IEC 61340-4-8

Edition 2.0 2014-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrostatics – Part 4-8: Standard test methods for specific applications – Electrostatic discharge shielding – Bags

Électrostatique – Partie 4-8: Méthodes d'essai normalisées pour des applications spécifiques – Blindage contre les décharges électrostatiques – Sacs

IEC 61340-4-8:2014-11(en-fr)

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ELECTROSTATICS –

Part 4-8: Standard test methods for specific applications – Electrostatic discharge shielding – Bags

FOREWORD

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International Standard IEC 61340-4-8 has been prepared by IEC technical committee 101: Electrostatics.

This second edition cancels and replaces the first edition published in 2010 and constitutes a technical revision.

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

a) modification to the title to include the word "Electrostatic" before discharge shielding";
b) removal of normative references ANSI/ESD STM5.1 and ASTM D-257-78 and replaced by normative references IEC 61340-3-1 and IEC 60093;
c) new normative reference to IEC 61340-5-3 added, because the requirement for shielding bags have been included in this standard;
d) imperial units have been removed.

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

FDIS	Report on voting
101/448/FDIS	101/456A/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.

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

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- withdrawn,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.

INTRODUCTION

It is the intention of this part of IEC 61340 to provide industry with a common, repeatable method for testing and determining the electrostatic discharge shielding ability of electrostatic discharge shielding bags.

This test method describes the use of a single current probe in order to obtain the energy value inside a bag when tested with a 1 000 V human body model discharge pulse in an ESD simulator.

The standard addresses important variables such as:

– discharge waveform characteristics;
– capacitive probe capacitance;
– bag size.

ELECTROSTATICS –

Part 4-8: Standard test methods for specific applications – Electrostatic discharge shielding – Bags

1 Scope

This part of IEC 61340 provides a test method for evaluating the performance of electrostatic discharge shielding bags tested according to the requirements of IEC 61340-5-3. The design voltage for the test apparatus is 1 000 V d.c.

The test method presented in this standard can also be applied to packaging other than shielding bags.

The purpose of this standard is to ensure that testing laboratories who use this test method to evaluate a given packaging material will obtain similar results.

This standard does not address protection from electromagnetic interference (EMI), radio frequency interference (RFI), electromagnetic pulsing (EMP) nor protection against volatile materials.

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.

IEC 60093, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*[1]

IEC 61340-3-1, *Electrostatics – Part 3-1: Methods for simulation of electrostatic effects – Human body model (HBM) electrostatic discharge test waveforms*

IEC 61340-5-3, *Electrostatics – Part 5-3: Protection of electronic devices from electrostatic phenomena – Properties and requirements classification for packaging intended for electrostatic discharge sensitive devices*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
electrostatic discharge shield
barrier or enclosure that limits the passage of current and attenuates an electromagnetic field resulting from an electrostatic discharge

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1 Replacements for IEC 60093 are currently under consideration and have been assigned project numbers in the IEC 62631-3 series. The relevant project is 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*.

4 Required equipment

4.1 ESD simulator

A basic ESD simulator is shown in Figure 1. This simulator and the resulting waveforms are taken from IEC 61340-3-1. The equivalent circuit for the simulator consists of a 100 pF capacitor in series with a 1 500 Ω resistor.

4.2 Waveform verification equipment

4.2.1 General

Equipment capable of verifying the pulse waveforms defined in this part of IEC 61340 shall include, but is not limited to, a storage oscilloscope, a suitable current probe and a high voltage resistor.

4.2.2 Oscilloscope

A digital storage oscilloscope capable of a minimum 200 MHz single shot bandwidth and a minimum sampling rate of 500 mega samples per second.

4.2.3 Current probe

The current probe shall have a minimum frequency response of 200 MHz. Included in the current probes that meet this requirement are for example a Tektronix CT-1, CT-2 and CT-6 [2]. The maximum cable length shall be 1 m.

4.2.4 High voltage resistor

The resistor shall be a 500 Ω, ±1 % tolerance, voltage rating at least 2 000 V, low inductance, sputtered metal film type.

4.3 Capacitive probe

A parallel plate capacitive probe shall be constructed as shown in Figure 2. The capacitance of the probe shall be 8 pF ±2 pF. The probe capacitance can be verified according to Clause 6, point c).

The spacer between the plates shall be made of an insulating material such as polycarbonate or acrylic.

4.4 Discharge electrode and ground electrode

The discharge electrode and the ground electrode shall be 3,8 cm ± 0,025 cm in diameter and shall be made of a conductive material. The support area that surrounds the ground electrode shall be 22 cm ± 1,0 cm × 27 cm ± 1,0 cm and have a surface resistance greater than 1×10^{12} Ω as measured by IEC 60093.

4.5 Bag size

The bags used for this test shall be 20 cm ±0,5 cm × 25 cm ±0,5 cm with 20 cm being the open end. The defined bag size relates to the inner dimension of a bag.

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[2] The information concerning Tektronix CT-1, CT-2 and CT-6 is given for the convenience of users of this standard and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

When bags are tested for reasons other than to evaluate performance according to the requirement of IEC 61340-5-3, it is recommended to compare bags of the same size.

4.6 Computer/software

A computer is recommended to analyse the data that is acquired by the oscilloscope. A generic description of the analysis system is described in Annex A.

4.7 Environmental chamber

A chamber is required that can meet the following environmental test conditions:

– control humidity to 12 % RH ±3 % RH at a temperature of 23 °C ±2 °C;

– control humidity to 50 % RH ±5 % RH at a temperature of 23 °C ±2 °C.

5 ESD simulator waveform verification procedure

The following procedure shall be used to verify the resistive current (I_p) waveform from the ESD simulator:

a) Connect the 500 Ω resistor specified in 4.2.4 to the wiring from the ESD simulator discharge and ground connections keeping the cabling as short as possible (the cables used shall be the same as those used to perform the shielding test). Connect the current probe around the wire end of the resistor which is connected to the ESD simulator ground. Connect the discharge electrode cable to the tester output and the ground electrode cable to equipment ground.

NOTE The conductive discharge and ground electrodes are not used for this portion of the test.

b) Connect the current probe to the storage oscilloscope. Set the oscilloscope input impedance to 50 Ω. (Match the impedance of the probe and the scope input.)

c) Set the ESD simulator discharge voltage to 1 000 V d.c.

d) Set the horizontal time scale in the oscilloscope to 5 ns per division and initiate a pulse. Observe the waveform rise time, peak current and leading edge ringing. All parameters shall be within the limits specified in Figure 3a and Clause 5, point e).

e) If necessary, adjust the ESD simulator voltage level until a peak current (I_p) of 0,50 A ±10 % is obtained. This voltage level represents an equivalent 1 000 V discharge level. This is the voltage level that will be used in Clause 7.

f) Set the horizontal time scale in the oscilloscope to 100 ns per division and observe the complete current waveform. The pulse shall meet the decay time requirement (t_d) as shown in Figure 3b.

g) Using the computer, analyse the resulting current waveform. The software shall be capable of calculating energy for different resistances. For this portion of the procedure the resistance is 2 000 Ω (this consists of the 1 500 Ω ESD simulator resistance and the 500 Ω high-voltage resistor). The energy from a 1 000 V (100 pF) discharge shall be 50 μJ (±6 μJ). This is obtained from the equation $W = 1/2\ CV^2$.

6 System verification procedure

The following procedure shall be followed:

a) Connect the 500 Ω resistor between the two conductive plates of the capacitive probe. Place the capacitive probe between the discharge and ground electrodes. Ensure that the discharge electrode, the capacitive probe and the ground electrode are vertically aligned and that there is good constant contact between all three elements.

b) Connect the current probe to the storage oscilloscope. Set the oscilloscope input resistance to 50 Ω.

c) Set the horizontal time scale in the oscilloscope to 5 ns per division and initiate a 1 000 V pulse. The peak current, due to the capacitive loading of the capacitive probe, shall not reduce the peak current to less than 0,42 A. If the reading is outside of this range, check the capacitance of the capacitive probe with a capacitance meter and/or adjust the length of the wiring if necessary.

7 Test procedure including conditioning

The test procedure shall be as follows and all testing shall be performed in the conditioned environment:

a) Place a minimum of six samples of the product to be tested in an environmental chamber set for the following conditions:

- temperature: 23 °C ±2 °C;
- relative humidity: 12 % RH ±3 % RH;
- conditioning period: minimum of 48 h.

Place an equal number of additional samples into an environmental chamber set for the following conditions:

- temperature: 23 °C ±2 °C;
- relative humidity: to 50 % RH ± 5 % RH;
- conditioning period: minimum of 48 h.

b) Place the capacitive probe into the 20 cm × 25 cm bag such that its centre is 10,0 cm ±0,5 cm from the edge of the bag and is centred, side to side. Ensure good contact between the electrodes, the bag and the probe. If other bag sizes are used, the capacitive probe shall be placed in the geometric centre of the bag.

c) Set the oscilloscope horizontal time scale to 50 ns per division. The horizontal time scale may have to be adjusted if the entire current waveform is not displayed on the oscilloscope.

d) Initiate a 1 000 V pulse (or 1 000 V equivalent) as determined in Clause 5, point e).

e) If using a computer, calculate and record the energy seen inside the bag (use 500 Ω for the resistance setting for the software). Repeat step d) five more times to obtain six data points per bag.

f) Repeat steps b) through e) for the remaining samples.

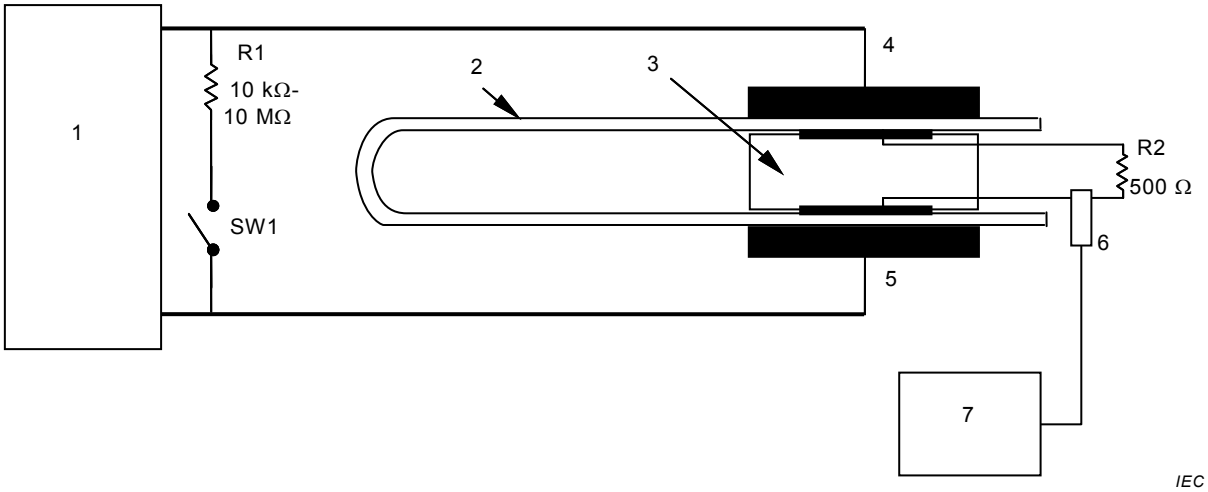
g) Repeat steps b) through f) for the bags that were conditioned at 50 % RH.

8 Reporting

a) Report the average, minimum, maximum and standard deviation of all energy readings for both humidity levels.

b) Record the following additional information:

- peak current;
- bag size;
- bag thickness;
- conditioning period;
- test conditions;
- ESD simulator description (manufacturer/model/serial number);
- oscilloscope description (manufacturer/model/serial number and last calibration date).



Key

1 ESD simulator (nominally 100 pF and 1 500 Ω)

2 bag under test

3 capacitive probe

4 discharge electrode

5 ground electrode

6 current probe

7 oscilloscope

NOTE 1 The current probe (6) is specified in 4.2.3.

NOTE 2 The 500 Ω resistor (R2) is specified in 4.2.4.

NOTE 3 The performance of the tester is strongly influenced by parasitic capacitance and inductance.

Switch SW1 is closed 10 ms to 100 ms after the pulse delivery period to ensure that the discharge electrode is not left in a charged state. The switch should be open at least 10 ms prior to the delivery of the next pulse. R1 and SW1 are part of the ESD simulator's internal circuitry.

Figure 1 – ESD simulator