DOCUMENT NO.: KP1/13D/4/1/TSP/14/059-1

Kenya Power

SINGLE PHASE METER TESTING BENCH - SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc

March 2025

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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.

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue1 Rev 0	2025-03-11	New Specification	Eng. J. Ndirangu	Dr. Eng. P. Kimemia

FOREWORD

This Specification has been prepared by the Standards Department in collaboration with Meter Central laboratory, both of The Kenya Power and Lighting Company Plc (KPLC) and it lays down requirements for the single phase meter testing bench, for use in testing of single phase meters in the Meter Central Laboratory. 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: Miniature Circuit Breaker (MCB) Testing Bench — Specification Bench

KP1/13D/4/1/TSP/14/059: Three phase Meter Testing Bench - Specification

This specification stipulates the minimum requirements for the single phase meter testing bench 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 testing bench for KPLC.

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

Name	Division
Patricia Ngaanga	IESR
John Kenyanya	IESR
Eng. Julius Ndirangu	IESR

1. SCOPE

1.1. This specification is for a stationary single phase meter testing bench.

1.2. The specification stipulates the minimum requirements of the single phase meter testing bench as well as schedule of Guaranteed Technical Particulars.

2. NORMATIVE REFERENCES

The following standards contain provision 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 62057-1:2023	Electrical energy meters - Test equipment, techniques and procedures - Part 1: Stationary meter test units (MTUs)
IEC62058-31	Electricity metering equipment (AC) - Acceptance inspection - Part 31: Particular requirements for static meters for active energy (classes 0.2s, 0.5s, 1 and 2)
IEC 62053-21	Electricity metering equipment – Particular requirements – Part 21: Static meters for AC active energy (classes 0.5, 1 and 2)
IEC 62053-22	Electricity metering equipment – Particular requirements – Part 22: Static meters for AC active energy (classes 0.1S, 0.2S and 0.5S)

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
KPLC:	Kenya Power and Lighting Co. Plc

LED	Light Emitting Diode

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

The single phase meter testing bench shall be suitable for use indoors in tropical areas and harsh climatic conditions including areas exposed to:

Altitude: From sea level up to 2200m above mean sea level.

Humidity: Humidity of up to 95%;

Temperatures: Average ambient temperature of +35°C with a minimum of -1°C and a maximum of +45°C.

Pollution: Pollution level III

4.2. DESIGN FEATURES

4.2.1. The Single Phase Meter Testing Bench shall have the rack and power source parts as separate components. Only the electrical connections/cables will be with the rack.

4.2.2. The electrical connections/cables from power source to the rack shall be bundled neatly.

4.2.3. The test bench shall have double side rack with two rows to suspend the meters

4.2.4. The Single Phase Meter Testing Bench shall have 40 testing positions, 20 on each side.

4.2.5. The dimensions of the rack shall NOT be more than (W x L x H) 150cmX 240cm X 200cm

4.2.6. The degree of protection of the power source enclosure shall be IP51.

4.2.7. The Single Phase Testing Bench shall be made of aluminum alloy material, light and strong, corrosion resistant

4.2.8. The testing bench shall have wheels for movement and shall be able to be fixed at a stationary position (caster and brake).

4.2.9. The testing bench shall be fitted with working tables on both sides 80cm from ground with dimensions of L=size of the rack and W=45cm

4.2.10. The height of lower test terminals (meter connection) from ground shall **NOT** be less than 90 cm

4.2.11. The test bench shall have adjustable testing positions for testing of the various sizes of meters during testing.

4.2.12. The Single Phase Testing Bench shall test energy meters with phase- and neutral circuit measurement elements

4.2.13. The Single phase Testing Bench shall have quick connectors with adjustable 4 pins to test with current in phase or current in neutral without changing the wiring.

4.2.14. The test bench terminals (pins) shall be made of brass (Copper and zinc alloy) and arrangement shall be LNNL (Live in Neutral in Neutral out Live out).

4.2.15. The bench shall test meters even when one position is vacant through isolation via software.

4.2.16. The adjustment of the testing position shall be by Allan keys not screws.

4.2.17. The test bench shall have two (2) mains sockets (240V AC). It shall also have two (2) emergency stop buttons to stop the test in the event of a fault.

4.2.18. The test bench shall be directly connected to the mains power supply of 3 x 240/415 V ± 10 % and frequency of 50 Hz ± 2%.

4.2.19. The Single Phase Testing Bench shall have protection for: over voltage, short circuits, overloads and open current circuits. It shall also have an inbuilt voltage stabilizer

4.2.20. The test bench shall be equipped at the top of the rack with status lamps as follows;

Red: On (bench during testing mode)

Yellow: Alarm

Green: Off (bench on standby mode)

4.2.21. The test bench rack shall have error display for each measurement position with its own error calculator.

4.2.22. The error calculator shall have switchable input for RS485

4.2.23. Each measurement position shall have LED display of the meter error 6-digit with floating decimal point.

4.2.24. The single Test Bench shall contain multi-channel MSVT (Multi-secondary Voltage Transformer) of class 0.05 or higher to test Single-Phase meters with closed links between the current and Voltage measuring circuits

4.2.25. The test bench shall have scanning head with swing facility on each measurement position mounted on a fixing device for easy positioning in all 3 axes. All scanning heads shall be mounted on a common rail and have facility to lift away from the meter in case of meter change.

4.2.26. The scanning heads shall be able to scan rotor marks and LEDs of electronic meters as well Infrared diodes

4.2.27. The power source shall consist of current- and voltage amplifiers, waveform controller, reference standard and server for communication.

4.2.28. The reference standard shall be connected direct to the primary test circuit to assure that the system accuracy is related to the reference standard accuracy.

4.2.29. The test bench standard meter shall be of accuracy class 0.05 or higher with screen display.

4.2.30. The Single Phase Test Bench reference Standard shall have a 2 wire active measuring mode (1P 2W)

4.2.31. The power source shall be protected against over & under voltage, surge, thermal and earth leakage

4.2.32. The power source shall be controlled by the computer through software.

4.2.33. The power source shall communicate with a computer through both wireless WIFI (Router) without internet and RS232. The connection from RS232 to computer shall be via USB/Ethernet port.

4.2.34. The power source shall consist of current- and voltage amplifiers, waveform controller, reference standard and server for communication.

4.2.35. The voltage amplifiers shall have protection against short circuit, overload and overheating.

4.2.36. The voltage amplifiers type shall be of switch mode type.

4.2.37. The current amplifiers shall have protection against open circuit, overload and overheating.

4.2.38. The controller shall have protection against Under-voltage and over voltage (3x240 /415V±10%)

4.2.39. The Single Phase Testing Bench shall have a hand held unit with blue tooth connection. The hand held unit shall have a barcode scanner for scanning meter serial numbers during testing.

4.2.40. The ratings for the controller, voltage amplifier, current amplifier, reference standard, scanning head and multi secondary voltage transformer shall be as per Table 1(a) to 1(f).

Table 1: Ratings

1(a) Controller

Item	Value
Frequency for test circuit	40 Hz – 70 Hz
Adjustable in steps of	0.001 Hz
Test voltage settings, ph-N	Ph-N 0 V – 380 V
Test current settings	1 mA – 120 A
Phase adjustment	0…360°
Adjustment in steps of	0.01°
Harmonics in voltage	2nd – 21st, max. magnitude 40% of the fundamental wave
Harmonics in current	2nd – 40th, max. magnitude 40% of the fundamental wave

1(b) Voltage Amplifier

Item	Value
Test voltage	0 ... 480 V
Voltage ranges	57.7 V, 100 V, 220 V, 380 V,400 V
Adjustment	0%...120% of range
Accuracy of the test amplitude	< 0.05%
Accuracy of the test phase adjustment	< ± 0.01°
Efficiency	> 85%
Stability of the output settings	< 50 ppm , ti = 60 s
Distortion	< 0.5%

Item	Value
Superposition of harmonics	2^{nd}…40^{th} , max 40% of fundamental
Harmonics phase shift	0°…360°
Output power	1500 VA per phase
Frequency	40…70 Hz

1(c) Current Amplifier

Item	Value
Current:	1 mA – 120 A
Current ranges:	10 mA, 25 mA, 50 mA, 100 mA, 0.25 A, 0.5 A, 1 A, 2.5 A, 5 A, 10 A, 25 A, 50 A, 100 A, 200 A
Adjustment:	0%...120% of range
Accuracy of the test amplitude:	0.05%
Accuracy of the test phase adjustment:	0.01°
Efficiency:	> 85%
Stability of the output settings:	< 100 ppm, ti = 60 s
Distortion:	< 0.5 %
Superposition of harmonics:	2^{nd}…40^{th}, max 40% of fundamental
Harmonics phase shift:	0°…360°
Output power	2,500 VA

1(d) Reference Standard

Mains input	
Item	**Value**
Voltage:	85 V…265 V AC
Frequency:	40 Hz…70 Hz
Operating temperature	-1 °C … 45 °C
Power consumption:	< 30 VA
Preheating time:	15 minutes
Max. relative humidity:	≤ 90 %, not condensing
Surge voltage protection:	class C

Measurement values	
Item	**Value**
Test voltage, phase-neutral	10V…576 V
Voltage ranges	60 V, 120 V, 240 V, 480 V, auto range
Test current	1 mA…160 A
Current ranges	10 mA, 20 mA, 50 mA, 0.1 A, 0.2 A, 0.5 A, 1 A, 2 A, 5 A, 10 A, 20 A, 50 A, 100 A, 200 A auto range
Frequency range, fundamental wave:	15 Hz….70 Hz
Bandwidth:	3500 Hz
Voltage measurement accuracy:	< 0.01%
Voltage measurement drift:	< 35 ppm/year
Current measurement accuracy < 25mA:	< 0.02%
Current measurement accuracy ≥ 25mA:	< 0.01%
Current measurement drift:	< 65 ppm/year
Power measurement accuracy P, Q, S:	< 0.02% (current ≥ 25 mA and λ = 1)
Power measurement drift:	< 100 ppm
Phase angle:	< 0.01° (current ≥ 25 mA and voltage >30 V)
Frequency:	0.005 Hz
Voltage temperature drift:	< 2,5 ppm/K
Current temperature drift:	< 5 ppm/K
Power temperature drift:	< 7.5 ppm/K

1(e) Scanning Head

Item	Value
Wavelength	450 nm …1050 nm
Max. frequency, unmodulated	2 kHz
Dark to light change	max. 20 µs
Light to dark change	max. 20 µs
Pulse width	min. 0.2 ms
Operating voltage	6 V … 25 V DC

Item	Value
Operating current	≤ 70 mA (DC 24 V)
Power	0.5 W (no load)
Scanning distance	10 mm …40 mm
Output signal, high	≥ 4.5 V
Output signal, low	≤ 0.2 V
Output current	3.5 mA … 4 mA
Anti-interference distance	≤ 3.0 mm
Sensitivity, artificial light	≤ 1000 lx
Sensitivity, outdoor	≤ 1500 lx
Protection class as per IEC 61010-1	IP51

1(f) Multi Secondary Voltage Transformer

Item	Value
Primary frequency	45 Hz – 60 Hz
Range of secondary burden	4 VA – 15 VA
Accuracy Error prim/sec	≤ ± 0.1%
Phase Error prim/sec	≤ ± 2 min
Accuracy Error sec/sec (within burden range)	≤ ± 0.05%
Phase Error sec/sec (within burden range)	≤ ± 1 min

4.3. FUNCTIONALITY

4.3.1. The Single Phase Test Bench shall be able to test meters of different brands and meter Constants at the same time

4.3.2. Each test position shall be independently controlled by a computer.

4.3.3. The Single Phase Test Bench shall test single phase meters by way of automatic and manual operation

4.3.4. The Single phase Test Bench shall test din rail single phase meters with measuring elements on both phase and neutral circuits through connection cables.

4.3.5. The Single Phase Test Bench shall have extremely high power stability

4.3.6. The Single Phase Test Bench shall test meters with measuring elements on both phase and neutral circuits without changing the wiring.

4.3.7. The Single Phase Test Bench shall be able to perform the following tests both on phase and neutral circuits as per IEC62052-11:2020 standard.

a) Meter constant, IEC62052–11 clause 7.4
b) Initial startup of the meter, IEC62052-11 clause 7.5
c) Test of no load condition, IEC62052-11 clause 7.6
d) Starting current test, IEC62052-11 clause 7.7
e) Repeatability test, IEC62052-11 clause 7.8
f) Limits of error due to variations of current IEC62052-11 clause 7.9
g) Limits of error due to influence of quantiles IEC62052-11 clause 10

4.4. COMPUTER AND SOFTWARE REQUIREMENTS

4.4.1. The test bench shall be supplied with one desktop computer, loaded with operating software in English language as 7 in Table 2.

Table 2: Minimum Specifications for Desktop Computer and Software.

Parameter	Value
Processor (CPU)	Intel Core i7 or higher
Operating System	Licensed Microsoft Windows 11 or newer
Memory	8 GB RAM or higher
Storage	1 TB internal HDD, DVD-RW
Monitor/Display	24" LED monitor

Parameter	Value
Accessories	Keyboard, Mouse, Printer
Interfaces	USB port with RS232 adapter and Bluetooth, Ethernet
Software	i) Latest Microsoft Office ii) Microsoft Internet Explorer > version 8, PDF reader software (e.g. Acrobat Reader) iii) Test application software compatible with Windows 11 or newer

4.4.2. The operating system shall be licensed Microsoft Windows 11 or higher.

4.4.3. The Microsoft operation system and software shall NOT require additional licenses for the life time of the test bench. The licenses shall be non –expiry.

4.4.4. The test application software shall be used for controlling the meter test equipment and related devices in accordance with IEC 62052-11:2020.

4.4.5. The software shall display the progress of the test being carried out.

4.4.6. The software shall display the actual testing values.

4.4.7. The software shall display error / results for each position.

4.4.8. The software shall be able to determine and display in a bar graph the individual error per load point and position for each test

4.4.9. The software application shall be capable of running in multiple screen mode. For example, screen one to show the test results and ongoing testing process while screen two provide all information regarding the settings (actual values, phasor diagram, and harmonics analysis).

4.4.10. The software shall test all types of electronic and electromechanical energy meters.

4.4.11. The software shall allow generation of Test plans for individual meters. The number of tests per test plan shall be unlimited.

4.4.12. The software shall do the following tests complete automatically;

(i) Pre-warming

(ii) No-load test

(iii) Starting test

(iv) All kind of accuracy tests related to variation of current

(v) Register and meter constant tests

(vi) Voltage variation tests

(vii) Frequency variation tests

(viii) Reverse current tests

(ix) Accuracy tests in the presence of harmonics

(x) Influence of self-heating

(xi) Thermal Stability verification

4.4.13. The software shall clearly indicate complete test plan and provide a summary indicating pass or fail of each position and the test point.

4.4.14. Access to meter test system information shall only be through user-level password(s).

4.4.15. The software shall support 3 access levels:

a) Low level security - The level of security would allow users with the appropriate password to read specified data fields in the test bench.

b) Medium level security - The level of security would allow users with the appropriate password to perform specified tests.

c) High level security - The level of security would allow users with the appropriate password to reconfigure the test bench with a new program or test plans.

4.4.16. The software shall be capable of tracking user access to the test bench.

4.4.17. The software shall have troubleshooting capability to identify a fault in the system and indicate its location.

4.4.18. The software shall save test results automatically in a format that cannot be edited and assign them a unique number

4.4.19. The software shall store test results in files with individual meter search/query facility.

4.4.20. The stored results shall be available for online review in HTML format and printable in PDF.

4.4.21. The software shall allow customization of the test reports (e.g. utility log, name, date, tester) and to exporting of the test results for analysis in excel and other formats.

4.4.22. The software shall allow for retrieval and printing of the results.

4.4.23. The software shall be able to indicate traceability i.e. reference serial no, calibration certificate number and date of calibration

4.5. SUPPLY VOLTAGE

The test bench shall be operated from a three mains power supply according to EN 50160 3x240/415 V ±10%, 50 Hz.

4.6. ACCESSORIES

The test bench shall be supplied complete with all the necessary cable accessories and consumable spare parts at no additional cost to KPLC. The accessories shall be as shown in Table 3.

Table 3: Accessories and Spare Parts

Description	Quantity
Connection cables between the power source cabinet and the test stands	1 set
Connection cables between the PC system and the power source	1 set
Connection cables between the power supply and the power source cabinet	1 set
Multi core flexible Cable for testing of din rail meters- red cable length 60cm	80pcs

Description	Quantity
One side safety plug flat, other side safety terminal with 2 adjusting screws	
Multi core flexible Cable for testing of din rail meters- black cable length 60cm One side safety plug flat, other side safety terminal with 2 adjusting screws	80 pcs
Allen key opener	1pc
RS485 signal cables	40 pcs
All other necessary accessories for commissioning the test bench	
SPARE PARTS	
Testing terminals	40
Scanning heads	10

5. TESTS REQUIREMENTS

The test bench shall be inspected and tested in accordance with the requirements of IEC 62057-1:2023and other relevant standards and provisions of this specification.

6. MARKING, LABELLING AND PACKING

6.1. The test bench 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 number;

e) The inscription "Property of K.P. &. L. Co Plc."

f) Date, Month and Year of manufacture.

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

6.3. The packaging shall include the test bench calibration certificate/s of all various parts. Each test data shall include the corresponding Uncertainty budget values.

7. INFORMATION AND WARRANTY

7.1. The test system shall be guaranteed by warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of at least sixty (60) months from the date of delivery and commissioning. All defects arising during the warranty period shall be repaired or parts replaced at the supplier's cost.

7.2. All software supplied shall be updated by the supplier at no extra cost during the warranty period and afterwards. The licences shall be non-expiring.

7.3. The successful bidder and /or manufacturer shall install, test and commission the single phase meter testing bench. Additionally, they shall, at no extra cost to KPLC, carry out technical training on the operation, maintenance and calibration of the test bench after delivery to at least fifteen (15) KPLC staff and confirm their competency on use of the test system. The training shall cover but not be limited to:

a) Equipment installation;

b) Equipment features and operation

c) Equipment software;

d) Equipment configuration and data downloading and saving, etc

e) Equipment maintenance calibration

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 on the test bench in accordance with IEC 62057-1:2023 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 valid accreditation certificate to ISO/IEC 17025:2017 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 test bench shall be subject to acceptance tests at the manufacturer's premises before dispatch. Acceptance tests shall be witnessed by at least two Engineers appointed by The Kenya Power and Lighting Company (KPLC).

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 Routine and Type Test reports for the test bench shall be submitted to The Kenya Power and Lighting Company for approval before shipment.

A.6 During delivery of the test bench, 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, the single phase meter testing bench or any of its parts which upon examination, test or use fail to meet any or all of the requirements in this 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 test bench 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 certificates shall be submitted with the tender for evaluation.

B.3 The bidder shall indicate the delivery time of the test bench. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for exact or similar test bench sold in the last five years shall be submitted with the tender for evaluation.

C. DOCUMENTATION AND DEMONSTRATION (Normative)

C.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, test bench 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 60 months from date of commissioning at KPLC laboratory.

h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2015 certificate or ISO 17025:2017 certificate.

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

i. Fully filled clause by clause Guaranteed Technical Particulars (GTP) signed by the manufacturer,

ii. Design drawings and wiring diagrams of the test bench,

iii. Original software, software manuals and operation manuals shall be submitted,

iv. 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 9001:2008 or later,

v. Detailed test program to be used during factory testing,

vi. Detailed commissioning and training program.

vii. Marking details and method to be used in marking the test bench,

viii. 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 test bench for The Kenya Power & Lighting Company.

ix. Packaging details (including packaging materials).

C.3 The successful bidder and manufacturer shall demonstrate at their cost to at least two KPLC staff at the manufacturer's factory.

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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 requirement		Bidder's offer
Manufacturer's Name and address			State
Country of Manufacture			State
Bidder's Name and address			State
1	Scope	Stationary single phase meter testing bench	State
2	**Normative References**	IEC 62057-1:2023, IEC62058-31, IEC 62053-21, IEC 62053-22	State
3	**Definitions and Abbreviations**		State
4	**REQUIREMENTS**		
4.1	**SERVICE CONDITIONS**		
	i. Altitude: From sea level up to 2200m above mean sea level. ii. Humidity: Humidity of up to 95%; iii. Temperatures: Average ambient temperature of +35°C with a minimum of -1°C and a maximum of +45°C. iv. Pollution: Pollution level III		State

4.2	**DESIGN FEATURES**	
4.2.1.	Single Phase Meter Testing Bench shall have the rack and power source parts as separate components. Only the electrical connections/cables will be with the rack	State
4.2.2.	Electrical connections/cables from power source to the rack shall be bundled neatly	State
4.2.3.	Test bench shall have double side rack with two rows to suspend the meters	State
4.2.4.	Single Phase Meter Testing Bench shall have 40 testing positions, 20 on each side	State
4.2.5.	Dimensions of the rack shall NOT be more than (W x L x H) 150cm x 240cm x 200cm	State
4.2.6.	The degree of protection of the power source enclosure shall be IP51	State
4.2.7.	Single Phase Testing Bench shall be made of aluminum alloy material, light and strong, corrosion resistant	State
4.2.8.	The testing bench shall have wheels for movement and shall be able to be fixed at a stationary position (caster and brake)	State
4.2.9.	The testing bench shall be fitted with working tables on both sides 80cm from ground with dimensions of, L=size of the rack and W=45cm	State
4.2.10	Height of lower test terminals (meter connection) from ground shall **NOT** be less than 90 cm	State
4.2.11	Test bench shall have adjustable testing positions for testing of the various sizes of meters during testing	State
4.2.12	The Single Phase Testing Bench shall test energy meters with phase- and neutral circuit measurement elements	State
4.2.13	The Single phase Testing Bench shall have quick connectors with adjustable 4 pins to test with current in phase or current in neutral without changing the wiring	State
4.2.14	Test bench terminals (pins) shall be made of brass (Copper and zinc alloy) and arrangement shall be LNNL (Live in Neutral in Neutral out Live out).	State
4.2.15	Bench shall test meters even when one position is vacant through isolation via software	State
4.2.16	Adjustment of the testing position shall be by Allan keys not screws	State
4.2.17	Test bench shall have two (2) mains sockets (240V AC). It shall also have two (2) emergency stop buttons to stop the test in the event of a fault	State
4.2.18	Test bench shall be directly connected to the mains power supply of 3 x 240/415 V ± 10 % and frequency of 50 Hz ± 2%	State
4.2.19	The Single Phase Testing Bench shall have protection for: over voltage, short circuits, overloads and open current circuits. It shall also have an inbuilt voltage stabilizer	State

4.2.20	Test bench shall be equipped at the top of the rack with status lamps as follows: i. Red: On (bench during testing mode) ii. Yellow: Alarm iii. Green: Off (bench on standby mode)	State
4.2.21	Test bench rack shall have error display for each measurement position with its own error calculator	State
4.2.22	Error calculator shall have switchable input for RS485	State
4.2.23	Each measurement position shall have LED display of the meter error 6-digit with floating decimal point	State
4.2.24	Test Bench shall contain multi-channel MSVT (Multi-secondary Voltage Transformer) of class 0.05 or higher to test Single-Phase meters with closed links between the current and Voltage measuring circuits	State
4.2.25	Test bench shall have scanning head with swing facility on each measurement position mounted on a fixing device for easy positioning in all 3 axes. All scanning heads shall be mounted on a common rail and have facility to lift away from the meter in case of meter change	State
4.2.26	Scanning heads shall be able to scan rotor marks and LEDs of electronic meters as well Infrared diodes	State
4.2.27	Power source shall consist of current- and voltage amplifiers, waveform controller, reference standard and server for communication	State
4.2.28	Reference standard shall be connected direct to the primary test circuit to assure that the system accuracy is related to the reference standard accuracy	State
4.2.29	Test bench standard meter shall be of accuracy class 0.05 or higher with screen display	State
4.2.30	Test Bench reference Standard shall have a 2 wire active measuring mode (1P 2W)	State
4.2.31	Power source shall be protected against over & under voltage, surge, thermal and earth leakage	State
4.2.32	Power source shall be controlled by the computer through software	State

4.2.33	Power source shall communicate with a computer through both wireless WIFI (Router) without internet and RS232. The connection from RS232 to computer shall be via USB/Ethernet port	State
4.2.34	Power source shall consist of current- and voltage amplifiers, waveform controller, reference standard and server for communication	State
4.2.35	Voltage amplifiers shall have protection against short circuit, overload and overheating	State
4.2.36	Voltage amplifiers type shall be of switch mode type	State
4.2.37	Current amplifiers shall have protection against open circuit, overload and overheating	State
4.2.38	The controller shall have protection against Under-voltage and over voltage (3x240 /415V±10%)	State
4.2.39	The Single Phase Testing Bench shall have a hand held unit with blue tooth connection. The hand held unit shall have a barcode scanner for scanning meter serial numbers during testing	State
4.2.40	The ratings for the controller, voltage amplifier, current amplifier, reference standard, scanning head and multi secondary voltage transformer shall be as per Table 1(a) to 1(f)	State

Table 1: Ratings

1 (a) Controller

Item	Value	
Frequency for test circuit	40 Hz – 70 Hz	State
Adjustable in steps of	0.001 Hz	State
Test voltage settings, ph-N	Ph-N 0 V – 380 V	State
Test current settings	1 mA – 120 A	State
Phase adjustment	0…360°	State

	Adjustment in steps of	0.01°	State
	Harmonics in voltage	2nd – 21st, max. magnitude 40% of the fundamental wave	State
	Harmonics in current	2nd – 40th, max. magnitude 40% of the fundamental wave	State
	1 (b) Voltage Amplifier		
	Item	**Value**	
	Test voltage	0 ... 480 V	State
	Voltage ranges	57.7 V, 100 V, 220 V, 380 V,400 V	State
	Adjustment	0%...120% of range	State
	Accuracy of the test amplitude	< 0.05%	State
	Accuracy of the test phase adjustment	< ± 0.01°	State
	Efficiency	> 85%	State
	Stability of the output settings	< 50 ppm , ti = 60 s	State
	Distortion	< 0.5%	State
	Superposition of harmonics	2nd…40th , max 40% of fundamental	State
	Harmonics phase shift	0°…360°	State
	Output power	1500 VA per phase	State
	Frequency	40…70 Hz	State
	1(c) Current Amplifier		
	Item	**Value**	
	Current:	1 mA – 120 A	State

	Current ranges:	10 mA, 25 mA, 50 mA, 100 mA, 0.25 A, 0.5 A, 1 A, 2.5 A, 5 A, 10 A, 25 A, 50 A, 100 A, 200 A	State
	Adjustment:	0%...120% of range	State
	Accuracy of the test amplitude:	0.05%	State
	Accuracy of the test phase adjustment:	0.01°	State
	Efficiency:	> 85%	State
	Stability of the output settings:	< 100 ppm, ti = 60 s	State
	Distortion:	< 0.5 %	State
	Superposition of harmonics:	2^{nd}...40^{th}, max 40% of fundamental	State
	Harmonics phase shift:	0°...360°	State
	Output power	2,500 VA	State
	1(d) Reference Standard		
	Mains input		
	Item	**Value**	
	Voltage:	85 V...265 V AC	State
	Frequency:	40 Hz...70 Hz	State
	Operating temperature	-1 °C ... 45 °C	State
	Power consumption:	< 30 VA	State
	Preheating time:	15 minutes	State
	Max. relative humidity:	≤ 90 %, not condensing	State
	Surge voltage protection:	class C	State

	Measurement values		
	Item	**Value**	
	Test voltage, phase-neutral	10V…576 V	State
	Voltage ranges	60 V, 120 V, 240 V, 480 V, auto range	State
	Test current	1 mA…160 A	State
	Current ranges	10 mA, 20 mA, 50 mA, 0.1 A, 0.2 A, 0.5 A, 1 A, 2 A, 5 A, 10 A, 20 A, 50 A, 100 A, 200 A auto range	State
	Frequency range, fundamental wave:	15 Hz….70 Hz	State
	Bandwidth:	3500 Hz	State
	Voltage measurement accuracy:	< 0.01%	State
	Voltage measurement drift:	< 35 ppm/year	State
	Current measurement accuracy < 25mA:	< 0.02%	State
	Current measurement accuracy ≥ 25mA:	< 0.01%	State
	Current measurement drift:	< 65 ppm/year	State
	Power measurement accuracy P, Q, S:	< 0.02% (current ≥ 25 mA and λ = 1)	State
	Power measurement drift:	< 100 ppm	State
	Phase angle:	< 0.01° (current ≥ 25 mA and voltage >30 V)	State
	Frequency:	0.005 Hz	State

	Voltage temperature drift:	< 2,5 ppm/K	State
	Current temperature drift:	< 5 ppm/K	State
	Power temperature drift:	< 7.5 ppm/K	State
	1 (e) Scanning Head		
	Item	**Value**	
	Wavelength	450 nm …1050 nm	State
	Max. frequency, unmodulated	2 kHz	State
	Dark to light change	max. 20 µs	State
	Light to dark change	max. 20 µs	State
	Pulse width	min. 0.2 ms	State
	Operating voltage	6 V … 25 V DC	State
	Operating current	≤ 70 mA (DC 24 V)	State
	Power	0.5 W (no load)	State
	Scanning distance	10 mm …40 mm	State
	Output signal, high	≥ 4.5 V	State
	Output signal, low	≤ 0.2 V	State
	Output current	3.5 mA … 4 mA	State
	Anti-interference distance	≤ 3.0 mm	State
	Sensitivity, artificial light	≤ 1000 lx	State
	Sensitivity, outdoor	≤ 1500 lx	State
	Protection class as per IEC 61010-1	IP51	State

	1 (f) Multi Secondary Voltage Transformer		
	Item	**value**	
	Primary frequency	45 Hz – 60 Hz	State
	Range of secondary burden	4 VA – 15 VA	State
	Accuracy Error prim/sec	≤ ± 0.1%	State
	Phase Error prim/sec	≤ ± 2 min	State
	Accuracy Error sec/sec (within burden range)	≤ ± 0.05%	State
	Phase Error sec/sec (within burden range)	≤ ± 1 min	State
4.3	**FUNCTIONALITY**		
4.3.1	Test Bench shall be able to test meters of different brands and meter Constants at the same time		State
4.3.2	Each test position shall be independently controlled by a computer		State
4.3.3	Test Bench shall test single phase meters by ways of automatic and manual operation		State
4.3.4	Test Bench shall test din rail single phase meters with measuring elements on both phase and neutral circuits through connection cables		State
4.3.5	Test Bench shall have extremely high power stability		State
4.3.6	Test Bench shall test meters with measuring elements on both phase and neutral circuits without changing the wiring		State
4.3.7	Test Bench shall be able to perform the following tests both on phase and neutral circuits as per IEC62052-11:2020 standard. h) Meter constant, IEC62052-11 clause 7.4 i) Initial startup of the meter, IEC62052-11 clause 7.5 j) Test of no load condition, IEC62052-11 clause 7.6 k) Starting current test, IEC62052-11 clause 7.7 l) Repeatability test, IEC62052-11 clause 7.8 m) Limits of error due to variations of current IEC62052-11 clause 7.9 n) Limits of error due to influence of quantiles IEC62052-11		State

	clause 10		
4.4	**COMPUTER AND SOFTWARE REQUIREMENTS**		
4.4.1	Test bench shall be supplied with one desktop computer, loaded with operating software in English language as detailed in Table 2		State
	Table 2: Minimum Specifications for Desktop Computer and Software.		
	Parameter	**Value**	
	Processor (CPU)	Intel Core i7 or higher	State
	Operating System	Licensed Microsoft Windows 11 or newer	State
	Memory	8 GB RAM or higher	State
	Storage	1 TB internal HDD, DVD-RW	State
	Monitor/Display	24" LED monitor	State
	Accessories	Keyboard, Mouse, Printer	State
	Interfaces	USB port with RS232 adapter and Bluetooth, Ethernet	State
	Software	(i) Latest Microsoft Office (ii) Microsoft Internet Explorer > version 8, PDF reader software (e.g. Acrobat Reader) (iii) Test application software compatible with Windows 11 or newer	State
4.4.2	The operating system shall be licensed Microsoft Windows 11 or higher.		State
4.4.3	The Microsoft operation system and software shall NOT require additional licenses for the life time of the test bench. The licenses shall be non –expiry		State
4.4.4	The test application software shall be used for controlling the meter test equipment and related devices in accordance with IEC 62052-11:2020		State
4.4.5	The software shall display the progress of the test being carried out		State
4.4.6	The software shall display the actual testing values		State
4.4.7	The software shall display error / results for each position		State
4.4.8	The software shall be able to determine and display in a bar graph the individual error per load point and position for each test		State
4.4.9	The software application shall be capable of running in multiple screen mode. For example, screen one to show the test results and ongoing testing process while screen two provide all information regarding the settings (actual values, phasor diagram, and harmonics analysis)		State

4.4.10	Software shall test all types of electronic and electromechanical energy meters	State
4.4.11	Software shall allow generation of Test plans for individual meters. The number of tests per test plan shall be unlimited	State
4.4.12	The software shall do the following tests complete automatically; (i) Pre-warming (ii) No-load test (iii) Starting test (iv) All kind of accuracy tests related to variation of current (v) Register and meter constant tests (vi) Voltage variation tests (vii) Frequency variation tests (viii) Reverse current tests (ix) Accuracy tests in the presence of harmonics (x) Influence of self-heating (xi) Thermal Stability verification	State
4.4.13	Software shall clearly indicate complete test plan and provide a summary indicating pass or fail of each position and the test point	State
4.4.14	Access to meter test system information shall only be through user-level password(s)	State
4.4.15	The software shall support 3 access levels: a) Low level security - The level of security would allow users with the appropriate password to read specified data fields in the test bench. b) Medium level security - The level of security would allow users with the appropriate password to perform specified tests. c) High level security - The level of security would allow users with the appropriate password to reconfigure the test bench with a new program or test plans	State
4.4.16	The software shall be capable of tracking user access to the test bench	State
4.4.17	The software shall have troubleshooting capability to identify a fault in the system and indicate its location	State

4.4.18	The software shall save test results automatically in a format that cannot be edited and assign them a unique number	State
4.4.19	The software shall store test results in files with individual meter search/query facility	State
4.4.20	Stored results shall be available for online review in HTML format and printable in PDF	State
4.4.21	Software shall allow customization of the test reports (e.g. utility log, name, date, tester) and to exporting of the test results for analysis in excel and other formats	State
4.4.22	Software shall allow for retrieval and printing of the results	State
4.4.23	Software shall be able to indicate traceability i.e. reference serial no, calibration certificate number and date of calibration	State
4.5	**SUPPLY VOLTAGE**	
	The test bench shall be operated from a three mains power supply according to EN 50160 3x240/415 V ±10%, 50 Hz	State
4.6	**ACCESSORIES**	
	The test bench shall be supplied complete with all the necessary cable accessories and consumable spare parts at no additional cost to KPLC. The accessories shall be as shown in Table 3	

Table 3: Accessories and Spare Parts

Description	Quantity	
Connection cables between the power source cabinet and the test stands	1 set	State
Connection cables between the PC system and the power source	1 set	State
Connection cables between the power supply and the power source cabinet	1 set	State

	Multi core flexible Cable for testing of din rail meters- red cable length 60cm One side safety plug flat, other side safety terminal with 2 adjusting screws	80pcs	State
	Multi core flexible Cable for testing of din rail meters- black cable length 60cm One side safety plug flat, other side safety terminal with 2 adjusting screws	80 pcs	State
	Allen key opener	1pc	State
	RS485 signal cables	40 pcs	State
	All other necessary accessories for commissioning the test bench		State
	SPARE PARTS		
	Testing terminals	40	State
	Scanning heads	10	State
5	**TESTS REQUIREMENTS**		
	Test bench shall be inspected and tested in accordance with the requirements of IEC 62057-1:2023and other relevant standards and provisions of this specification		State
6	**MARKING, LABELLING AND PACKING**		
6.1	Test bench shall be marked legibly and indelibly in English with the following information: g) Name or trade mark of the manufacturer; h) Country of origin; i) Type/model; j) Serial number; k) The inscription "Property of K.P. &. L. Co Plc." l) Date, Month and Year of manufacture		State

6.2	Test bench shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling	State
6.3	Packaging shall include the test bench calibration certificate/s of all various parts. Each test data shall include the corresponding Uncertainty budget values	State
7.0	**Information And Warranty**	
7.1	Test System shall be guaranteed by warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of at least sixty (60) months from the date of delivery and commissioning. All defects arising during the warranty period shall be repaired or parts replaced at the supplier's cost	State
7.2	All software supplied shall be updated by the supplier at no extra cost during the warranty period and afterwards. The licenses shall be non-expiring	State
7.3	Successful bidder and /or manufacturer shall install, test and commission the single phase meter testing bench. Additionally, they shall, at no extra cost to KPLC, carry out technical training on the operation, maintenance and calibration of the test bench after delivery to at least fifteen (15) KPLC staff and confirm their competency on use of the test system. The training shall cover but not be limited to: a) Equipment installation; b) Equipment features and operation c) Equipment software; d) Equipment configuration and data downloading and saving, etc e) Equipment maintenance calibration	State
TESTS AND INSPECTION		
A.1	It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified on the test bench in accordance with IEC 62057-1:2023 Tenderers shall confirm the manufacturer's capabilities in this regard when submitting tenders. Any limitations shall be clearly specified	State
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 valid accreditation certificate to ISO/IEC 17025:2017 for the testing	Submit

	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	Test bench shall be subject to acceptance tests at the manufacturer's premises before dispatch. Acceptance tests shall be witnessed by at least two Engineers appointed by The Kenya Power and Lighting Company (KPLC)	State
A.4	**TESTING FACILITY**	
A.4.1	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	Submit
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	State
A.5	Routine and Type Test reports for the test bench shall be submitted to The Kenya Power and Lighting Company for approval before shipment	State
A.6	During delivery of the test bench, 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, the single phase meter testing bench or any of its parts which upon examination, test or use fail to meet any or all of the requirements in this specification	State Compliance
B	**QUALITY MANAGEMENT SYSTEM**	
B.1	Quality assurance plan (QAP) based on and include relevant parts to fulfil the requirements of ISO 9001:2015	Submit
B.2	Manufacturer's Declaration of Conformity, copy of valid and relevant ISO 9001 certificates	Submit
B.3	Bidder shall indicate the delivery time of the test bench. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for exact or similar test bench sold in the last five years shall be submitted with the tender for evaluation	State/Submit
C	**DOCUMENTATION AND DEMONSTRATION**	
C.1	Bidder shall submit its tender complete with technical documents: i) Fully filled clause by clause Guaranteed Technical Particulars (GTP) signed by the manufacturer, j) Copies of the manufacturer's catalogues, brochures, test bench drawings and wiring diagrams and technical data showing description leaflet, programming details and manuals,	Submit

	k) Sales records for the last five years and at least four customer reference letters, l) Details of manufacturing capacity and the manufacturer's experience. m) Copies of required type test certificates and type test reports by a third-party testing laboratory accredited to ISO/IEC 17025, n) Copy of accreditation certificate to ISO/IEC 17025 for the third-party testing laboratory, o) Manufacturer's warranty and guarantee; subject to 60 months from date of commissioning at KPLC laboratory. p) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2015 certificate or ISO 17025:2017 certificate	
C.2	Successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture; (i) Fully filled clause by clause Guaranteed Technical Particulars (GTP) signed by the manufacturer, (ii) Design drawings and wiring diagrams of the test bench, (iii) Original software, software manuals and operation manuals shall be submitted, (iv) 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 9001:2008 or later, (v) Detailed test program to be used during factory testing, (vi) Detailed commissioning and training program. (vii) Marking details and method to be used in marking the test bench, (viii) 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 test bench for The Kenya Power & Lighting Company. (ix) Packaging details (including packaging materials)	Submit

C.3	Successful bidder and manufacturer shall demonstrate at their cost to at least two KPLC staff at the manufacturer's factory	State Compliance
	Statement of Compliance to Specification	Provide

***NOTE*:**

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

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Manufacturer's Name, Signature, Stamp and Date