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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Withdrawn

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

Electrostatique –
Partie 5-3: Protection des dispositifs électroniques contre les phénomènes électrostatiques – Classification des propriétés et des exigences relatives à l'emballage destiné aux dispositifs sensibles aux décharges électrostatiques

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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ELECTROSTATICS –

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

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International Standard IEC 61340-5-3 has been prepared by IEC technical committee 101: Electrostatics.

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

FDIS	Report on voting
101/295/FDIS	101/302/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.

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This standard was written based on the ESD Association Standard ANSI/ESD S541-2003 [1][1] with some modification in relation to IEC 61340-5-1:2007 [2] and IEC/TR 61340-5-2:2007 [3].

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 amendment and the base 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- withdrawn,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.

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[1] References in square brackets refer to the bibliography.

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INTRODUCTION

Packaging is necessary to protect electrostatic discharge sensitive devices (ESDS) from physical and environmental damage during manufacture, transportation and storage.

Additionally, packaging for ESDS should also prevent damage from static electricity.

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ELECTROSTATICS –

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

1 Scope

This part of IEC 61340 defines the ESD protective packaging properties needed to protect electrostatic discharge sensitive devices (ESDS) through all phases of production, transport and storage. Test methods are referenced to evaluate packaging and packaging materials for these product and material properties. Performance limits are provided.

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

2 Normative references

The following referenced documents are indispensable for the application 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 61340-2-3, *Electrostatics – Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge accumulation*

IEC 61340-4-8, *Electrostatics – Part 4-8: Standard test methods for specific applications – Discharge shielding - Bags*

ANSI/ESD STM 11.13, *Two-point resistance measurement*

3 Terms and definitions

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

3.1
electrostatic discharge
ESD
transfer of charge between bodies at different electrostatic potentials

3.2
electrostatic discharge sensitive device
ESDS
sensitive devices, integrated circuit or assembly that may be damaged by electrostatic fields or electrostatic discharge

3.3
ESD protected area
EPA
area in which an ESDS can be handled with accepted risk of damage as a result of electrostatic discharge or fields

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3.4
unprotected area
UPA
areas outside an EPA as shown in Figure 2

3.5
intimate packaging
material which makes contact with ESDS

3.6
proximity packaging
material not making contact with ESDS which is used to enclose one or more devices

3.7
secondary packaging
material used primarily to give additional physical protection to the outside of a proximity package

3.8
volume resistance
Ω
ratio of a d.c. voltage (V) applied between two electrodes placed on two (opposite) surfaces of a specimen and the current (A) between the electrodes

3.9
surface resistance
Ω
ratio of a d.c. voltage (V) applied between two electrodes on a surface of a specimen and the current (A) between the electrodes

4 Tailoring

This standard, or portions thereof, may not apply to all applications. Tailoring is accomplished by evaluating the applicability of each requirement for the specific application. Upon completion of the evaluation, requirements may be added, modified or deleted.

Tailoring decisions, including rationale, shall be documented.

5 Packaging application requirement

5.1 General

Transportation of ESDS requires packaging that provides protection from electrostatic hazards. Within an EPA in which all ESD risks are well controlled, ESD protective packaging may not be necessary.

5.2 Inside an EPA

Packaging used within an EPA shall consist of dissipative or conductive materials for intimate contact.

Items sensitive to <100 V human body model (HBM) may need additional protection depending on application and program plan requirements.

NOTE Dissipative materials are preferred for intimate packaging in situations where charged device model (CDM) damage is a concern.

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5.3 Outside an EPA

Transportation of sensitive products outside of an EPA shall require packaging that provides both:

a) dissipative or conductive materials for intimate contact;

b) a structure that provides electrostatic discharge shielding.

NOTE 1 If electrostatic field shielding materials are used to provide discharge shielding, a material that provides a barrier to current flow should be used in combination with the electrostatic field shielding material.

NOTE 2 Dissipative materials are preferred for intimate packaging in situations where charged device model (CDM) damage is a concern.

6 Classification of ESD packaging material properties

6.1 General

Materials and packages that are useful in preventing damage to sensitive electronic devices exhibit certain properties. These properties include:

a) resistance properties:

– conductive;

– dissipative;

b) Shielding properties:

– electrostatic discharge;

– electrostatic field.

6.2 Material resistance properties

Most standard packaging materials are electrically insulative and insulative materials retain charge. Making the package less insulative provides a path for the charge to dissipate from the package to a material at a lower potential.

Specific ranges of resistance are useful for different purposes. Packaging can be classified by these resistance ranges of its construction.

6.2.1 Resistance of conductive materials

Conductive materials may be surface conductive, volume conductive or both. A surface conductive material shall have a surface resistance of $<1 \times 10^4\ \Omega$.

Volume conductive materials shall have a volume resistance $<1 \times 10^4\ \Omega$.

6.2.2 Resistance of electrostatic field shielding materials

Within the conductive materials classification, electrostatic field shielding materials shall have a homogeneous layer with a surface resistance of $<1 \times 10^3\ \Omega$ or a volume resistance of $<1 \times 10^3\ \Omega$.

Other methods may also define the electrostatic field shielding classification.

NOTE These resistance values do not necessarily imply RFI/EMI/EMP shielding.

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6.2.3 Resistance of dissipative materials

A static dissipative material shall have a surface resistance $\geq 1 \times 10^4\ \Omega$ and $< 1 \times 10^{11}\ \Omega$, or a volume resistance $\geq 1 \times 10^4\ \Omega$ and $< 1 \times 10^{11}\ \Omega$.

6.2.4 Resistance of insulative materials

Electrostatic insulative materials have a surface resistance $\geq 1 \times 10^{11}\ \Omega$, or a volume resistance $\geq 1 \times 10^{11}\ \Omega$.

6.3 Material electrostatic shielding properties

NOTE Electrostatic shielding materials protect packaged sensitive electronic items from the effects of electrostatic discharges and fields that are external to the package.

6.3.1 Electrostatic discharge shielding

Electrostatic discharge shielding packaging is capable of attenuating an electrostatic discharge. The calculated energy allowed inside a static discharge shielding bag shall be less than 50 nJ when tested according to IEC 61340-4-8 or equivalent test method modified to accommodate the product.

6.3.2 Electrostatic field shielding

Electrostatic field shielding packaging is capable of attenuating an electrostatic field.

NOTE Classified field-shielding materials may allow current flow through their volume.

7 Technical requirements for ESD protective packaging

7.1 Packaging and material properties

Table 1 and 2 provide test methods for determining material classifications for finished packages and materials. When possible, testing should be performed on the finished package.

7.2 Packaging marking

7.2.1 Classification symbol

ESD protective packaging shall be marked with the ESD classification symbol as shown in Figure 1 or in accordance with customer contracts, purchase orders, drawings or other documentation.

7.2.2 Packaging classification

The primary function code shall be marked below the ESD classification symbol as shown in Figure 1:

S electrostatic discharge shielding;

F electrostatic field shielding;

C electrostatic conductive;

D electrostatic dissipative.

7.2.3 Traceability

Packaging should be marked with information that allows traceability to the packaging manufacturer and to the manufacturer's date/lot code information.

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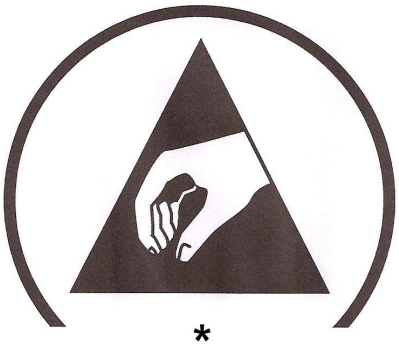
The date/lot code should allow traceability to quality control information pertaining to the manufacture of the specific lot of packaging.



IEC 455/10

*** Primary function codes:**

S electrostatic discharge shielding
F electrostatic field shielding
C electrostatic conductive
D electrostatic dissipative

Figure 1 – Example of packaging label

Table 1 – Test methods for electrostatic protective packaging

Material classification	Test method [c]	Method description	Limits
Conductive	IEC 61340-2-3 ANSI/ESD STM11.13 [a]	R_S Surface resistance R_V Volume resistance R_{p-p} Point-to-point resistance	$<1 \times 10^4\ \Omega$
Electrostatic field shielding	IEC 61340-2-3 [b]	R_S Surface resistance R_V Volume resistance	$< 1 \times 10^3\ \Omega$
Dissipative	IEC 61340-2-3 ANSI/ESD STM11.13 [a]	R_S Surface resistance R_V Volume resistance R_{p-p} Point-to-point resistance	$\geq 1 \times 10^4$ to $<1 \times 10^{11}\ \Omega$
Insulative	IEC 61340-2-3 ANSI/ESD STM11.13 [a]	R_S Surface resistance R_V Volume resistance R_{p-p} Point-to-point resistance	$\geq 1 \times 10^{11}\ \Omega$

[a] ANSI/ESD STM 11.13 describes the R_{p-p} point-to-point resistance measurement with a two point probe. IEC 61340-2-3 describes all three test methods R_S, R_V and R_{p-p}.

[b] IEC 61340-2-3 describes test methods for the determination of the electrical resistance and resistivity of solid materials in the range from $10^4\ \Omega$ to $10^{12}\ \Omega$. When using the concentric ring probe according to IEC 61340-2-3 for surface and volume resistance, the probe shall be able to measure values lower than $10^3\ \Omega$. The test voltage may also need to be lowered in this case.

[c] For product qualification of packaging materials, the environmental conditions for preconditioning and testing shall be 23 °C ± 2 °C and 12 % ± 3 % relative humidity. The preconditioning before the measurement shall be ≥48 h.

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Table 2 – Test methods and requirements for electrostatic discharge shielding packaging

	Packaging system	
	Shielding bags	**Other ESD shielding packaging design**
Test method	IEC 61340-4-8	User defined
Requirement	Energy < 50 nJ	– intimate packaging shall be dissipative or conductive – a barrier layer or a defined air gap attenuating ESD energy shall be included [a)]
[a)] No component of the packaging system shall cause ESD risk when taken within EPA.		

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