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Kenya Power

GUIDED WAVE ULTRASONIC CORROSION DETECTION EQUIPMENT - SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd

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TABLE OF CONTENTS

0.1 CIRCULATION LIST 3
0.2 AMENDMENT RECORD 4
FOREWORD 5
1. SCOPE 6
2. NORMATIVE REFERENCES 6
3. DEFINITIONS AND ABBREVIATIONS 7
4. REQUIREMENTS 7
4.1. SERVICE CONDITIONS 7
4.2. DESIGN AND CONSTRUCTION 8
4.2.1. GENERAL 8
4.2.2. PARTICULAR REQUIREMENTS 9
5. TESTS REQUIREMENTS 10
6. MARKING AND PACKAGING 10
6.1. MARKING 10
6.2. PACKAGING 11
7. TRAINING 11
APPENDICES 12
A: TESTS AND INSPECTION (Normative) 12
B: QUALITY MANAGEMENT SYSTEM (Normative) 12
C: DOCUMENTATION (Normative) 13
D: GUARANTEED TECHNICAL PARTICULARS (Normative) 15

0.1 CIRCULATION LIST

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

REVISION OF KPLC STANDARDS

In order 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.

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	2025-01-23	New Issue	Jean Otsyula	Dr. Eng. Peter Kimemia

FOREWORD

This specification has been prepared by the Standards Department in collaboration with the Transmission Network Maintenance Department, both of The Kenya Power and Lighting Company Plc (KPLC) and it lays down requirements for Guided Wave Ultrasonic Corrosion Detection Equipment. It is intended for use by KPLC in purchasing the equipment.

The equipment is intended for in-service rapid, reliable and accurate, non-destructive screening of buried transmission towers' guy anchor/stay rods/stubs with total volumetric coverage from a single inspection point at ground level.

Corrosion and other defects – metal loss, cracks – of a buried anchor rod is to be detected and its geometry/severity characterized and estimated via data inspection/analysis software to meet required standards. This shall inform appropriate follow-up inspection to be performed with localized Non Destructive Testing (NDT) techniques (visual, ultrasound, eddy current etc.) and corrective measures to be taken to avert catastrophic failure.

There is no other specification in this series.

This specification stipulates the minimum requirements for the Guided Wave Ultrasonic Corrosion Detection Equipment acceptable for use in the company and it shall be the responsibility of the supplier and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC. Good workmanship and good engineering practice shall be exhibited in the manufacture of the Guided Wave Ultrasonic Corrosion Detection Equipment for KPLC.

Users of this KPLC specification are responsible for their correct interpretation and application.

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

Name	Department
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1. SCOPE

1.1. This specification covers technical requirements for the design and construction of Guided Wave Ultrasonic Corrosion Detection Equipment for use within KPLC.

1.2. The specification also covers inspection and tests as well as a schedule of Guaranteed Technical Particulars to be filled and signed by the manufacturer and submitted for tender evaluation.

2. NORMATIVE REFERENCES

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.

ISO 22232-1, 2, & 3:2020:	Non-destructive testing – Characterization and verification of ultrasonic test equipment
BS 9690-2:2011:	Non-destructive testing. Guided wave testing – Part 2: Basic requirements for guided wave testing of pipes, pipelines and structural tubulars.
ISO 4773:2023:	Non-destructive testing – Ultrasonic guided-wave testing using the phased-array technique
BS EN ISO 16810:	Non-destructive testing – Ultrasonic testing – General principles.
BS EN ISO 16811:	Non-destructive testing – Ultrasonic testing – Sensitivity and range setting
BS EN 16823:	Non-destructive testing – Ultrasonic testing – Through transmission technique
IEC 62133-2:2017:	Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems.
IEC 62828-1:2017:	Reference conditions and procedures for testing industrial and process measurement transmitters – Part 1: General procedures for all types of transmitters
ISO 9712:2021:	Non-Destructive Testing – Qualification & Certification of NDT Personnel.

ISO/IEC 17025:	General requirements for the competence of testing and calibration laboratories
ISO 9001:2015:	Quality management systems – Requirements

3. DEFINITIONS AND ABBREVIATIONS

For the purpose of this specification the definitions and abbreviations given in the reference standards shall apply together with the following abbreviations:

ASTM	American Society for Testing and Materials
BS	British Standard
GWUT	Guided Wave Ultrasonic Testing
IEC	International Electro Technical Commission
ISO	International Organization for Standardization
KPLC	Kenya Power and Lighting Company Plc
NDT	Non-Destructive Testing
SNR	Signal-to-Noise-Ratio

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

4.1.1 The guided wave ultrasonic corrosion detection equipment shall be suitable for continuous use outdoor 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;

d) Pollution: Design pollution level to be taken as "Very Heavy" (Pollution level IV) for coastal applications in accordance with IEC 60815.

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

4.2. DESIGN AND CONSTRUCTION

4.2.1. GENERAL

4.2.1.1. The guided wave ultrasonic corrosion detection equipment shall be designed and constructed in accordance with ISO 22232-1, 2, & 3:2020; ISO 4773:2023; and the requirements of this specification.

4.2.1.2. The guided wave ultrasonic corrosion detection equipment shall be suitable for use in both mild and high tensile steel parts.

4.2.1.3. The equipment shall be used for NDT screening of cylindrical anchor rods with the characteristics shown in Table 1 below as per KPLC standards.

Table 1: Anchor rod characteristics

Size, Lx Dia.	Anchor rod material
6' x 5/8" (1.83m x 15.88mm)	Hot-dip galvanized mild steel
8' x 3/4" (2.44m x 19.05mm)	
9' x 1" (2.74m x 25.4mm)	

4.2.1.4. The transducer rings for the inspection shall be adaptable to the range of diameters of the anchor rods described in Table 1.

4.2.1.5. The guided wave ultrasonic corrosion detection equipment shall be provided with two 6.6Ah, 18VDC Li-ion batteries and a 75W, 230-240V, 18-VDC output battery charger in accordance with IEC 62133-2:2017.

4.2.1.6. The equipment shall have a colored LCD touch screen designed for easy operation.

4.2.1.7. The equipment software shall assist with collection, validation and analysis of the inspection results. The software shall be non-expiring.

4.2.1.8. The guided wave ultrasonic corrosion detection equipment shall comprise of a report generator that can summarize the necessary inspection data into PDF, Excel or Word Format.

4.2.1.9. The equipment shall communicate via USB, LAN or wireless mode.

4.2.1.10. The equipment shall be supplied complete with a laptop pre-installed with the necessary wave analysis software that runs on a windows-based operating system.

4.2.1.11. The guided wave ultrasonic corrosion detection equipment shall be accessorized with software license, mains charger, carrier bag, USB cable, Ethernet cable, and probes of a minimum length of 2.5m.

4.2.1.12. The equipment shall be portable and weigh approximately 8kg packed in an ergonomic protective bag.

4.2.2. PARTICULAR REQUIREMENTS

4.2.2.1. The operating characteristics of the guided wave ultrasonic corrosion detection equipment shall be based on ISO 4773:2023; ISO 22232-1, 2, & 3:2020, BS EN ISO 16810, BS EN ISO 16811 and BS EN ISO 16823: 2014. Selection formulas shall be required to comply during tests, with the capabilities stated in Table 2 below.

Table 2: Guided wave ultrasonic corrosion detection equipment specifications

No.	Parameters	Units	Value
Guided wave ultrasonic equipment			
1	Battery capacity	No, VDC, Ah, f (Hz)	2No., 18-20, ≥6.6, 50-60
2	Battery life	No. of tests	≥200 or Minimum 24 hours continuously pulsing.
3	Output Drive Voltage	Vpp	400
4	Output Current	Amps	40
5	Receiver Time Controlled Gain (TCG)	dB	0≥TCG≤80
6	Data resolution	bits	≥12
7	Humidity range	%	0-95
8	Ingress Protection (IP) rating	-	65
9	Anchor rod test range (minimum)	m	50
10	Communication interface	-	USB 2.0 LAN 10/100 Base-T Ethernet (supplied with cable).
11	Transducer channel	No	≥8
12	Support Operating Software	-	Windows 7 to Windows 11
13	Transmitter frequency range	kHz	15≥kHz≤500
14	Transmitter pulsing rate (Pulse Repetition Frequency)	Hz	Up to 20
15	Operation modes	-	Pulse-echo and pitch-catch
16	Operating temperature range	°C	-1≥°C≤40

No.	Parameters	Units	Value
17	Waveform	-	⎍⎍⎍
18	Size (LxWxH)	mm	Manufacturer to state
19	Pulsing rate	-	Manufacturer to state
	Transducer		
20	Transducer type	-	Piezoelectric/magnetostrictive
21	Transduction ring type	-	Claw
22	Nominal applicable Anchor Rod Diameter	mm	15 to 32
23	Transducer type	-	High Definition (HD)
24	Transducer ring operating frequency range	-	High
25	Transducer ring closing mechanism	-	Screw
26	Transducer ring axial/radial clearances	mm	≤75/38

5. TESTS REQUIREMENTS

The guided wave ultrasonic corrosion detection equipment shall be inspected and tested in accordance with the requirements of ISO 9712:2021, ISO 4773:2023, ISO 22232-1,2,&3, BS EN ISO 16810, 16811, 16823: 2014, IEC 62133-2:2017 and provisions of this specification.

6. MARKING AND PACKAGING

6.1. MARKING

6.1.1. The following information shall be marked indelibly and legibly on a nameplate permanently attached to each guided wave ultrasonic corrosion detection equipment in English language:

a) The manufacturer's name or trade mark;
b) Type and identification number of the equipment;
c) Frequency range & pulsing rate;
d) Test range (mm);
e) Weight:
f) Rated battery capacity;
g) The year of manufacture;

h) The letters, "**Property of the Kenya Power & Lighting Plc**".

6.2. PACKAGING

6.2.1. The guided wave ultrasonic corrosion detection equipment shall be supplied ergonomically packed in plastic hard carrying cases with foam.

6.2.2. Accessories such as removable transducers, communication cables, laptop, batteries and battery charger shall be separately packaged.

6.2.3. A set of three (3) technical manuals for the guided wave ultrasonic corrosion detection equipment shall be supplied with each equipment. Details on the batteries and accessories shall also be submitted during delivery (as well as for tender evaluation).

7. TRAINING

The supplier/manufacturer shall arrange to conduct a training on familiarization, use/inspection and analysis of data using the necessary software for the guided wave ultrasonic corrosion detection equipment. Requisite certifications shall be provided to a minimum of ten (10) KPLC Engineers. The supplier shall meet all the costs for conducting the training.

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APPENDICES

A: TESTS AND INSPECTION (Normative)

A.1 It shall be the responsibility of the supplier to test or to have all the relevant tests performed.

A.2 Copies of Type Test Certificates and Type Test Reports issued by a third party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. A copy of the accreditation certificate for the testing laboratory shall also be submitted with the tender (all in English Language).

***NOTE**: Any translations of certificates and test reports into the English language shall be signed and stamped by the Testing Authority.*

A.3 The Type Test Certificates and Type Test Reports issued by the third party testing laboratory should have been performed by NDT personnel certified to ISO 9712:2021.

A.4 Routine and sample test reports for the guided wave ultrasonic corrosion detection equipment to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods.

A.5 KPLC Engineers will witness acceptance tests at the manufacturer's premises before delivery. The tests shall be in accordance with relevant international standards and this specification.

A.6 On receipt of the guided wave ultrasonic corrosion detection equipment, KPLC will inspect them and may perform any of the relevant tests in order to verify compliance with the specification. The supplier shall replace without charge to KPLC, any guided wave ultrasonic corrosion detection equipment which upon examination, test or use fail to meet any or all of the requirements in the specification.

B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the guided wave ultrasonic corrosion detection equipment meets physical properties, tests and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9000:2015.

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

C: DOCUMENTATION (Normative)

C.1 The bidder shall submit its tender complete with technical documents 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 (GTP) signed and stamped by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions and technical data;
c) Sales records for the last five years and at least four customer reference letters;
d) Details of manufacturing capacity and the manufacturer's experience;
e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025.
f) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;
g) Proof of NDT personnel accredited to ISO 9712:2021 for the third party testing laboratory;
h) Contacts and address of third party testing laboratory;
i) Manufacturers letter of authorization, ISO 9001:2015 certificate and other technical documents required in the tender.

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

a) Fully filled clause by clause guaranteed technical particulars (GTP) stamped and signed by the manufacturer (these are not the ones submitted with the tender);
b) Detailed design Drawings of the guided wave ultrasonic corrosion detection equipment to be manufactured for KPLC;
c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2015;

d) Marking details and method to be used in marking the guided wave ultrasonic corrosion detection equipment;
e) Packaging details (including packaging materials).

C.3 The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery to KPLC stores.

***NOTE**: The drawings to be submitted by the supplier to KPLC for approval before manufacture shall be in standard format clearly indicating the drawing number, parts list with material details and quantities, standard of manufacture, ratings, approval details and identity of the manufacturer (as per manufacturer's authorization submitted during tendering).*

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D: GUARANTEED TECHNICAL PARTICULARS (Normative)

To be filled and signed by the Manufacturer 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 type test certificates and test reports for tender evaluation, all in English Language)

Tender No. .....

Bidder's name and Address.....

Clause number	KPLC Requirements		Bidder's Offer
Manufacturer's Name and Address			Specify
Country of Manufacture			Specify
Name and Model Number			Specify
1.	Scope		State
2.	Normative References		State
3.	Definitions and Abbreviations		State
4.	Requirements		
4.1	Service conditions		State
4.2	Design and Construction		
4.2.1	General		
4.2.1.1	Standard of manufacture		State
4.2.1.2	Suitable for use in both mild and high tensile steel parts		Specify
4.2.1.3	Suitable for NDT screening of cylindrical anchor rods as per Table 1 of the specification		State
4.2.1.4	Transducer ring range		State
4.2.1.5	Battery technology and accessories		State
4.2.1.6	Touch screen type		State
4.2.1.7	Equipment Software (non-expiring)		Specify
4.2.1.8	Report generator and supported formats		State
4.2.1.9	Communication protocols		State
4.2.1.10	Fully furnished laptops		Provide
4.2.1.11	Assorted accessories	Software license	Provide
		Mains charger	Provide
		Carrier bag	Provide

Clause number	KPLC Requirements		Bidder's Offer
		USB cable	Provide
		Ethernet cable, and	Provide
		Probes of a minimum length of 2.5m	Provide
4.2.1.12	Weight and protective carrier bag		Specify
4.2.2	Particular Requirements		
4.2.2.1	Operating Characteristics and reference standards		State
Table 2	Guided wave ultrasonic equipment		
	Battery capacity – Number, DC Voltage, Ampere-hour capacity and frequency (No.,VDC, Ah, Hz)		State
	Battery life (No. of tests)		State
	Output Drive Voltage (Vpp)		State
	Output Current (A)		State
	Receiver Time Controlled Gain (TCG) – (dB)		State
	Data resolution (bits)		State
	Humidity range (%)		State
	Ingress Protection (IP) rating		State
	Anchor rod test range (m)		State
	Communication interface		State
	Transducer channel (No.)		State
	Support Operating Software		State
	Transmitter frequency range (kHz)		State
	Transmitter pulsing rate (Pulse Repetition Frequency) – (Hz)		State
	Operation modes		State
	Operating temperature range (°C)		State
	Waveform		State
	Size (LxWxH) – (mm)		State
	Transducer		
	Transducer type		State
	Transduction ring type		State
	Nominal applicable Anchor Rod Diameter (mm)		State
	Transducer type		State
	Transducer ring operating frequency range		State
	Transducer ring closing mechanism		State
	Transducer ring axial/radial clearances		State

Clause number	KPLC Requirements	Bidder's Offer
5	Test requirements	State
6	Marking and Packaging	
6.1	Marking	State
6.2	Packaging	State
7	Training	State
	Appendices	
A	Test and inspection	
A.1	Responsibility of carrying out tests	State
A.2	Copies of Type Test Reports submitted with tender for evaluation	Provide
	Copy of lab accreditation certificate to ISO/IEC 17025	Provide
A.3	Proof of NDT personnel certified to ISO 9712:2021 for testing lab	Provide
A.4	Routine and sample test reports/certificates to be submitted by supplier to KPLC for approval before shipment/delivery	Provide
A.5	Tests to be witnessed by KPLC Engineers at the factory	List
A.6	Inspection at the stores and replacement of rejected items	State compliance
B	Quality Management System	
B.1	Quality Assurance Plan	Provide
B.2	Copy of ISO 9001:2015 Certificate	Provide
C	Documentation	
C.1	Documents submitted with tender	Provide
C.2	Documents to be submitted by supplier to KPLC for approval before manufacture	Provide
C.3	Recommendations for use, care, storage and routine inspection/testing procedures	Provide
	Statement of compliance to specification (indicate deviations if any & supporting documents)	State compliance

.....

Manufacturer's Name, Signature, Stamp and Date

NOTE:

1. *Bidders shall give full details of the items on offer as per the specification and applicable standards. The details provided shall conform to the test reports and their certificates, as well as labelled drawings complete with dimensions, catalogues and/or brochures for the purpose of tender evaluation.*

2. *Bidders should note that the above Guaranteed Technical Particulars Schedules must be fully completed and submitted with the bid. Wherever there is conflict between the GTPs and the clauses in the specification, the clauses in the specification take precedence. Failure to complete the schedules shall lead to rejection of the bid.*

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

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