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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrostatics –
Part 4-10: Standard test methods for specific applications – Two-point resistance measurement

Électrostatique –
Partie 4-10: Méthodes d'essai normalisées pour des applications spécifiques – Mesure de la résistance en deux points

IEC 61340-4-10:2012

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ELECTROSTATICS –

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FOREWORD

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International Standard IEC 61340-4-10 has been prepared by IEC technical committee 101: Electrostatics.

The text of this standard is based on ANSI/ESD STM11.13-2004. It was submitted to the National Committees for voting under the Fast Track Procedure.

The text of this standard is based on the following documents:

FDIS	Report on voting
101/368/FDIS	101/377/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

ELECTROSTATICS –

Part 4-10: Standard test methods for specific applications – Two-point resistance measurement

1 Scope

This part of IEC 61340 provides a test method to measure the resistance between two points on an item's surface.

It is intended for measuring the resistance of items in the range of $10^4 \leq R < 10^{12}$ Ω.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM D257-07, *Standard Test Methods for DC Resistance or Conductance of Insulating Materials*

ASTM D2240, *Standard Test Method for Rubber Property – Durometer Hardness*

3 General discussion

This method is recommended for testing items with irregularly shaped surfaces. Conventional concentric ring and parallel bar electrode configurations are used for testing planar items only. However, most packaging items are not planar. Examples include shipping tubes, trays, tote boxes and carrier tapes. This probe employs springs to apply consistent contact pressure between the electrode and the item. Force created by springs is subject to variance from wear, contamination and manufacturing tolerance. This variance is acceptable for this application. Elastomeric electrodes compensate for uneven item surfaces. These features yield consistent results between laboratories and test operators.

4 Equipment

4.1 Probe

Refer to Figure 1 and Table 1.

This two-point probe consists of an insulated metal body with a polytetrafluoroethylene (PTFE) insulator inserted into each end. One insulator holds test leads; the other holds receptacles that accept spring-loaded pins. One receptacle is surrounded by a cylindrical insulator, which is surrounded by a metal shield. The pins are gold plated and have a spring force of 4,56 N ±10 % at a travel of 4,32 mm (0,170 in). The pin tips are machined to accept friction fitted 3,18 mm (0,125 in) diameter electrically conductive rubber electrodes. The rubber has a Shore A (IRHD) durometer hardness of 50-70 (ASTM D2240). The electrodes are 3,18 mm (0,125 in) long. Electrode volume resistivity is <500 Ω cm.

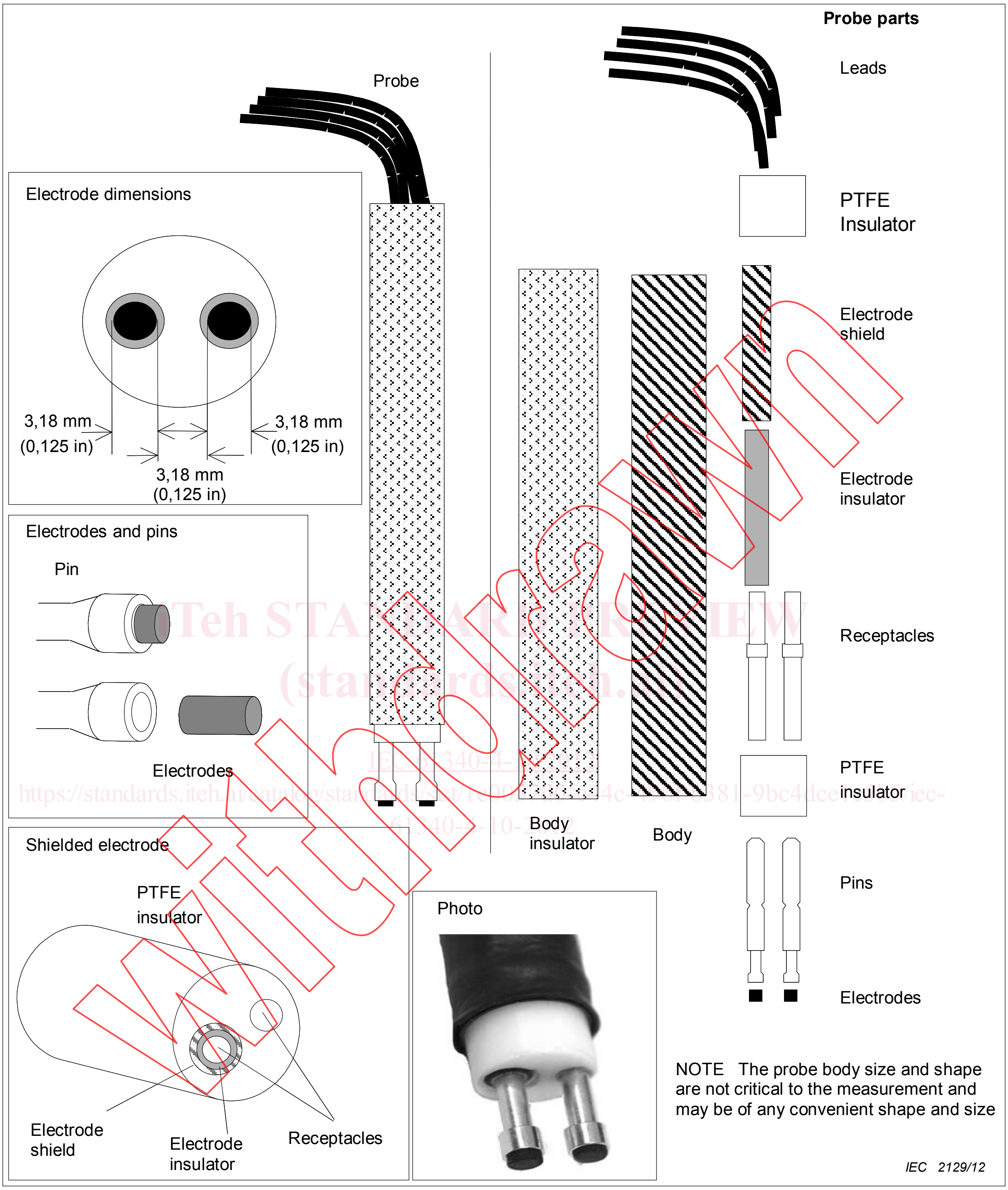

Figure 1 – Two-point probe configuration

Table 1 provides a list of the key components in Figure 1.

Table 1 – Material for two-point probe

Item	Detail	Example
PTFE insulators	Approximately 25,4 mm (1,0 in) by 12,7 mm (0,5 in) diameter	
Electrode shield	Metal tubing approximately 31,8 mm (1,25 in) by 4,75 mm (0,187 in) diameter	
Electrode insulator	Heat shrinkable PTFE or other insulator	
Receptacles	Receptacle – with solder cup	Interconnect devices Inc. R-5-SC
Pins	Spring pin force is 4,56 N at 4,32 mm (0,170 in) travel. Tip machined to accept electrode	Interconnect devices Inc. S-5-F-16.4-G
Electrodes	3,18 mm (0,125 in) by 3,18 mm (0,125 in) diameter conductive material with a Shore A (IRHD) durometer hardness between 50 and 70. Volume resistivity to be <500 Ω-cm.	Vanguard products, VC-7815
NOTE This is not intended to be a complete materials list for probe construction, but does provide key elements that enable performance replication. Refer to Figure 1 for part placement. Part manufacturers and numbers information are for reference. Equivalent parts may be used.		

4.2 Sample support surface

An insulative surface, when used for specimen support, shall have a resistance of greater than 1,0 $\Omega \times 10^{13}$ Ω when measured in accordance with ASTM D257-07.

4.3 Resistance measurement apparatus

The measurement apparatus, called the meter, whether it is a single meter or a collection of instruments, has the following capabilities:

a) Meter for laboratory evaluations

The meter shall have an output voltage of 100 V (±5 %) while under load for measurements of 1,0 $\Omega \times 10^6$ Ω and above, and 10 V (±5 %) while under load for measurements less than 1,0 $\Omega \times 10^6$ Ω. The meter shall be capable of making measurements from 1,0 $\Omega \times 10^3$ Ω (±10 % accuracy) to 1,0 $\Omega \times 10^{13}$ Ω (±10 % accuracy).

b) Meter for acceptance testing

The laboratory evaluation meter may be used for acceptance testing or the following may be used. The meter shall have an open circuit voltage of 100 V (± 10 %) for measurements of 1,0 $\Omega \times 10^6$ Ω and above, and 10 V (±10 %) for measurements less than 1,0 $\Omega \times 10^6$ Ω. The meter shall be capable of making measurements from 1,0 Ω x 10^3 Ω (±20 % accuracy) to 1,0 $\Omega \times 10^{13}$ Ω (±20 % accuracy).

In case of disagreement, the meter used for laboratory evaluations shall be used to resolve any disputes.

c) Meter for compliance verification (periodic testing)

A meter meeting the requirements of laboratory evaluations or acceptance testing may be used. The compliance verification meter shall be capable of making measurements one order of magnitude above and below the intended measurement range. The output voltage of compliance verification meters may vary from laboratory evaluation or acceptance testing meters, and may be rated under load or open circuit. These meters shall be correlated to the acceptance testing meter or the laboratory evaluation meter.

In case of disagreement, the meter used for acceptance testing meter or laboratory evaluations shall be used to resolve any disputes.

NOTE A constant voltage meter as noted above was used to collect all data used to validate this standard test method. Data was not collected to validate this equipment configuration.

4.4 Test leads

Test leads appropriate for the meter are required. A shielded lead from the probe body to the instrument will greatly reduce electrical interference. Measurements for the verification of this test method were made using a shielded lead. See Figure 2.

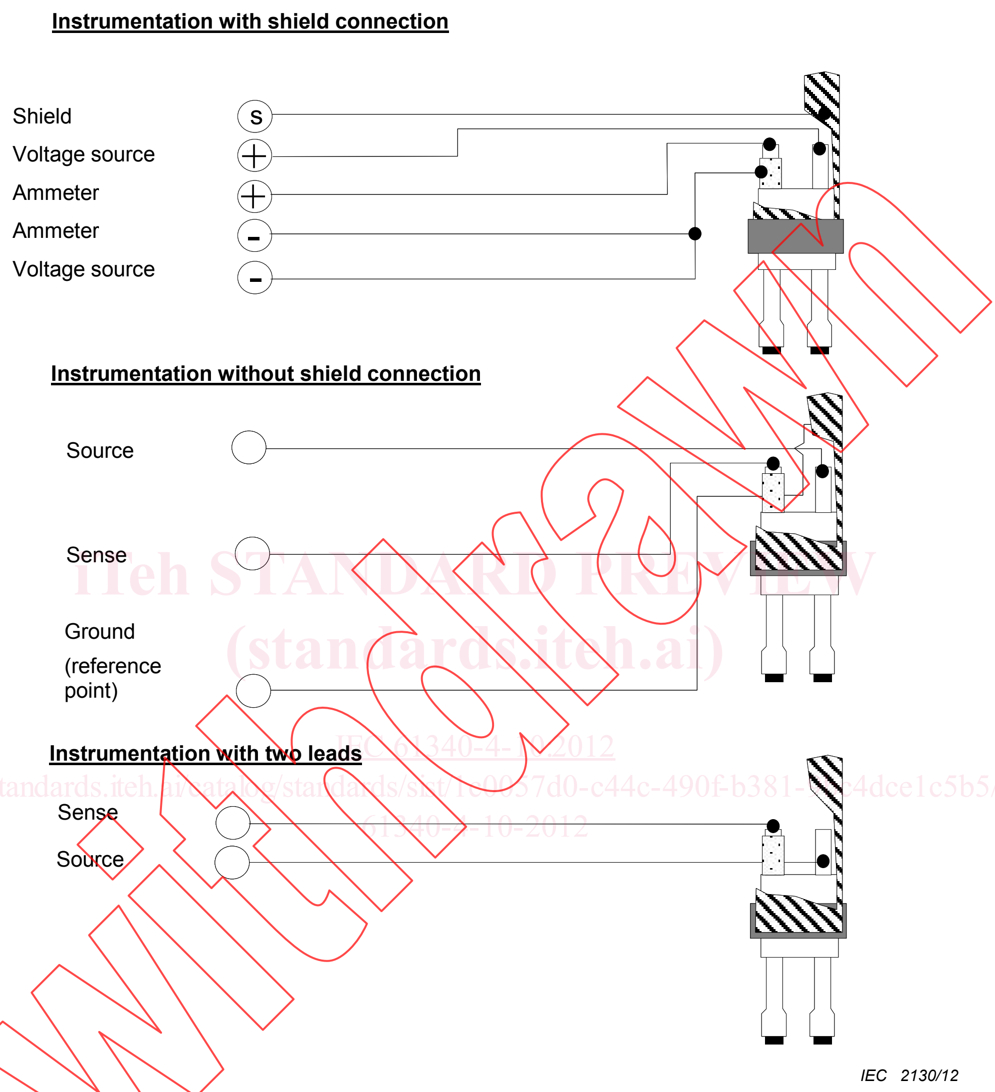

Figure 2 – Probe to instrumentation connection

4.5 Verification resistors

The low resistance verification fixture shall consist of a 1,0 $\Omega \times 10^5\ \Omega$ (±1 %) resistor bonded to two metal contact plates. The plates shall be of size and shape so that each probe electrode contacts only one plate, and so that the plates are not in contact with each other. The plates may be affixed to a material with the same properties as the sample support surface. Figure 3 illustrates one possible configuration of a resistance verification fixture.

The high resistance verification fixture will consist of a 1,0 $\Omega \times 10^9\ \Omega$ (±5 %) resistor bonded to two metal contact plates. The plates shall be of a size and shape so that each probe electrode contacts only one plate, and so that the plates are not in contact with each other. The plates may be affixed to a material with the same properties as the sample support surface. Figure 3 illustrates one possible configuration of a resistance verification fixture.

The actual value of the resistors should be measured periodically. This measured value should be used to verify probe operation.

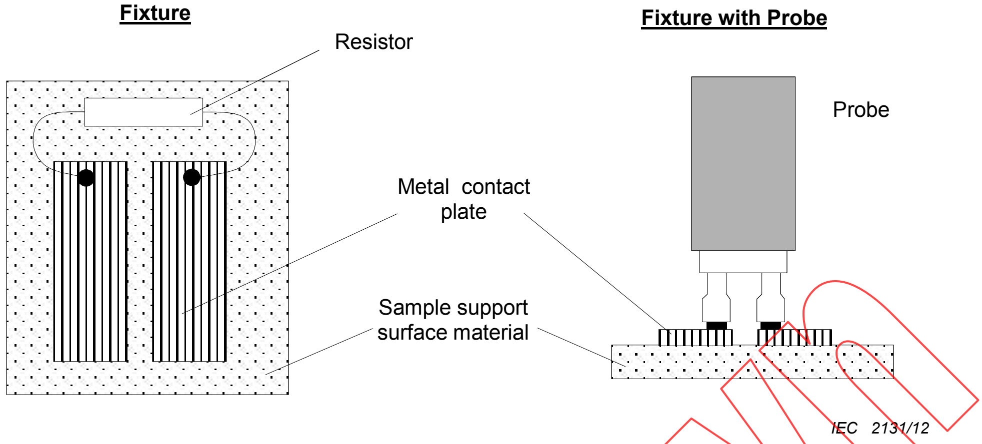

Figure 3 – Resistance verification fixture

5 Sample preparation

Condition six specimens of the item to be tested in an environment with a relative humidity of 12 % ± 3 % and at a temperature of 23 °C ± 3 °C (72 ± 5) °F. Preconditioning of the samples shall be for a period of at least 48 h. All testing shall be conducted in the preconditioned environment.

6 Verification procedure

Correct probe operation shall be verified by measuring known resistance values.

a) Connect the probe to the meter as shown in Figure 2.

b) Place the probe electrodes onto the low resistance verification fixture as shown in Figure 3.

c) Compress the spring-loaded pins downward approximately half of the length of travel (Figure 4).

d) Apply 10 V for 15 s and observe the resistance.

e) Record the resistance value. The value should be within 10 % of the actual resistor value.

f) Repeat the procedure using the high resistance verification fixture at 100 V.