IEC 61340-4-3

Edition 2.0 2017-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrostatics –
Part 4-3: Standard test methods for specific applications – Footwear

Électrostatique –
Partie 4-3: Méthodes d'essai normalisées pour des applications spécifiques – Chaussures

IEC 61340-4-3:2017-12(en-fr)

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ELECTROSTATICS –

Part 4-3: Standard test methods for specific applications – Footwear

FOREWORD

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International Standard IEC 61340-4-3 has been prepared by IEC technical committee 101: Electrostatics.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) classification of footwear as electrostatic conductive or electrostatic dissipative has been removed – classification is not specified;
b) environmental classes for laboratory testing have been removed – one set of conditions for pre-conditioning, conditioning and testing is specified;
c) reference to IEC 61340-2-3 for measuring the resistance of the counter electrode inserted inside footwear has been removed.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
101/544/FDIS	101/550/RVD

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

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

A list of all the parts in the IEC 61340 series, published under the general title *Electrostatics*, can be found on the IEC website.

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

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- withdrawn,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

INTRODUCTION

Footwear, especially shoes, has become an important electrostatic control device in all areas, but particularly in electronics manufacturing. Standards exist from various national committees and these have served as guidance in the preparation of this part of IEC 61340 for electrostatic control footwear.

Control of unwanted electrostatic charge is of particular importance where personnel work around electrostatic-sensitive processes, materials or items. In many cases, devices such as wrist straps are employed to provide an electrical bond between a person's skin and a ground connection. Many instances exist in industry where wrist straps or other tethering devices cannot be safely or conveniently applied, but there is still a need to provide a ground connection for personnel. A convenient method to provide a ground connection for personnel is through their footwear while standing or walking on a defined and properly specified electrostatic control floor surface.

The measurement method described in this document can be used to monitor electrical specifications of footwear during manufacture, prior to selection by an end user or periodically during use. The method described involves the use of a specific set of test equipment and instruments. Other equipment and instruments may be used to measure the parameters specified, but in the event of any dispute, the equipment, instruments and measurement method established in this document apply.

ELECTROSTATICS –

Part 4-3: Standard test methods for specific applications – Footwear

1 Scope

This part of IEC 61340 describes a test method for determining the electrical resistance of footwear (shoes, slippers or booties) used in the control of electrostatic potential on people. This document is suitable for use by the manufacturer of footwear as well as the end user. A method for measuring the electrical resistance of footwear alone is described and serves as a qualification test or an acceptance test for new footwear, or as a periodic test of in-use footwear.

Although this document does not include requirements for personal safety, footwear used within the scope of this document in all places of work is regulated by the relevant local statutory requirements regarding the health and safety of all persons.

Insulating footwear is not included within the scope of this document although the electrical resistance measurement techniques can be applicable.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62631-3-1, *Dielectric and resistive properties of solid insulating materials – Part 3-1: Determination of resistive properties (DC methods) – Volume resistance and volume resistivity – General method*

IEC 62631-3-2, *Dielectric and resistive properties of solid insulating materials – Part 3-2: Determination of resistive properties (DC methods) – Surface resistance and surface resistivity*

IEC 62631-3-3, *Dielectric and resistive properties of solid insulating materials – Part 3-3: Determination of resistive properties (DC methods) – Insulation resistance*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Test specimens

The minimum number of specimens for qualification testing shall be three pairs. Cleaning of specimens, if needed, shall be in accordance with the manufacturer's recommendations.

5 Environment for conditioning and testing

5.1 Conditioning and controlled environment for qualification tests

The electrostatic behaviour of materials generally depends on environmental conditions, mainly on relative humidity. For this reason, electrical measurements shall be performed under controlled conditions defined in Table 1.

The samples are both conditioned and tested in a test room or suitable facility under the environmental conditions specified in Table 1. Pre-conditioning of samples is necessary as defined in Table 1 to eliminate the effect of stress appearing after moulding of certain materials or to dry the footwear before actual conditioning begins.

Table 1 – Controlled conditions for electrical measurements

	Preconditioning	Conditioning	Measurement
Hours (h)	72^{+10}_{0}	72^{+10}_{0}	
Temperature (°C)	40 ± 3	23 ± 3	23 ± 3
Relative humidity (% RH)	< 15	12 ± 3	12 ± 3
It is possible the conditioning times specified in Table 1 are not sufficient to bring the specimens into complete equilibrium with the environment. They have been selected as a compromise between experimental cost and accuracy. If it is desired to evaluate the performance at near equilibrium, then a series of measurements should be made after a range of conditioning times.			

5.2 Environment for acceptance tests

The environment of the in-use facility can be very different from the one in which the qualification tests are performed. Experience will be necessary to ensure that qualification test results remain valid for in-use footwear. Acceptance testing shall be done under the known conditions of use.

6 Test report

The test report shall include at least the following information:

a) date of measurement;

b) description and identification of footwear (name, grade, colour, manufacturer, etc.);

c) type of measurement;

d) temperature and relative humidity conditions during test;

e) minimum, maximum and average of test values;

f) type, size and number of specimens;

g) pre-conditioning (cleaning of specimens and pre-drying);

h) conditioning;

i) description of resistance measurement apparatus;

j) voltage polarity;

k) applied voltage;

l) time for which voltage is applied before a reading is taken;

m) any deviations from the specified procedure.

7 Test equipment

7.1 Load applied to footwear under test

The load applied to the footwear under test is 12,5 kg ± 2,5 kg. This is achieved using a bag, or bags, sufficiently flexible (cotton socks work well) and filled with 12,5 kg ± 2,5 kg of metal shot (∅ ≤ 3 mm), to fit inside the footwear under test.

Resistance testing of footwear while not being worn requires the application of a mass or weight either directly or through the application of a known force to the footwear while placed on a counter electrode. The mass or weight may be one of several designs, including any method not described in this document, provided that it meets the intent and purpose of applying a known load to the footwear under test.

7.2 Conductive electrode

The conductive electrode is fitted so as to contact and cover as large an area as possible of the sole on the inside of the footwear (i.e., insole). The resistance shall be < 500 Ω (e.g. aluminium foil fitted to the insole of the footwear will function correctly).

7.3 Counter electrode

This consists of a stainless steel plate larger than the footwear under test (typically with minimum dimensions of 150 mm × 300 mm).

7.4 Insulative support plate

The insulative support plate shall have an area greater than or equal to the area of the counter electrode (7.3) with a minimum thickness of 1 mm. The vertical resistance shall be at least one order of magnitude greater than the expected value of the test specimen or if the expected value is unknown, greater than $1x10^{13}$ Ω when tested with 500 V in compliance with IEC 62631-3-1, IEC 62631-3-2 and IEC 62631-3-3.

7.5 Resistance measurement apparatus

7.5.1 General

A self-contained resistance meter (ohmmeter) or power supply and current meter in the appropriate configuration for resistance measurement, with ±10 % accuracy, and capable of the following requirements.

7.5.2 Laboratory evaluations (qualification testing)

The apparatus shall have a circuit voltage while under load of 10 V ± 0,5 V for resistance below $1,0 \times 10^6$ Ω, and 100 V ± 5 V for resistance of $1,0 \times 10^6$ Ω and above. The measuring range of the apparatus shall be at least one order of magnitude either side of the expected range of resistance being measured. The apparatus shall be used in a manner that ensures unintended ground paths do not influence measurements.

7.5.3 Acceptance testing

The apparatus shall have an open circuit voltage of 10 V ± 0,5 V for resistance below 1,0 × 10^6 Ω, and 100 V ± 5 V for resistance of 1,0 × 10^6 Ω and above. The measuring range of the apparatus shall be at least one order of magnitude either side of the expected range of resistance being measured. The apparatus shall be used in a manner that ensures unintended ground paths do not influence measurements.

In case of dispute, laboratory evaluation apparatus shall be used.

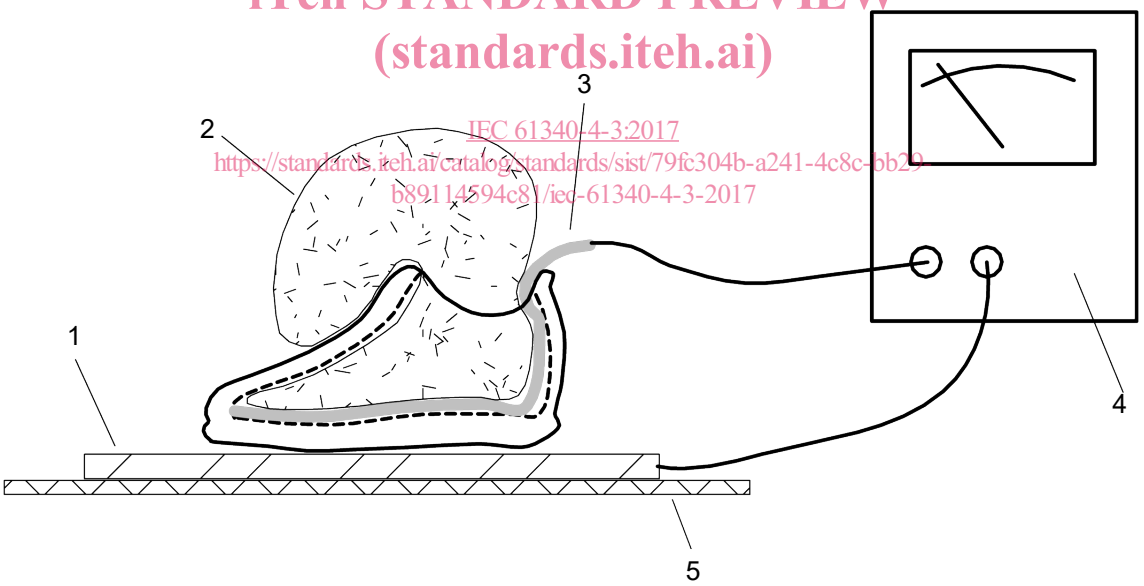
7.6 Environmental test chamber

An enclosed chamber or other environment capable of maintaining the conditions described in Clause 5.1 and Table 1.

8 Test procedure

For tests, follow the pre-conditioning and conditioning procedures specified in Clause 5.1 and Table 1.

The arrangement of test equipment for making measurements is shown in Figure 1.



IEC

Key

1 counter electrode
2 load applied to footwear under test
3 conductive electrode
4 resistance measurement apparatus
5 insulative support plate

Figure 1 – Form-fitting weight and measuring set-up (schematic)

a) Place the footwear on the stainless steel counter electrode.
b) Install a conductive electrode on the inside surface of the footwear under test.