

**DOCUMENT NO.: KP1/13D/4/1/TSP/09/128**



**Kenya Power**

**BATTERY TEST SYSTEM  
— SPECIFICATION**

**A Document of the Kenya Power & Lighting Company Plc.**

**May 2024**





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**BATTERY TEST SYSTEM**  
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<b>Doc. No.</b>	KPI/13D/4/1/TSP/09/128
<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 1 of 15	

**TABLE OF CONTENTS**

01. Circulation List .....	2
02. Amendment Record .....	3
FOREWORD .....	4
1. SCOPE .....	5
2. REFERENCES .....	5
3. TERMS AND DEFINITIONS .....	5
4. REQUIREMENTS .....	6
4.1. SERVICE CONDITIONS .....	6
4.2. DESIGN AND CONSTRUCTION .....	6
4.3. WARRANTY AND SUPPORT .....	8
5. TESTS AND INSPECTION .....	8
6. MARKING AND PACKING .....	9
6.1. MARKING .....	9
6.2. PACKING .....	9
APPENDICES .....	10
APPENDIX A: TESTS AND INSPECTION (Normative) .....	10
APPENDIX B: QUALITY MANAGEMENT SYSTEM (Normative) .....	10
APPENDIX C: DOCUMENTATION AND DEMONSTRATION (Normative) .....	10
APPENDIX D: GUARANTEED TECHNICAL PARTICULARS (Normative) .....	12

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 2 of 15	

**01. Circulation List**



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

**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.

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Users are reminded that by virtue of Section 25 of the Copyright Act, 2001 (Revised 2014) Cap 130 of the Laws of Kenya copyright subsists in all KPLC standards and except as provided under section 26 of this act, no KPLC standard produced by KPLC may be reproduced, stored in retrieval system by any means without prior permission from the Managing Director & CEO, KPLC.

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 3 of 15	

**02. Amendment Record**

<b>Rev No.</b>	<b>Date (YYYY-MM-DD)</b>	<b>Description of Change</b>	<b>Prepared by (Name &amp; Signature)</b>	<b>Approved by (Name &amp; Signature)</b>
Issue 1 Rev 0	2024-05-28	New Issue	Rotich Benard	Dr. Eng. Peter Kimemia

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 4 of 15	

**FOREWORD**

This Specification has been prepared by the Standards Department in collaboration with the Quality Control Section, all of the Kenya Power and Lighting Company PLC (abbreviated as KPLC) and it lays down requirements for Battery Test System.

The Battery Test System is intended for use by the Quality Control Laboratory for measuring the capacity of batteries of up to 500V DC. The batteries covered are Lead-acid, Li-ion cell and Ni-based cells.

The specification stipulates the minimum requirements for Battery Test System acceptable for use in KPLC. It shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards, regulations and specifications in the manufacture of the Battery Test System for Kenya Power and Lighting Company PLC.

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

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

No	Name	Department
1.	Wesley Terer	Logistics, Supply chain
2.	Rotich Benard	Standards, IESR

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 5 of 15	

**1. SCOPE**

This specification covers Battery Test System for measuring the capacity of batteries of up to 500V DC. The batteries covered are Lead-acid, Li-ion cell and Ni-based cells.



**2. REFERENCES**

The following standards contain provisions, which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

- EN 61326-1: Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements;
- IEC 60529: Degrees of protection provided by enclosures (IP code)
- IEC 60896-11: Stationary lead-acid batteries- Part 11: Vented types - General requirements and methods of tests;
- IEC EN 61010-1: Electrical Laboratory Equipment Testing- Electrical safety testing
- IEEE 450-2010: IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications;
- IEEE 1106-2015: IEEE Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications;
- IEEE 1188-2005: IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications;
- ISO 9001: Quality Management systems – Requirements
- ISO/IEC 17025: General Requirements for the competence of testing and calibration laboratories

**3. TERMS AND DEFINITIONS**

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

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 6 of 15	

**4. REQUIREMENTS**

**4.1. SERVICE CONDITIONS**

The Battery Test System shall be suitable for continuous operation outdoors in tropical areas at:

- 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 “Heavy” (Pollution level III) for inland and “Very Heavy” (Pollution level IV) for coastal applications in accordance with IEC 60815.

**4.2. DESIGN AND CONSTRUCTION**

4.2.1. The Battery Test System shall be designed, manufactured and tested according to IEEE 450-2010, IEEE 1188-2005, IEEE 1106-2015, IEC 60896-11, IEC 60896-22, IEC EN 61010-1 and EN 61326-1.

4.2.2. The Battery Test System shall be capable of carrying out the following battery measurements:

- a) Capacity measurement test;
- b) String and cell voltage, cell (electrolyte)/ambient temperature, DC current measurement using current clamps;
- c) Simultaneous string voltage and DC current measurement;
- d) Bluetooth communication with external Density Meter.

4.2.3. The equipment shall be portable, rugged and lightweight, shock proof and impact resistant. The carrying case shall be able to withstand a fall of one meter without damage to the equipment.

**4.2.4. Test results:**

4.2.4.1. The Battery Test System shall generate test results automatically and display them on a built in LCD Screen.

4.2.4.2. The Battery Test System shall have inbuilt storage and printing/downloading capabilities of the test results.

4.2.5. The Battery Test System shall be suitable and safe for use in an energized switchyard condition.

4.2.6. The Battery Test System shall have stabilized output current such that no adjustments will be required.

4.2.7. The Battery Test System shall be powered by mains power - 230V 50Hz.

4.2.8. The Battery Test System shall be capable of suppressing electrical and magnetic interference.

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<b>Doc. No.</b>	KP1/13D/4/1/TSP/09/128
<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 7 of 15	

4.2.9. The Battery Test System shall have the technical particulars as shown in Table 1:

**Table 1: Technical particulars of Battery Test System**

Parameter	Requirement	
<b>1. Power Supply Adapter</b>	Input voltage	90-264 V 50HZ
<b>2. Internal Voltage Measurement</b>	Measurement range	0 – 500 V DC
	Display range	0 – 999.9 V DC
	Resolution	0.1 V or better
	Measurement Accuracy	± 0.5% of reading ± 0.1 V
<b>3. Internal Current Measurement</b>	Measurement range	0 – 300 A DC
	Display range	0 – 2 999.9 A DC
	Resolution	0.1 A
	Measurement Accuracy	± (0.5 % of reading + 0.1 A)
<b>4. Time Measurement</b>	Typical Accuracy	± 0.01 % of reading ± 1
<b>5. Input for current probe</b>	Range	0 – 1 V DC
	mV/A ratio	Software settable values: 0.3 to 100 mV/A
	Input impedance	> 1 MΩ
<b>6. Load section</b>	Battery Voltage	5.25 – 500 V DC
	Power	28.4 kW (max)
	Discharge Modes	Constant current/power/resistance
<b>7. Capacity</b>	Display Range	0 – 9999.9999 Ah
	Resolution	0.0001 Ah
<b>8. Protection</b>	Automatic overload protection	Overcurrent, overheat and overvoltage protection
	Thermal cut-outs	Emergency Stop button
<b>9. Display Size</b>	4.3-inch color touch screen display	
<b>10. Dimensions, Weight</b>	Approximately: 730 x 221 x 355 mm, 20.6 kg	
<b>11. Language</b>	English	

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 8 of 15	

Parameter	Requirement	
<b>12. Ingress Protection Class</b>	IP 20	
<b>13. Accessories for each Battery Test System</b>	<b>Description</b>	<b>Quantity</b>
	- Mains power cable	1
	- USB with DV-B Win PC software	1
	- USB cable	1
	- Ground (PE) cable	1
	- Transport case	1
	Current cables	2 x 3 m 35 mm <sup>2</sup> (2 AWG) with alligator clamps (A4) isolated
	Cable bag	2
	Cable for parallel operation	3 m
	Battery Voltage recorder with accessories for extended measurement range	String / Cell Voltage: ± 600 V DC Current / Intercell voltage: ± 1 V DC
	Sense cables 2 x 5 m with banana plugs + dolphin clip	1
Cable set 2 x 5 m 1 mm <sup>2</sup> (16.4 ft, 17 AWG) for simultaneous triggering	1	



**4.3. WARRANTY AND SUPPORT**

4.3.1. The Battery Test System shall be backed by a minimum of 24-months factory warranty.

4.3.2. Technical support and software upgrade, where applicable shall be provided free of charge to Kenya Power for a period of not less than 24 months.

**5. TESTS AND INSPECTION**

The Battery Test System shall be inspected and tested in accordance with applicable standards and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified. Tenderers shall confirm the manufacturer’s capabilities in this regard when submitting tenders. Any limitations shall be clearly specified.

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 9 of 15	

**6. MARKING AND PACKING**

**6.1. MARKING**

6.1.1. Each Battery Test System shall be legibly and permanently marked with the following information:



- a) Manufacturer's name or trade mark;
- b) The type reference number / model number;
- c) The serial number;
- d) Units of the measured quantity;
- e) Ranges of measurement;
- f) Type of battery and polarity of connection in the battery compartment;
- g) Standard of manufacture;
- h) Year of manufacture;
- i) The words '**PROPERTY OF KPLC**'.

**6.2. PACKING**

6.2.1. The Battery Test System shall be packaged in a carrying case to protect it from damage and entry of moisture during transportation, handling and storage.

6.2.2. The carrying case shall be shock proof and impact resistant and shall be able to withstand a fall of one meter without damage to the Battery Test System.

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Doc. No.	KP1/13D/4/1/TSP/09/128
Issue No.	1
Revision No.	0
Date of Issue	2024-05-28
Page 10 of 15	

**APPENDICES**

**APPENDIX A: TESTS AND INSPECTION (Normative)**



- A.1. 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 be submitted with the tender (all in English Language). Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority.
- A.2. Copies of Test Reports to be submitted shall include the following tests as per IEC 60383, ISO 1461 and relevant standards:
- (i) Measured values of the standard equipment
  - (ii) Indicated values of the unit under test (Battery Test System)
  - (iii) Expanded Relative uncertainty
  - (iv) Details of standard and reference equipment used in calibration tests.
- A.3. The Battery Test System shall be subjected to acceptance tests at the manufacturer’s premises before dispatch. Test certificates and calibration certificates for the Battery Test System to be supplied shall be submitted to KPLC for approval before shipment/delivery of the equipment
- A.4. On receipt of the Battery Test System, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The supplier shall replace/rectify without charge to KPLC, Battery Test System that upon examination, test or use fail to meet any of the requirements in this specification.

**APPENDIX B: QUALITY MANAGEMENT SYSTEM (Normative)**

- B.1. Supplier shall submit quality assurance plan (QAP) that shall be used to ensure that the Battery Test System material, manufacture, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations.
- B.2. The Manufacturer’s Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2015 certificate (or the Diamond Mark of Quality from Kenya Bureau of Standards) shall be submitted with the tender for evaluation.

**APPENDIX C: DOCUMENTATION AND DEMONSTRATION (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:



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Date: 2024-05-28	Date: 2024-05-28



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<b>Doc. No.</b>	KP1/13D/4/1/TSP/09/128
<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 11 of 15	

- a) Fully filled clause by clause guaranteed technical particulars (GTP) signed by the manufacturer;
  - b) Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions, Schematic Diagram and technical data;
  - c) Copies of required test/calibration reports of testing/calibrating laboratory accredited to ISO/IEC 17025;
  - d) Copy of accreditation certificate to ISO/IEC 17025 for the testing/calibrating laboratory;
  - e) Manufacturers letter of authorization, ISO 9001 certificate, and other technical documents required in the tender.
- C.2. The successful bidder (supplier) may submit the following documents/details to KPLC for approval before manufacture:
- a) Fully-filled clause by clause Guaranteed Technical Particulars (GTP) signed by the manufacturer, specific values shall be filled in. Terms like "Yes", "Agree", "Complied" **shall not be acceptable**;
  - b) 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 contract documents, standards, specifications and regulations.
  - c) Test Program to be used after manufacture,
  - d) Marking details and method to be used in marking the Battery Test System,
  - e) Manufacturer's undertaking to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards, regulations and specifications in the manufacture of the Battery Test System for KPLC,
- C.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the Battery Test System to KPLC stores.
- C.4. The successful bidder shall demonstrate to KPLC Staff (in Nairobi) the use of the Battery Test System.

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Doc. No.	KP1/13D/4/1/TSP/09/128
Issue No.	1
Revision No.	0
Date of Issue	2024-05-28
Page 12 of 15	

**APPENDIX 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, copies of complete type test reports and accreditation certificate to ISO/IEC 17025 for the third party testing laboratory for tender evaluation, all in English Language).*

**TENDER NO. .... BIDDER'S NAME & ADDRESS .....**

Clause number	Requirement	Bidder's offer		
Manufacturer's Name and address		State		
Country of Manufacture		State		
Name and model Number		State		
1.	Scope	State		
2.	Normative References	State		
3.	Definitions and Abbreviations			
3.1.	Abbreviations	State		
4.	<b>Requirements</b>			
4.1	Service Conditions	State		
4.2	<b>Design and construction</b>			
4.2.1	Standard of manufacture	State		
4.2.2	Measurement Capabilities	State		
4.2.3	Portability, Rugged and light weight	State		
4.2.4	<b>Test results</b>			
4.2.4.1	Shall generate test results automatically and display them on a built in LCD Screen	State		
4.2.4.2	Shall have built in storage and printing/downloading capabilities of the test results.	State		
4.2.5	Shall be suitable for use in an energized switchyard condition	State		
4.2.6	shall have stabilized output current such that no adjustments required	State		
4.2.7	Mains power voltage and frequency	State		
4.2.8	It shall be capable of suppressing electrical and magnetic interference	State		
4.2.9	<b>Technical particulars of Battery Test System</b>			
	<b>Description</b>	<b>Range</b>	<b>Requirement</b>	State
	1. Power Supply Adapter	Input voltage	90-264 V 50HZ	State
	2. Internal Voltage Measurement	Measurement range	0 – 500 V DC	State
		Display range	0 – 999.9 V DC	State
		Resolution	0.1 V or better	State

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<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 13 of 15	

3. <b>Internal Current Measurement</b>	Measurement Accuracy	± 0.5% of reading ± 0.1 V	State	
	4. <b>Time Measurement</b>	Measurement range	0 – 300 A DC	State
		Display range	0 – 2 999.9 A DC	State
		Resolution	0.1 A	State
		Measurement Accuracy	± (0.5 % of reading + 0.1 A)	State
	5. <b>Input for current probe</b>	Typical Accuracy	± 0.01 % of reading ± 1	State
		Range	0 – 1 V DC	State
		mV/A ratio	Software settable values: 0.3 to 100 mV/A	State
	6. <b>Load section</b>	Input impedance	> 1 MΩ	State
		Battery Voltage	5.25 – 500 V DC	State
		Power	28.4 kW (max)	State
	7. <b>Capacity</b>	Discharge Modes	Constant current/power/resistance	State
Display Range		0 – 9999.9999 Ah	State	
8. <b>Protection</b>	Resolution	0.0001 Ah	State	
	Automatic overload protection	Overcurrent, overheat and overvoltage protection	State	
	Thermal cut-outs	Emergency Stop button	State	
9. <b>Display Size</b>	4.3-inch color touch screen display		State	
10. <b>Dimensions, Weight</b>	Approximately: 730 x 221 x 355 mm, 20.6 kg		State	
11. <b>Language</b>	English		State	
12. <b>Ingress Protection Class</b>	IP 20		State	
13. <b>Accessories for each Battery Test System</b>	<b>Item</b>	<b>Quantity</b>		
	Mains power cable	1	State	
	USB with DV-B Win PC software	1	State	
	USB cable	1	State	
	Ground (PE) cable	1	State	
	Transport case	1	State	
	Current cables	2 x 3 m 35 mm <sup>2</sup> (2 AWG) with alligator clamps (A4) isolated	State	
Cable bag	2	State		

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Doc. No.	KP1/13D/4/1/TSP/09/128
Issue No.	1
Revision No.	0
Date of Issue	2024-05-28
Page 14 of 15	

		Cable for parallel operation	3 m	State
		Battery Voltage recorder with accessories for extended measurement range	String / Cell Voltage: $\pm$ 600 V DC Current / Intercell voltage: $\pm$ 1 V DC	State
		Sense cables 2 x 5 m with banana plugs + dolphin clip	1	State
		Cable set 2 x 5 m 1 mm <sup>2</sup> (16.4 ft, 17 AWG) for simultaneous triggering	1	State
4.3.	<b>Warranty and Support</b>			
4.3.1	Shall be backed by a minimum of 24-months factory warranty.			State
4.3.2	Shall provide free technical support and software upgrade To Kenya Power for a period of not less than 24 months.			State
5	<b>TEST AND INSPECTION</b>			
5.1	Test Requirement			State
6	<b>Marking &amp; Packing</b>			
6.1	<b>Marking</b>			
6.1.1	Marking (indicate parameters to be marked, method of marking & position of marking)			State
6.2.	<b>Packing</b>			
6.2.1	Packaging details			State
6.2.2	Carrying case shall be shock proof			State
	<b>APPENDICIES</b>			
A	<b>TESTS AND INSPECTION (Normative)</b>			
A.1	Copies of Type Test Reports, Valid Accreditation Certificate of Testing laboratory			Attach
A.2	Tests in the submitted test reports			List
A.3	Test to be witnessed by KPLC during FAT and equipment to carry out the tests			list
A.4	Inspection of stay Battery Test System s at KPLC stores and replacement of rejected stay Battery Test System s			Specify
B	<b>Quality Management System</b>			
B.1	Quality Assurance Plan			Provide
B.2	Copy of ISO 9001:2015 Certificate			Provide
C	<b>Documentation and demonstration</b>			

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<b>Doc. No.</b>	KP1/13D/4/1/TSP/09/128
<b>Issue No.</b>	1
<b>Revision No.</b>	0
<b>Date of Issue</b>	2024-05-28
Page 15 of 15	

C.1	Documents submitted with tender	State
C.2	Documents to be submitted by supplier to KPLC for approval before manufacture	State
C.3	Documents to be submitted during delivery at the store	Provide
C.4	Demonstration	State
	Statement of compliance to specification (indicate deviations if any & supporting documents)	State compliance

.....  
**Manufacturer's Name, Signature, Stamp and Date**

**\*\*Note**

*All guaranteed values **MUST** be clearly stated. Words like 'agreed', Yes; 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

**Issued by: Head of Section, Standards Development**

**Signed:**

**Date: 2024-05-28**

**Authorized by: Head of Department, Standards**

**Signed:**

**Date: 2024-05-28**