

DOCUMENT NO.: KP1/13D/4/1/TSP/14/021



Kenya Power

PRECISION DECADE RESISTANCE BOX — SPECIFICATION

A Document of the Kenya Power & Lighting Company Plc

October 2021



TITLE:
**PRECISION DECADE
RESISTANCE BOXES –
SPECIFICATION**

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0.1 CIRCULATION LIST

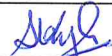

COPY NO.	COPY HOLDER
1	Manager, Standards
2	Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)

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.

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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)
0	2021-10-04	New issue	S. Nguli	Dr. Eng. Kimemia

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FOREWORD

This specification is prepared by the Standards Department in collaboration with Utility Consultancy department, both of the Kenya Power and Lighting Company Plc (KPLC) and it lays down requirements for the Precision Decade Resistance Box, for use in calibration of AC/DC equipment in the Meter Central Laboratory(MCL). It is intended for use by KPLC in purchasing these items.

The other specifications in this series are:

KP1/6C/4/1/TSP/14/015: Specification for portable class 0.2 three phase working standard for testing electrical meters.

KP1/6C/4/1/TSP/14/058: Specification Miniature Circuit Breaker Testing Bench.

KP1/13D/4/1/TSP/14/059: Three phase meter testing bench.

This specification stipulates the minimum requirements for the precision decade resistance box (PDRB) acceptable for use in the company. 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 in the manufacture of the PDRB for KPLC.

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

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

Name	Department
Patricia Ngaanga	Utility Consultancy
John Kenyanya	Utility Consultancy
Stephen Nguli	Standards
Rotich Benard	Standards

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1. SCOPE

- 1.1. This Specification is for the Precision Decade Resistance Boxes (PDRB) to be used for calibration purposes.
- 1.2. The specification stipulates the minimum requirements of the precision decade resistance box as well as schedule of Guaranteed Technical Particulars.

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 will apply; for undated editions, the latest edition of the referenced document shall apply.

- IEC 60115-1: 2020 Fixed resistors for use in electronic equipment
- IEC 60529 Degrees of protection provided by Enclosures (IP Code)
- IEC 60898-1:2015 Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation
- IEC 60898-2:2003 Circuit-breakers for overcurrent protection for household and similar installations - Part 2: Circuit-breakers for a.c. and d.c. operation
- IEC 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use -Part 1: General requirements
- IEC 61058-2-4:2003 Switches for Appliances-part 2-4 Particular requirements for independently mounted switches
- IEC 61140:2016 Protection against electric shock-common aspects for installation and equipment
- ISO 9001:2015: Quality management systems — Requirements

3. DEFINITIONS AND ABBREVIATIONS

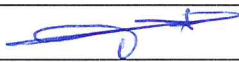
For the purpose of this specification the definitions given in the reference standards shall apply and the following abbreviations:

- IEC: International Electro-Technical Commission
- ISO: International Organization for Standardization
- LCD: Liquid Crystal Display
- KP: Kenya Power

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4. REQUIREMENTS

4.1. Service Conditions

The precision decade resistance box shall be suitable for use indoors in tropical areas and harsh climatic conditions including areas exposed to:

- At altitudes of up to 2200m above sea level and humidity of up to 95%,
- Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C.
- 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 Features

- 4.2.1. The PDRB external casing shall be made of a non-conducting material to protect the user against electrical shocks.
- 4.2.2. The PDRB shall be equipped with Ø 4mm safety terminals for connection and designed to international safety standard EN 61010-1
- 4.2.3. Each PDRB shall have seven (7) decades for full-scale resistance values.
- 4.2.4. The PDRB shall have clearly marked resistant values adjacent to each dial.
- 4.2.5. The PDRB shall have dials with an overlap position for fine-tuning values without the need to reset dials when passing through a decade point.
- 4.2.6. The PDRB shall have a modern compact design of high quality construction with high reliability.
- 4.2.7. The PDRB shall have a terminal to connect it to ground (Earth).
- 4.2.8. The PDRB shall have rotary switch selector with a stop position to prevent accidental switching from 10 to 0
- 4.2.9. The rotary switch shall be dust tight and have clear visual indication to make the setting and reading of the setting easy.
- 4.2.10. The individual switch shall be made of multiple solid silver contacts to minimize contact resistance.
- 4.2.11. The dimensions of PDRB shall be more or equal to L x W x H=(12x46x10) cm
- 4.2.12. The weight of the PDRB shall be less than 6 kg.

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4.2.13. The PDRB shall conform to the degree of protection IP54 as given in IEC 60529.

4.2.14. The PDRB body cover shall be constructed in a way to allow opening for routine maintenance activities and repairs.

4.3. **Functionality**

4.3.1. The PDRB shall have resistance ranges from 0 Ω to 10 TΩ. as outlined below.

No	RANGE	STEPS VALUE(Ω)
1	0 - 110kΩ	0.01
2	0 - 1MΩ	0.1
3	0 - 10MΩ	1.0
4	0 - 110MΩ	10
5	0 - 1GΩ	100
6	0 - 10GΩ	1000
7	0 - 110GΩ	10,000
8	0 - 1TΩ	100,000
9	0 - 10TΩ	100,000

4.3.2. The accuracy of PDRB shall equal or better than $\pm 0.1\%$.

4.3.3. The PDRB shall have a temperature coefficient less than 5 ppm/°C.

4.3.4. The PDRB shall have a zero resistance less than 1 mΩ/decade.

4.3.5. The PDRB shall have a zero resistance of $0.0015 \pm 0.0005 \Omega$ per decade after settling of contacts.

4.3.6. The decade resistors of the PDRB shall be switched in a series circuit.

4.3.7. The PDRB shall have the value of the resistances totaling up to the resistance of the unit.

4.3.8. The PDRB shall have a breakdown voltage of 1500 volts to case.

4.4. **Accessories**

The accessories associated with the PDRB shall be provided and the associated lead sets.

5. **TESTS REQUIREMENTS**

The PDRB shall be inspected and tested in accordance with the requirements of IEC 60115-1:2020 and other relevant standards and provisions of this specification.

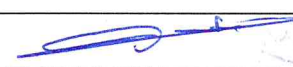
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6. MARKING, LABELLING AND PACKING

6.1. Marking

The precision decade resistance box shall be marked legibly and indelibly in English with the following information:

- a) Name or trade mark of the manufacturer;
- b) Country of origin;
- c) Type/model;
- d) Serial no;
- e) The inscription "Property of K.P. & L. Co Ltd."
- f) Year of manufacture.

6.2. Packing

The PDRB shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.

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APPENDICES

A. TESTS AND INSPECTION (Normative)


- A.1 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.
- 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 to ISO/IEC 17025 for the testing laboratory shall also be submitted. Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Laboratory that carried out the tests.
- A.3 The precision decade resistance box shall be subject to acceptance tests at the manufacturer's premises before dispatch. Acceptance tests shall be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Plc (KPLC). Tests and test conditions and acceptance tests shall be as specified in IEC 60898-1:2015
- A.4 **Testing Facility**
- A.4.1 The bidder shall provide current e-mail address, fax and telephone numbers and contact person at the Testing Laboratory where Type Tests and Special Tests were carried out.
- A.4.2 All test and measuring equipment to be used during acceptance testing shall have been calibrated and copies of valid calibration certificates shall be provided to KPLC Engineers. A detailed list of workshop tools, test/measuring equipment and list of tests that can be carried out by the manufacturer shall be submitted with the tender for evaluation.
- A.5 Test reports for the PDRB shall be submitted to The Kenya Power and Lighting Company for approval before shipment.
- A.6 During delivery of the PDRB, KPLC will inspect the items 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, failure of the PDRB to meet any or all of the requirements in the specification.

B. QUALITY MANAGEMENT SYSTEM (Normative)

- B.1 The bidder shall submit a quality assurance plan (QAP) that will be used to ensure that the precision decade resistance box design, material, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2015
- B.2 The Manufacturer's Declaration of Conformity to applicable standards, this specification and copies of quality management certifications including copy of valid and relevant ISO 9001:2015 certificate shall be submitted with the tender for evaluation.
- B.3 The bidder shall indicate the delivery time of the PDRB. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture

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for exact or similar PDRB sold in the last five years shall be submitted with the tender for evaluation.

C. WARRANTY

- C.1. The supplier/manufacturer warrants the purchaser that all goods supplied under this contract shall have no defect arising from design, materials or workmanship.
- C.2. A warranty of 60 months from the date of delivery of the PDRB to Kenya Power store shall be offered by the manufacturer.

D. DOCUMENTATION AND DEMONSTRATION (Normative)

- D.1 The bidder shall submit its tender complete with technical documents required by Appendix D (Guaranteed Technical Particulars) for tender evaluation. The 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 by the manufacturer,
 - b) Copies of the manufacturer's catalogues, brochures, precision decade resistance box drawings and wiring diagrams and technical data showing description leaflet, programming details and manuals,
 - 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 certificates and 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) Manufacturer's warranty and guarantee; subject to 36 months from date of delivery to KPLC laboratory.
 - h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2015 certificate, ISO 17025:2017 certificate.
- D.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 (GTP) signed by the manufacturer,
 - b) Design drawings and wiring diagrams of the PDRB
 - c) Original software, software manuals and operation manuals shall be submitted,
 - d) 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

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QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2015 or later,

- e) Detailed test program to be used during factory testing,
- f) Marking details and method to be used in marking the PDRB.
- g) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the PDRB for The Kenya Power & Lighting Company,
- h) Packaging details (including packaging materials).

D.3 The successful bidder and manufacturer shall demonstrate at their cost to at least two KPLC staff at the manufacturers factory.

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E. 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 requirement	Bidder's offer
	Manufacturer's Name and address	Specify
	Country of Manufacture	Specify
	Bidder's Name and address	Specify
1.0	Scope	Specify
2.0	Manufacturing Standard(s)	List
3.0	Definitions and abbreviations	Specify
4.1	Service conditions	state
4.2.1	External casing material for the PDRB	specify
4.2.2	Diameter of safety terminals and applicable standards	Specify
4.2.3	No. of decades full scale resistors per PDRB	specify
4.2.4	Marking of resistor(s) value	State
4.2.5	Provision of dials with overlap positions for tuning	specify
4.2.6	Type of design of the PDRB	specify
4.2.7	Provision for grounding	specify
4.2.8	Type of selector switch and provision of limit pointers	specify
4.2.9	The switch to be dust tight with clear visual indicators	specify
4.2.10	Material of manufacture of contacts	specify
4.2.11	Dimensions of PDRB	state
4.2.12	Weight of PDRB	State
4.2.13	Degree of protection and compliant standard	State
4.2.14	Instructions for routine maintenance and repairs	To provide
4.3.1	PDRB resistance values	specify
4.3.2	PDRB accuracy	state

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Clause number	KPLC requirement	Bidder's offer
4.3.3	PDRB temperature coefficient	state
4.3.4	PDRB zero resistance value	State
4.3.5	PDRB zero resistance after setting of contacts	state
4.3.6	Mode of decade resistor switching	specify
4.3.7	Summation of the PDRB resistance	specify
4.3.8	PDRB breakdown voltage, volts	specify
4.4	Accessories of PDRB	list
5	Standard of manufacture and Tests of PDRB	State
6.1	Marking ,	specify
6.2	Packing	
A	TESTS AND INSPECTION (NORMATIVE)	
A.1	Test standard(s)	state
A.2	Type test certificates submitted with tender for evaluation and tests covered	State/List
A.3	Copies of previous type test and routine test reports by the relevant independent /international testing laboratory submitted.	List
	Valid Accreditation Certificate of the Testing Laboratory as per ISO/IEC 17025:2017	Attach/ List
	Routine test to be witnessed at the factory by KPLC engineers	
A.4.1	Current E-mail and address, fax and telephone number and contact person at the Testing laboratory	provide
A 4.2	Valid calibration of equipment to use during laboratory testing/ FAT	To provide
A.5	Test reports to be submitted to KPLC before delivery	
A.6	Inspection at KPLC stores and supply to replace/rectify without charge to KPLC the whole or part of the consignment that does not meet the requirements of the specification	
	QUALITY MANAGEMENT SYSTEM	
B1	Submit QAP for the cable manufacturing	Attach
B2	Copy of valid ISO 9001: 2015 certificate	Attach

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Clause number	KPLC requirement	Bidder's offer
B3	Manufactures lead in time, monthly & annual production capacity. Experience in the production of the type and model of PDRB being offered.	State
	A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar rating of cables sold in the last five years as well as reference letters from at least four of the customers	List
C	Warranty	
C.1.	Warranty that goods are new and without defects	provide
C.2.	Warranty period	State
D	DOCUMENTATION	
D.1.	Technical documentation submitted with tender bid	List
D.2	Documents to be submitted Kenya Power for approval before manufacture/supply	State
D.3	Submit recommendations for use, detailed user's installation guide, etc. during delivery	State

****Note**

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

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

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