



Kenya Power

TITLE:

**SPECIFICATION FOR  
LOW VOLTAGE MEASURING  
INSTRUMENTS**

Part 2: Insulation Resistance Meter

Doc. No. KP1/3CB/TSP/09/058-2

Issue No. 1

Revision No. 0

Date of Issue 2014-07-06

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**FOREWORD**

This specification has been prepared by the Research and Development Department in collaboration with Distribution Division, both of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for overhead line instruments (Insulation Resistance Meters) for use on distribution and sub-transmission power lines. It is intended for use by KPLC in purchasing of the instrument.

**1. SCOPE**

- 1.1 This specification is for low voltage low voltage insulation resistance meter for use on distribution and sub-transmission power lines.
- 1.2 The specification covers the following categories of low voltage (600 -1000 V) overhead line resistance meters: Insulation Resistance Test Set rated 5 kV
- 1.3 The specification also covers inspection and tests of the insulation resistance meter and their accessories as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.
- 1.4 The specification stipulates the minimum requirements for low voltage insulation resistance meter for overhead power lines acceptable for use in the company and it shall be the responsibility of the suppliers & manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the insulation resistance meter for KPLC.

The specification does not purport to include all the necessary provisions of a contract.

**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:

IEC 61010: Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements; --Part 2-033: Particular requirements for hand-held multimeters and other meters, for domestic and professional use, capable of measuring mains voltage,

IEC 61326: Electrical equipment for measurement, control and laboratory use - EMC requirements.

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- IEC 61557: Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c - Equipment for testing, measuring or monitoring of protective measures -- Part 1: General requirements; -- Part 2: Insulation resistance;
- IEC 60695: Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods — Glow-wire flammability test method for end-products
- IEC 60664: Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests,
- IEC 60112: Method for the determination of the proof and the comparative tracking indices of solid insulating materials
- IEC 60529: Degrees of protection provided by enclosures (IP Code)
- IEC 60068: Environmental testing
- IEEE Std 43: IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery
- OIML D 11: General Requirements for Measuring Instruments - Environmental Conditions

**3. TERMS AND DEFINITIONS**

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

**4. REQUIREMENTS**

**4.1. SERVICE CONDITIONS**

The equipment shall be tropicalized, designed and constructed for continuous outdoor operation in tropical areas and harsh climatic conditions including areas exposed to sea spray (along the coast), humidity of up to 95% and average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C.

**4.2. Safety and Environmental Design Requirements**

4.2.1. Insulation resistance meter shall comply with IEC 61010-1 and IEC 61557-1 standards. When used for a designated purpose, they shall not endanger persons, livestock or property

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i.e. they shall be constructed in such a way that possibilities for unintentional, accidental, or intentional misuse are minimal.

4.2.2. The design shall also ensure that no hazardous touch voltages appear during the measurements. This shall be achieved by a suitable design of the source for the output voltage by:

- a) Limiting the open-circuit value of the output voltage to an r.m.s. value of 50 V;
- b) Limiting the r.m.s. (peak) value of the short-circuit current to 3.5 mA when the value of the voltage exceeds 50 V.

**NOTE:** *When no compliance with the above condition exists, then an automatic disconnection of the measurement process shall operate within a time period permissible according to Figure 1 of IEC 61010-1.*

4.2.3. If the equipment indicates the voltage conditions at its measuring terminals, it shall also indicate if the system voltage exists and if the live conductor is exchanged with the protective conductor.

- 4.2.4. Insulation resistance meter shall also comply with OIML D 11 requirements such that:
- a) Their errors do not exceed the maximum permissible errors under rated operating conditions.
  - b) When they are exposed to disturbances, either
    - Significant faults do not occur, or
    - Significant faults are detected and acted upon by means of a checking facility.

4.2.5. Instruments powered by a battery (stand-alone, rechargeable auxiliary or back-up batteries) shall have the type (-s) and capacity (-ies) of the batteries allowed to be used in the applicable measuring instruments specified by the manufacturer. They shall also automatically check that the state of charge of these batteries will permit measurement with specification.

4.2.6. Instruments powered by the mains power and provided with a back-up battery for data-storage only, shall also comply with the requirements for mains powered instruments.

4.2.7. The terminals shall be designed so that the probe assembly can be connected to the measuring equipment reliably and accidental touching of any live parts is impossible.

4.2.8. Software controlled instruments that are complex in their functionality shall require that the user is guided for the correct use and for achieving correct measurement results.

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4.2.9. The manufacturer shall specify the limiting conditions; storage and transport conditions for each specified influence quantity - quantity which is not the subject of the measurement and whose change affects the relationship between the indication and the result of the measurement.

4.2.10. Insulation resistance meter shall have a valid calibration status prior to being confirmed, within a specified metrological requirement.

4.2.11. The insulation resistance meter shall be manufactured and tested in conformity with the following safety and environmental design requirements:

**Table 1: Safety and Environmental Design Requirements**

No	Particulars	Test Performance	
1	Operating conditions	Operating temperature	0 ... +40 °C as per IEC 61557-1
		Storage temperature	-5 ... +50 °C
		Humidity range - Rel. humidity	5 ... 95 %, non-condensing
		Permissible percentage operating uncertainties	Shall not exceed ±30 % as per IEC 61557-1
		Supply voltage	85 % to 110 % of the nominal supply voltage for supply from the distribution systems as per IEC 60038
2	Environmental conditions	Shock (operating)	15 g / 11 ms half sine as per IEC 60068-2-27
		Vibration (operating)	IEC 61557-1 - direction: three mutually perpendicular axes; - amplitude: 1 mm; - frequency: 25 Hz; - duration: 20 min.
		Dry heat test	IEC 60068-2-2: Type A test (Test level 2) Temperature - 55°C ± 2°C Duration of exposure - 2 h
		Damp heat test	IEC 60068-2-30: Test Db Test level 2 Temperature - 55°C ± 2°C Relative humidity - 93 % Duration of exposure - 4 h
		Salt mist test	IEC 60068-2-11 - Test level 4 Saline solution - 5 % NaCl, pH value- 6.5 - 7.2 %, Temperature - 35°C Duration - 96 h
		Flammability test	IEC 60695-2-11 - Needle flame test
2	EMC tests	Particular requirements test configurations, operational conditions and performance criteria IEC 61326-2-2.	

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No	Particulars	Test Performance	
3	Safety	Rated Impulse Voltage for equipment -1.2/50µs	6000 V as per IEC 60664-1, table 1
		Overvoltage category	At least Class III, 600 V as per IEC 61010-1
		Pollution category	At least Degree 2 as per IEC 61010-1
		Insulation material group	At least Group II - $400 \leq CTI < 600$ (PLC=1) as per IEC 60112
		Class of protection	Protection class II (reinforced insulation) as per IEC 60664-1
		Protection against enclosures	IP 54 as per IEC 60529
		Measuring category	At least category III as per IEC 61010-2-030
		Partial discharge requirements	As per IEC 60664-1 Annex C
	Solid insulation design	Shall withstand short term and long term stresses as per IEC 60664-1 clause 3.3	

\* If the internal emission source(s) is operating at a frequency below 9 kHz then measurements need only to be performed up to 230 MHz

**NOTE:** The tests results shall be as per the Performance Criteria A specified in IEC 61326-1 for the respective tests.

### 4.3. Design and Construction

4.3.1. The insulation resistance tester shall be designed, manufactured and tested in accordance with IEC 61557: Part 1, 2 standard requirements. It shall also comply fully with the provisions of clause 4.2.1 of this specification.

4.3.2. The meter shall be a direct reading portable electronic insulation resistance tester enclosed in the same casing as a dc to dc converter and shall have the ability to apply test voltage up to 5 kV, conforming to the requirements of IEEE 43:2000.

4.3.3. The meter shall be a multi-range tester with multi-voltage and multi-rated resistance ranges complete with a selector switch to change the range. The test voltages shall be 50 V to 1 kV in 10 V steps, 1 kV to 5 kV in 25 V steps; and the Insulation Resistance Range shall be 10 kΩ to 15 TΩ.

4.3.4. The insulation resistance meter in this specification shall be designed for testing the insulation resistance of low and high-voltage electric equipment including:

- a) High-voltage power cables and high-voltage buses
- b) Large motor/generator windings
- c) Line and substation transformers

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4.3.5. It shall be capable to perform automatic spot tests, step-voltage tests, dielectric discharge tests and dielectric absorption tests for the following applications:

- a) Acceptance testing at installation to check conformance to specifications.
- b) Routine preventive/predictive maintenance testing after installation.
- c) Quality assurance testing as part of the manufacturing process.
- d) Diagnostic testing to isolate faulty components for repair.

4.3.6. The minimum display functions and features shall be similar to those in Table 2 & 3 and Fig. 2.

**Table 2: Functions and test features for the Insulation Resistance meter.**

No.	Feature	Function
1	Voltage at terminals	Displays amount of voltage present at the terminal.
2	Battery level	Indicates the level of battery operation available.
3	Breakdown indicator	Indicates that breakdown mode is in operation
4	High-voltage indicator	Indicates the presence of high voltage during operation.
5	Digital display	Displays the reading during a test.
6	Dielectric Absorption Ratio (DAR)	IR measurements taken after 30 seconds and 60 seconds
7	Polarization Index (PI)	IR measurements taken at 1 minute and 10 minutes
8	Dielectric Discharge Measurements (DD)	Dielectric Discharge = I (after 60 seconds) / Volts x Capacitance
8	Time constant	6 through 8 — Displays the ratio value or the resistance measured at the indicated time.
9	Capacitance display	Indicates the capacitance of the test sample.
10	Analog display	Unique; patented analog display shows resistance with real-time pointer movement.
11	Timer	Displays the elapsed time of test. Displayed constantly eliminating the need for a separate timer.
12	Data recording	Indicates if data is being recorded during the test.
13	Alarm	Indicates that alarm has been set.
14	Burn indicator	Indicates that burn mode is in operation.
15	Test modes	Shows which pre-programmed test is being run.

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Fig. 2: Insulation resistance digital display.

Table 3: Technical particulars for a 5 kV Insulation meter.

Particulars	Requirement
Test Voltage	50 V to 1 kV in 10 V steps, 1 kV to 5 kV in 25 V steps
Insulation Resistance Range	Digital display: 10 kΩ to 15 TΩ
Accuracy (23° C)	±20% to 10 TΩ
Voltage Output Accuracy (0°C to 30°C)	0 to +4% ±1 V of nominal test voltage at 100 M½ load ±25 V for test voltages less than 500 V
Short Circuit/Charge Current	3.5 mA
Current Measurement	Range: ±0.01 nA to ±5 mA Accuracy (23°C): ±5% ±0.2 nA at all voltages
Capacitance Measurement	Range: 10 nF to 50 μF (for voltages > 500 V) Accuracy (23°C): ±5% ±5 nF
Capacitor	Charge Time: 5 seconds per μF at 3 mA Discharge Time: 5 seconds per μF to discharge from:
Display	Digital - 3 digits
Dielectric Absorption Ratio (DAR)	Best criteria - 1.4 or more as per IEEE Std. 43-2000
Polarization Index (PI)	Best criteria - 4.0 or more as per IEEE Std. 43-2000
Dielectric Discharge Measurements (DD)	Good criteria - 2.0 or less as per IEEE Std. 43-2000
Timer Range	Count up to 99 minutes and 59 seconds from start of test

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Particulars	Requirement
Memory Capacity	32 kB
Industry-Standard Tests	Auto IR, PI, DAR, SV, and DD
Interference Rejection	2 mA rms at 200 V and above
Guard Terminal	2% error guarding 500 kΩ leakage with 100 mΩ load
Voltage Input Range	95 to 240 V, ±10% rms 50/60 Hz and dc
Battery Life	6 hours continuous testing at 5 kV
Dimensions	To be specified by manufacturer
Weight	To be specified by manufacturer

**4.4. Quality Management System**

- 4.4.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the insulation resistance meter design, physical properties, tests and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.
- 4.4.2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.
- 4.4.3. The bidder shall indicate the delivery time of the items, manufacturer's monthly & annual production capacity and experience in the production of the type and size of items being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the insulation resistance meter sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

**5.0. TESTS AND INSPECTION**

- 5.1. The insulation resistance meter shall be inspected and tested in accordance with the requirements of IEC 61010-1, IEC 61010-2-030, IEC 61326-2-2, IEC 60068 and IEC 61557: Parts 1 & 2, standards and provisions of clause 4.2 and Table 1 of this specification. It shall be the responsibility of the supplier to perform or to have performed the tests specified and whatever other tests he normally performs at works.
- 5.2. Copies of previous Type Tests 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

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evaluation. The accreditation certificate to ISO/IEC 17025 for the same third party testing laboratory used shall also be submitted with the tender document (all in English Language).

5.3. Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be as stated below:

**a) Type tests for the instrument performance**

- (i) Electromagnetic compatibility (EMC)
- (ii) Impulse overvoltage tests on the equipment
- (iii) Dielectric voltage withstand tests on the equipment - Controlled overvoltage
- (iv) Functional tests of the equipment.

**b) Type tests for printed circuit board coating performance**


- (i) Environmental, humidity and thermal conditioning tests
- (ii) Dielectric voltage withstand tests
- (iii) Comparative tracking index (CTI)
- (iv) Resistance to soldering heat
- (v) Coating adhesion
- (vi) Insulation resistance between conductors

5.4. Routine and sample test reports for the insulation resistance meter to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers will witness tests at the factory before shipment.

5.5. On receipt of the goods KPLC will perform any of the tests specified in order to verify compliance with this specification. The supplier shall replace without charge to KPLC the insulation resistance meter, which upon examination, test or use; fail to meet any of the requirements in the specification.

5.6. Tests to be witnessed at the factory before shipment shall be in accordance with IEC 61557: Parts 1 & 2 standards and provisions of clause 4.2 and Table 1 of this specification and shall include the following:

- a) Visual inspection
- b) Performance test
- c) Influence of position tests
- d) Influence of the supply voltage tests
- e) Battery check facility tests
- f) Marking and operating instructions verifications.

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## 6.0. MARKING AND PACKING

### 6.1. Marking

Markings shall comply with IEC 61010-1 unless otherwise specified in other parts of IEC 61557. The measuring equipment shall carry the following marking which shall be clearly readable and indelible (in English Language).

- a) Type of equipment.
- b) Units of the measured quantity.
- c) Ranges of measurement.
- d) Type and current rating of the fuse in the case of exchangeable fuses.
- e) Type of battery/accumulator and polarity of connection in the battery compartment.
- f) Nominal voltage of the distribution system and the symbol for double insulation in accordance with IEC 61010-1 for measuring equipment with distribution system power supply.
- g) Manufacturer's name or registered trade mark.
- h) Model number, name or other means to identify the equipment (inside or outside).
- i) The words "PROPERTY OF KPLC".
- j) Reference to the operating instructions with the symbol as per Table 8 in accordance with IEC 61010-1.

**Table 8: Safety symbols**

	Caution, risk of danger (Important safety information - refer to the operation manual.)
	Application around and removal from HAZARDOUS LIVE conductors are permitted. IEC 60417- 5036
	Double insulation (Protection Class II) - IEC 60417- 5172
CAT III	Overtoltage (Installation) category III, Pollution Degree 2 per IEC 61010-1 refers to the level of Impulse Withstand Voltage protection provided.
	Conforms to European Union Directive
	Earth (ground) terminal – IEC 60417 - 5017

### 6.2. PACKING

6.2.1. The insulation resistance meter shall be packed in a standard rugged heavy duty robust case with cushion grip handles and rubberized gripping surface for outdoor use (protection category IP X5) in such a manner to avoid damage during transportation.

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6.2.2. The equipment shall be portable, rugged and light weight. Its carrying case shall be shockproof, and impact resistant. Also shall be able to withstand a fall of one meter without damage to the equipment.

6.2.3. The housing shall be complete with a gasket to seals the lid when closed so as to protect the instrument against water and dirt while the instrument is carried through rainstorms or other hazardous conditions. The lid shall be secured by two latches and a handle for portability. A compartment shall also be provided for storage of test cables and line cord.

**7.0. DOCUMENTATION**

7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

- a) Fully filled clause by clause guaranteed technical particulars (GTP) signed by the manufacturer;
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
- c) Sales records for the last five years and at least four customer reference letters;
- d) Details of manufacturing capacity and the manufacturer's experience;
- e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
- f) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;
- g) Manufacturers letter of authorization, ISO 9001:2008 certificate and other technical documents required in the tender.
- h) Operating instructions:  
The operating uncertainty, the intrinsic uncertainty and the variations *E1* to *E10* shall be provided in the operating instructions as per IEC 61557.

In addition, the operating instructions shall comprise the following details:

- (i) Connection diagrams.
- (ii) Instructions for measurements.
- (iii) Brief description of the principle of measurement.
- (iv) Diagrams or tables showing the maximum permissible indicated values taking into consideration the tolerances stated by the manufacturer (if necessary).
- (v) Type of battery/rechargeable cells.
- (vi) Information on the charging current, charging voltage and duration of charging for rechargeable cells.

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- (vii) Operational lifetime/runtime of the battery/rechargeable cells or the possible number of measurements.
- (viii) Type of IP protection (IEC 60529).
- (ix) Any necessary special guidance notes.

7.2. 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 with details of insulation resistance meter to be manufactured for KPLC.
- c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008
- d) Detailed test program to be used during factory testing;
- e) All documentation necessary for safety of the equipment as specified in IEC 61010-1 clause 5.4 shall be provided with the equipment.

7.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the insulation resistance meter to KPLC stores.

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**ANNEX A:** *Guaranteed Technical Particulars (to be filled and signed by the supplier and submitted together with copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records and copies of test certificates for tender evaluation)*

**Tender No** ..... **Bidder's Name & Address** .....

Description		Bidder's Offer
1	Name of the manufacturer and country of origin	
	Type Reference Number or Model Number	
2	Applicable Standards	
3	Terms and Definitions	
4	Requirements	
4.1	Service conditions	
4.2	Safety and Environmental Design Requirements	
	4.2.1 – 4.2.11	
	Particulars	KPLC test performance requirement
	Operating temperature	0 ... +40 °C as per IEC 61557-1
	Storage temperature	-5 ... +50 °C
	Humidity range - Rel. humidity	5 ... 95 %, non-condensing
	Permissible percentage operating uncertainties	Shall not exceed ±30 % as per IEC 61557-1
	Supply voltage	85 % to 110 % of the nominal supply voltage for supply from the distribution systems as per IEC 60038
	Shock (operating)	15 g / 11 ms half sine as per IEC 60068-2-27
	Vibration (operating)	IEC 61557-1 – direction: three mutually perpendicular axes; – amplitude: 1 mm; – frequency: 25 Hz; – duration: 20 min.
	Dry heat test	IEC 60068-2-2: Type A test (Test level 2) Temperature - 55°C ± 2°C Duration of exposure – 2 h
	Damp heat test	IEC 60068-2-30: Test Db Test level 2 Temperature - 55°C ± 2°C Relative humidity – 93 % Duration of exposure – 4 h
	Salt mist test	IEC 60068-2-11 – Test level 4 Saline solution – 5 % NaCl, pH value- 6.5 – 7.2 % Temperature – 35°C Duration – 96 h

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Date: 2014-07-06

Date: 2014-07-06



Kenya Power

TITLE:

**SPECIFICATION FOR  
LOW VOLTAGE MEASURING  
INSTRUMENTS**

Part 2: Insulation Resistance Meter

Doc. No. KP1/3CB/TSP/09/058-2

Issue No. 1

Revision No. 0

Date of Issue 2014-07-06

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	Flammability test	IEC 60695-2-11 – Needle flame test	
	Particular requirements test configurations, operational conditions and performance criteria	IEC 61326-2-2.	
	Rated Impulse Voltage for equipment -1.2/50µs	6000 V as per IEC 60664-1, table 1	
	Overvoltage category	At least Class III, 600 V as per IEC 61010-1	
	Pollution category	At least Degree 2 as per IEC 61010-1	
	Insulation material group	At least Group II - $400 \leq CTI < 600$ (PLC=1) as per IEC 60112	
	Class of protection	Protection class II (reinforced insulation) as per IEC 60664-1	
	Protection against enclosures	IP 54 as per IEC 60529	
	Measuring category	At least category III as per IEC 61010-2-030	
	Partial discharge requirements	As per IEC 60664-1 Annex C	
	Solid insulation design	Shall withstand short term and long term stresses as per IEC 60664-1 clause 3.3	
4.3	Design and construction		
4.3.1	Insulation Resistance Test Set		
	4.3.1 – 4.3.7		
	Requirements		
	<b>Particulars</b>	<b>KPLC Requirement</b>	
	Test Voltage	50 V to 1 kV in 10 V steps, 1 kV to 5 kV in 25 V steps	
	Insulation Resistance Range	Digital display: 10 kΩ to 15 TΩ	
	Accuracy (23° C)	±20% to 10 TΩ	
	Voltage Output Accuracy (0°C to 30°C)	0 to +4% ±1 V of nominal test voltage at 100 M½ load ±25 V for test voltages less than 500 V	
	Short Circuit/Charge Current	3.5 mA	
	Current Measurement	Range: ±0.01 nA to ±5 mA Accuracy (23°C): ±5% ±0.2 nA at all voltages	
	Capacitance Measurement	Range: 10 nF to 50 µF (for voltages > 500 V) Accuracy (23°C): ±5% ±5 nF	
	Capacitor	Charge Time: 5 seconds per µF at 3 mA Discharge Time: 5 seconds per µF to discharge from:	
	Display	Digital - 3 digits	
	Dielectric Absorption Ratio (DAR)	Best criteria - 1.4 or more as per IEEE Std. 43-2000	
	Polarization Index (PI)	Best criteria – 4.0 or more as per IEEE Std.	

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		43-2000	
	Dielectric Discharge Measurements (DD)	Good criteria – 2.0 or less as per IEEE Std. 43-2000	
	Timer Range	Count up to 99 minutes and 59 seconds from start of test	
	Memory Capacity	32 kB	
	Industry-Standard Tests	Auto IR, PI, DAR, SV, and DD	
	Interference Rejection	2 mA rms at 200 V and above	
	Guard Terminal	2% error guarding 500 kΩ leakage with 100 mΩ load	
	Voltage Input Range	95 to 240 V, ±10% rms 50/60 Hz and dc	
	Battery Life	6 hours continuous testing at 5 kV	
	Dimensions	To be specified by manufacturer	
	Weight	To be specified by manufacturer	
4.4	Quality Management Systems		
	4.4.1 – 4.4.3		
5.0	Test and Inspection		
	5.1 – 5.3		
	a – List types tests for the instrument performance provided		
	b - List types tests for the printed circuit coating performance provided		
	5.4 – 5.6		
6.0	Marking and packing		
	6.1 Packing		
	6.1.1 – 6.1.3		
	6.2 Marking		
7.0	Documentation		
	7.2– 7.3		
8.0	Manufacturer's Guarantee and Warranty		
9.0	List catalogues, brochures, technical data and drawings submitted to support the offer.		
10.0	List customer sales records submitted to support the offer.		
11.0	List Test Reports and Test Certificates submitted with tender		
12.0	List test & calibration reports to be submitted to KPLC for approval before shipment		
13.0	Statement of compliance to specification (indicate deviations if any & supporting documents)		

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

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