support and software upgrades		No. of months
4.5.3	A one-day training on the camera will be conducted to Kenya Power engineers/Technicians, in Nairobi Kenya		Specify
4.5.4	Training content		Specify
4.5.5	Hallmarks of successful training		List
5	**Test Requirements**		List
6	**Marking and Packing**		
6.1	**Marking** Information to be marked legibly and indelibly		State
6.2	**Packaging**		
6.2.1	Carrying case material and type		State
6.2.2	Case provide protection during inspection		State
APPENDICES			
A	**TESTS AND INSPECTION (NORMATIVE)**		
A1	Responsibility of performing tests		State
A2	Copies of previous type test reports by the relevant independent /international testing laboratory submitted		State
A3	The supplier will replace/rectify without charge to Kenya Power, camera which upon examination, test or use fail to meet any or all the requirements in the specification		Accept
B	**QUALITY MANAGEMENT SYSTEM(NORMATIVE)**		
B1	QAP and ISO 9001:2008		State

Clause number	KPLC requirement	Bidder's offer
B2	Manufacturer's Declaration of Conformity	State
	Copies of quality management certifications attached	State
B3	Delivery time, Production capacity & experience of the manufacturer	State
C	**TECHNICAL DOCUMENTATION (NORMATIVE)**	
C1	Technical documents to be submitted with tender documents	
	a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs) - Appendix D - stamped and signed by the manufacturer.	state
	b) Copies of the Manufacturer's catalogues, brochures, and technical data for the camera;	state
	c) Details of the manufacturer's experience; Sales records for the last five years and at least four customer reference letters.	state
	d) Copies of previous test certificates and test reports (As given in Clause A.2) by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language);	state
	e) Marking & Packaging details	State
C2	Documents to be submitted Kenya Power for approval before manufacture/supply	
	a) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer (these are not the ones submitted with the tender);	State
	b) Manufacturer's catalogues, brochures and Technical details of Thermal Imaging Camera to be manufactured for KPLC.	State
	c) Quality assurance plan (QAP	State
C3	Routine and sample test reports submitted to Kenya Power for approval before shipment/delivery of the goods	State
C4	Each package is supplied with detailed user manual printed in English language	Specify

** Words like 'agreed', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

.....

Manufacturer's Name, Signature, Stamp and Date