SVENSK STANDARD

SS-EN IEC 61340-5-1, utg 4:2025

2025-03-05

COMMENTED VERSION

Elektrostatiska urladdningar (ESD) – Del 5-1: Skydd av elektronik – Allmänna fordringar

Electrostatics –
Part 5-1: Protection of electronic devices from electrostatic phenomena –
General requirements

En så kallad ”Commented Version” (CMV) innehåller både den fastställda IEC-standarden och en kommenterad och ändringsmarkerad standard. Alla tillägg och borttagningar sedan den tidigare utgåvan är markerade med färg. Med en CMV sparar du mycket tid när du ska identifiera och förklara aktuella ändringar i standarden. SEK Svensk Elstandard kan bara ge ut CMV i de fall den finns tillgänglig från IEC.

IEC 61340-5-1

Edition 3.0 2024-05
COMMENTED VERSION

INTERNATIONAL STANDARD

colour inside

Electrostatics –
Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 17.220.99, 29.020

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROSTATICS –

Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This commented version (CMV) of the official standard IEC 61340-5-1:2024 edition 3.0 allows the user to identify the changes made to the previous IEC 61340-5-1:2016 edition 2.0. Furthermore, comments from IEC TC 101 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 61340-5-1 has been prepared by IEC technical committee 101: Electrostatics. It is an International Standard.

This third edition cancels and replaces the second edition published in 2016. This edition constitutes a technical revision.

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

a) definitions have been added to the document;
b) updates to product qualification requirements;
c) subclause 5.3.3 now includes a reference to groundable static control garment systems;
d) Table 2 was replaced;
e) subclause 5.3.4.2 was updated to define what an insulator is;
f) subclause 5.3.4.3 was updated to include a definition for isolated conductor;
g) Table 3 was updated, technical items added, including a reference to IEC 61340-5-4 for compliance verification testing;
h) Table 4 was added as a summary of the requirements in IEC 61340-5-3 and to include requirements for compliance verification of packaging;
i) Annex A was replaced: the former Annex is no longer required. Annex A are examples of tailoring.

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Draft	Report on voting
101/705A/FDIS	101/710/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

This part of IEC 61340 covers the requirements necessary to design, establish, implement and maintain an electrostatic discharge (ESD) control program for activities that: manufacture, process, assemble, install, package, label, service, test, inspect, transport, or otherwise handle electrical or electronic parts, assemblies, and equipment susceptible to damage by electrostatic discharges greater than or equal to 100 V human body model (HBM), 200 V charged device model (CDM), and 35 V on isolated conductors. ~~Isolated conductors were historically represented by machine model (MM).~~ The 35 V limit is related to the level achievable using ionizers specified in this document. ~~The MM test is no longer required for qualification of devices, only the HBM and CDM tests are. The MM test is retained in this standard for process control of isolated conductors only.~~ **1**

Any contact and physical separation of materials or flow of solids, liquids, or particle-laden gases can generate electrostatic charges. Common sources of ESD include charged: personnel, conductors, common polymeric materials, and processing equipment. ESD damage can occur when:

- a charged person or object comes into contact with an ESD sensitive device (ESDS);
- an ESDS comes into direct contact with a ~~highly~~ conductive surface while exposed to an electrostatic field;
- a charged ESDS comes into contact with another conductive surface which is at a different electrical potential. This surface ~~may or may not~~ can be grounded or ungrounded.

Examples of ESDS are microcircuits, discrete semiconductors, thick and thin film resistors, hybrid devices, printed circuit boards and piezoelectric crystals. It is possible to determine device and item susceptibility by exposing the device to simulated ESD events. The ESD withstand voltage determined by sensitivity tests using simulated ESD events does not necessarily represent the ability of the device to withstand ESD from real sources at that voltage level. However, the levels of sensitivity are used to establish a baseline of susceptibility data for comparison of devices with equivalent part numbers from different manufacturers. Three different models have been used for qualification of electronic components – HBM, MM, and CDM. In current practice devices are qualified only using HBM and CDM susceptibility tests.

This document covers the ESD control program requirements necessary for setting up a program to handle ESDS, based on the historical experience of both military and commercial organizations. The fundamental ESD control principles that form the basis of this document are as follows.

- Avoid a discharge from any charged, conductive object (personnel and especially automated handling equipment) into the ESDS. This can be accomplished by bonding or electrically connecting all conductors in the environment, including personnel, to a known ground or contrived ground (as on board ship or on aircraft). This attachment creates an equipotential balance between all conducting objects and personnel. Electrostatic protection can be maintained at a potential different from a “zero” voltage ground potential as long as all conductive objects in the system are at the same potential.
- Avoid a discharge from any charged ESD sensitive device. Charging can result from direct contact and separation or it can be induced by an electric field. Necessary insulators in the environment cannot lose their electrostatic charge by attachment to ground. Ionization systems provide neutralization of charges on these necessary insulators (circuit board materials and some device packages are examples of necessary insulators). The ESD hazard created by electrostatic charges on the necessary insulators in the workplace is assessed to ensure that appropriate actions are implemented, according to the risk.

- Once outside of an electrostatic discharge protected area (hereinafter referred to as an EPA) it is generally not possible to control the above items; therefore, ESD protective packaging ~~may~~ can be required. ESD protection can be achieved by enclosing ESD sensitive products in static protective materials, although the type of material depends on the situation and destination. Inside an EPA, static dissipative materials ~~may~~ can provide adequate protection. Outside an EPA, static discharge shielding materials are recommended. Whilst all of these materials are not discussed in this document, it is important to recognize the differences in their application. For more information see IEC 61340-5-3 and IEC TR 61340-5-5 [1][1].

Each organization has different processes, and so will require a different blend of ESD prevention measures for an optimum ESD control program. Measures should be selected, based on technical necessity, and carefully documented in an ESD control program plan, so that all concerned can be sure of the program requirements.

Training is an essential part of an ESD control program in order to ensure that the personnel involved understand the equipment and procedures they are to use in order to be in compliance with the ESD control program plan. Training is also essential in raising awareness and understanding of ESD issues. Without training, personnel are often a major source of ESD risk. With training, they become an effective first line of defence against ESD damage. Product qualification ensures that equipment sourced for use in the ESD control program meets the technical requirements before it is placed in service.

A product qualification plan details the criteria to be used for selection of ESD control items.

Regular compliance verification checks and tests are essential to ensure that equipment remains effective and that the ESD control program is correctly implemented in compliance with the ESD control program plan.

1 Numbers in square brackets refer to the bibliography.

ELECTROSTATICS –

Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

1 Scope

This part of IEC 61340 applies to organizations that: manufacture, process, assemble, install, package, label, service, test, inspect, transport, or otherwise handle electrical or electronic parts, assemblies and equipment with withstand voltages greater than or equal to 100 V human body model (HBM) and 200 V charge device model (CDM) ~~and 35 V for isolated conductors~~. Also, protection from isolated conductors is addressed by limiting the voltage on isolated conductors to less than 35 V. ESDS with lower withstand voltages ~~may~~ can require additional control elements or adjusted limits. Processes designed to handle items that have lower ESD withstand voltage(s) can still claim compliance to this document.

This document provides the requirements for an ESD control program. IEC TR 61340-5-2 [2] provides guidance on the implementation of this document.

This document does not apply to electrically initiated explosive devices, flammable liquids, gases, and powders.

The purpose of this document is to provide the administrative and technical requirements for establishing, implementing, and maintaining an ESD control program (hereinafter referred to as the “program”).

~~NOTE Isolated conductors were historically represented by MM.~~

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 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 61340-4-1, *Electrostatics – Part 4-1: Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors*

IEC 61340-4-3, *Electrostatics – Part 4-3: Standard test methods for specific applications – Footwear*

IEC 61340-4-5, *Electrostatics – Part 4-5: Standard test methods for specific applications – Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person*

IEC 61340-4-6, *Electrostatics – Part 4-6: Standard test methods for specific applications – Wrist straps*

IEC 61340-4-7, *Electrostatics – Part 4-7: Standard test methods for specific applications – Ionization*

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

IEC 61340-4-9, *Electrostatics – Part 4-9: Standard test methods for specific applications – Garments*

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*

IEC TS 61340-5-4, *Electrostatics – Part 5-4: Protection of electronic devices from electrostatic phenomena – Compliance verification*

SVENSK STANDARD

SS-EN IEC 61340-5-1, utg 4:2025

Fastställd	Sida	Ansvarig kommitté
2025-03-05	1 (24)	SEK TK 101

Elektrostatiska urladdningar (ESD) − Del 5-1: Skydd av elektronik − Allmänna fordringar

Electrostatics −
Part 5-1: Protection of electronic devices from electrostatic phenomena −
General requirements

Som svensk standard gäller europastandarden EN IEC 61340-5-1:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61340-5-1:2024.

Nationellt förord

Europastandarden EN IEC 61340-5-1:2024

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 61340-5-1, Third edition, 2024 - Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 61340-5-1, utg 3:2017 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2027-06-25.

ICS 17.220.99; 29.020.00

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Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

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Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61340-5-1

June 2024

ICS 17.220.99; 29.020

Supersedes EN 61340-5-1:2016; EN 61340-5-1:2016/AC:2017-05

English Version

Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements (IEC 61340-5-1:2024)

Electrostatique - Partie 5-1: Protection des dispositifs électroniques contre les phénomènes électrostatiques - Exigences générales (IEC 61340-5-1:2024)

Elektrostatik - Teil 5-1: Schutz von elektronischen Bauelementen gegen elektrostatische Phänomene - Allgemeine Anforderungen (IEC 61340-5-1:2024)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 61340-5-1:2024 E

European foreword

The text of document 101/705/FDIS, future edition 3 of IEC 61340-5-1, prepared by IEC/TC 101 "Electrostatics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61340-5-1:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-03-25
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-06-25

This document supersedes EN 61340-5-1:2016 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 61340-5-1:2024 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60749-28	NOTE	Approved as EN IEC 60749-28
IEC 60749-26	NOTE	Approved as EN IEC 60749-26
IEC 60749-27	NOTE	Approved as EN 60749-27
IEC 60364 series	NOTE	Approved as HD 60364 series
IEC 61010-1	NOTE	Approved as EN 61010-1
IEC 61140	NOTE	Approved as EN 61140

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 61340-2-3	-	Electrostatics - Part 2-3: Methods of test for determining the resistance and resistivity of solid materials used to avoid electrostatic charge accumulation	EN 61340-2-3	-
IEC 61340-4-1	-	Electrostatics - Part 4-1: Standard test methods for specific applications - Electrical resistance of floor coverings and installed floors	EN 61340-4-1	-
IEC 61340-4-3	-	Electrostatics – Part 4-3: Standard test methods for specific applications – Footwear	EN IEC 61340-4-3	-
IEC 61340-4-5	-	Electrostatics – Part 4-5: Standard test methods for specific applications – Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person	EN IEC 61340-4-5	-
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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	EN IEC 61340-5-3	-
IEC/TS 61340-5-4	-	Electrostatics - Part 5-4: Protection of electronic devices from electrostatic phenomena - Compliance verification		-

IEC 61340-5-1

Edition 3.0 2024-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

Électrostatique – Partie 5-1: Protection des dispositifs électroniques contre les phénomènes électrostatiques – Exigences générales

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SEK SVENSK STANDARD utg 4:2025 SS-EN IEC 61340-5-1, Utg 4:2025

INTRODUCTION

This part of IEC 61340 covers the requirements necessary to design, establish, implement and maintain an electrostatic discharge (ESD) control program for activities that: manufacture, process, assemble, install, package, label, service, test, inspect, transport, or otherwise handle electrical or electronic parts, assemblies, and equipment susceptible to damage by electrostatic discharges greater than or equal to 100 V human body model (HBM), 200 V charged device model (CDM), and 35 V on isolated conductors. The 35 V limit is related to the level achievable using ionizers specified in this document.

Any contact and physical separation of materials or flow of solids, liquids, or particle-laden gases can generate electrostatic charges. Common sources of ESD include charged: personnel, conductors, common polymeric materials, and processing equipment. ESD damage can occur when:

- a charged person or object comes into contact with an ESD sensitive device (ESDS);
- an ESDS comes into direct contact with a conductive surface while exposed to an electrostatic field;
- a charged ESDS comes into contact with another conductive surface which is at a different electrical potential. This surface can be grounded or ungrounded.

Examples of ESDS are microcircuits, discrete semiconductors, thick and thin film resistors, hybrid devices, printed circuit boards and piezoelectric crystals. It is possible to determine device and item susceptibility by exposing the device to simulated ESD events. The ESD withstand voltage determined by sensitivity tests using simulated ESD events does not necessarily represent the ability of the device to withstand ESD from real sources at that voltage level. However, the levels of sensitivity are used to establish a baseline of susceptibility data for comparison of devices with equivalent part numbers from different manufacturers. Three different models have been used for qualification of electronic components – HBM, MM, and CDM. In current practice devices are qualified only using HBM and CDM susceptibility tests.

This document covers the ESD control program requirements necessary for setting up a program to handle ESDS, based on the historical experience of both military and commercial organizations. The fundamental ESD control principles that form the basis of this document are as follows.

- Avoid a discharge from any charged, conductive object (personnel and especially automated handling equipment) into the ESDS. This can be accomplished by bonding or electrically connecting all conductors in the environment, including personnel, to a known ground or contrived ground (as on board ship or on aircraft). This attachment creates an equipotential balance between all conducting objects and personnel. Electrostatic protection can be maintained at a potential different from a “zero” voltage ground potential as long as all conductive objects in the system are at the same potential.
- Avoid a discharge from any charged ESD sensitive device. Charging can result from direct contact and separation or it can be induced by an electric field. Necessary insulators in the environment cannot lose their electrostatic charge by attachment to ground. Ionization systems provide neutralization of charges on these necessary insulators (circuit board materials and some device packages are examples of necessary insulators). The ESD hazard created by electrostatic charges on the necessary insulators in the workplace is assessed to ensure that appropriate actions are implemented, according to the risk.

- Once outside of an electrostatic discharge protected area (hereinafter referred to as an EPA) it is generally not possible to control the above items; therefore, ESD protective packaging can be required. ESD protection can be achieved by enclosing ESD sensitive products in static protective materials, although the type of material depends on the situation and destination. Inside an EPA, static dissipative materials can provide adequate protection. Outside an EPA, static discharge shielding materials are recommended. Whilst all of these materials are not discussed in this document, it is important to recognize the differences in their application. For more information see IEC 61340-5-3 and IEC TR 61340-5-5 [1][1].

Each organization has different processes, and so will require a different blend of ESD prevention measures for an optimum ESD control program. Measures should be selected, based on technical necessity, and carefully documented in an ESD control program plan, so that all concerned can be sure of the program requirements.

Training is an essential part of an ESD control program in order to ensure that the personnel involved understand the equipment and procedures they are to use in order to be in compliance with the ESD control program plan. Training is also essential in raising awareness and understanding of ESD issues. Without training, personnel are often a major source of ESD risk. With training, they become an effective first line of defence against ESD damage. Product qualification ensures that equipment sourced for use in the ESD control program meets the technical requirements before it is placed in service.

A product qualification plan details the criteria to be used for selection of ESD control items.

Regular compliance verification checks and tests are essential to ensure that equipment remains effective and that the ESD control program is correctly implemented in compliance with the ESD control program plan.

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

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ELECTROSTATICS –

Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

1 Scope

This part of IEC 61340 applies to organizations that: manufacture, process, assemble, install, package, label, service, test, inspect, transport, or otherwise handle electrical or electronic parts, assemblies and equipment with withstand voltages greater than or equal to 100 V human body model (HBM) and 200 V charge device model (CDM). Also, protection from isolated conductors is addressed by limiting the voltage on isolated conductors to less than 35 V. ESDS with lower withstand voltages can require additional control elements or adjusted limits. Processes designed to handle items that have lower ESD withstand voltage(s) can still claim compliance to this document.

This document provides the requirements for an ESD control program. IEC TR 61340-5-2 [2] provides guidance on the implementation of this document.

This document does not apply to electrically initiated explosive devices, flammable liquids, gases, and powders.

The purpose of this document is to provide the administrative and technical requirements for establishing, implementing, and maintaining an ESD control program (hereinafter referred to as the “program”).

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 61340-2-3, *Electrostatics – Part 2-3: Methods of test for determining the resistance and resistivity of solid materials used to avoid electrostatic charge accumulation*

IEC 61340-4-1, *Electrostatics – Part 4-1: Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors*

IEC 61340-4-3, *Electrostatics – Part 4-3: Standard test methods for specific applications – Footwear*

IEC 61340-4-5, *Electrostatics – Part 4-5: Standard test methods for specific applications – Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person*

IEC 61340-4-6, *Electrostatics – Part 4-6: Standard test methods for specific applications – Wrist straps*

IEC 61340-4-7, *Electrostatics – Part 4-7: Standard test methods for specific applications – Ionization*

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

IEC 61340-4-9, *Electrostatics – Part 4-9: Standard test methods for specific applications – Garments*

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*

IEC TS 61340-5-4, *Electrostatics – Part 5-4: Protection of electronic devices from electrostatic phenomena – Compliance verification*