

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Electrostatique –
Part 5-1: Protection des dispositifs électroniques contre les phénomènes
électrostatiques – Exigences générales**

<https://standards.iteh.ai/Catalogue/standards/iec/581447c9-355e-4e75-942a-2007138b0aef/iec-61340-5-1-2007>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2007 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Electrostatique –
Part 5-1: Protection des dispositifs électroniques contre les phénomènes
électrostatiques – Exigences générales**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

R

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Personnel safety.....	9
5 ESD control program	9
5.1 General.....	9
5.1.1 ESD control program requirements.....	9
5.1.2 ESD coordinator	9
5.1.3 Tailoring	9
5.2 ESD control program administrative requirements.....	9
5.2.1 ESD control program plan.....	9
5.2.2 Training plan	10
5.2.3 Compliance verification plan.....	10
5.3 ESD control program plan technical requirements	10
5.3.1 Grounding/equipotential bonding systems.....	11
5.3.2 Personnel grounding.....	12
5.3.3 ESD protected areas (EPA).....	13
5.3.4 Packaging.....	15
5.3.5 Marking.....	15
Annex A (normative) Test methods	16
Figure 1 – Schematic of an EPA with a ground reference.....	11
Figure 2 – Schematic of an equipotential bonding system.....	12
Figure A.1 – Wrist strap testing.....	16
Figure A.2 – Footwear testing (example).....	17
Table 1 – Grounding/bonding requirements.....	12
Table 2 – Personnel grounding requirements.....	13
Table 3 – EPA Requirements	14
Table 4 – Packaging	15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This first edition cancels and replaces the technical specification published in 1998. It constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

This version of IEC 61340-5-1 focuses on the requirements for an ESD control program. In addition, this version of IEC 61340-5-1 has been aligned with other major ESD control program standards used throughout the world.

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

FDIS	Report on voting
101/249/FDIS	101/251/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 maintenance result 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.

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 61340-5-1:2007](https://standards.iteh.ai/catalog/standards/iec/581447c9-355e-4e75-942a-2007138b0aef/iec-61340-5-1-2007)

<https://standards.iteh.ai/catalog/standards/iec/581447c9-355e-4e75-942a-2007138b0aef/iec-61340-5-1-2007>

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). This standard covers the ESD control program requirements necessary for setting up a program to handle ESD-sensitive devices (ESDs), based on the historical experience of both military and commercial organizations. The fundamental ESD control principles that form the basis of this standard 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 field induced. 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). Assessment of the ESD hazard created by electrostatic charges on the necessary insulators in the work place is required 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 often not possible to control the above items, therefore, ESD protective packaging may 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 provide adequate protection. Outside an EPA, static discharge shielding materials are recommended. Whilst all of these materials are not discussed in this standard, it is important to recognize the differences in their application.

Each company has different processes, and so will require a different blend of ESD prevention measures for an optimum ESD control program. It is vital that these measures are 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.

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.

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 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 be grounded.

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 level of sensitivity, determined by test using simulated ESD events, may not necessarily relate to the level of sensitivity in a real life situation. However, they are used to establish a baseline of susceptibility data for comparison of devices with equivalent part numbers from different manufacturers. Three different models are used for characterization of electronic components - human body model (HBM), machine model (MM), and charged device model (CDM).

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 61340-5-1:2007](https://standards.iteh.ai/catalog/standards/iec/581447c9-355e-4e75-942a-2007138b0aef/iec-61340-5-1-2007)

<https://standards.iteh.ai/catalog/standards/iec/581447c9-355e-4e75-942a-2007138b0aef/iec-61340-5-1-2007>

WITHDRAWN

ELECTROSTATICS –

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

1 Scope

This part of IEC 61340 applies to 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).

This standard provides the requirements for an ESD control program. The user should refer to IEC 61340-5-2 for guidance on the implementation of this standard.

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

The purpose of this standard 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 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 60364 (all parts), *Low-voltage electrical installations*

IEC/TS 60479-1, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC/TS 60479-2, *Effects of current on human beings and livestock – Part 2: Special aspects*

IEC 60749-26, *Semiconductor devices – Mechanical and climatic test methods – Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

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/TR 61340-5-2, *Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide*

ANSI/ESD S1.1, *Standard Test Method for the protection of electrostatic charge susceptible items – Wrist Straps*

ANSI/ESD STM2.1, *Standard Test Method for the protection of electrostatic discharge susceptible items – Garments*

ANSI/ESD STM3.1, *Standard Test Method for the electrostatic discharge susceptible items – Ionization*

ANSI/ESD STM11.31, *Standard Test Method for evaluating the performance of electrostatic discharge shielding materials – Bags*

3 Terms and definitions

For the purposes of this document, the terms and definitions in the future IEC 61340-1-2 as well as the following, apply.

3.1 common ground point

grounded device or location where the conductors of two or more ESD control items are bonded

3.2 common connection point

device or location where the conductors of two or more ESD control items are connected in order to bring the ESD protective items to the same electrical potential through equipotential bonding

3.3 equipotential bond

electrical connection of exposed conductive parts (or items used to control ESD) so that they are at substantially the same voltage under normal and fault conditions

3.4 ESD control items

materials or products designed to prevent the generation of static charge and / or dissipate static charges that have been generated so as to prevent damage to ESD sensitive devices

3.5 functional ground

terminal used to connect parts to earth for reasons other than safety

3.6 organization

company, group or body that handles ESDS

3.7 protective earth

terminal used to connect parts to earth for safety reasons

4 Personnel safety

The procedures and equipment described in this standard may expose personnel to hazardous electrical conditions. Users of this standard are responsible for selecting equipment that complies with applicable laws, regulatory codes and both external and internal policy. Users are cautioned that this standard cannot replace or supersede any requirements for personnel safety.

Electrical hazard reduction practices should be exercised and proper grounding instructions for equipment must be followed.

5 ESD control program

5.1 General

5.1.1 ESD control program requirements

An ESD control program, that has been established using the technical limits required by this standard, will minimize ESD related damage to devices that have an ESD sensitivity greater than or equal to 100 V HBM as determined through testing using IEC 60749-26. The program shall include both administrative and technical requirements as described in this standard. The organization shall establish, document, implement, maintain and verify the compliance of the program in accordance with the requirements of this standard.

5.1.2 ESD coordinator

A person shall be assigned by the organization with the responsibility for implementing the requirements of this standard including establishing, documenting, maintaining and verifying the compliance of the program.

5.1.3 Tailoring

This standard, or portions of it, 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 and technical justification, shall be documented.

5.2 ESD control program administrative requirements

5.2.1 ESD control program plan

The organization shall prepare an ESD control program plan that addresses each of the requirements of the program. Those requirements concern

- training,
- compliance verification,
- grounding/bonding systems,
- personnel grounding,
- EPA requirements,
- packaging systems,
- marking.

The plan is the principal document for implementing and verifying the program. The goal is a fully implemented and integrated program that conforms to internal quality system requirements. The plan shall apply to all applicable facets of the organization's work.

5.2.2 Training plan

The training plan shall define all personnel that are required to have ESD awareness and prevention training. At a minimum, initial and recurrent ESD awareness and prevention training shall be provided to all personnel who handle or otherwise come into contact with any ESDS items. Initial training shall be provided before personnel handle ESD sensitive devices. The type and frequency of ESD training for personnel shall be defined in the training plan. The training plan shall include a requirement for maintaining employee training records and shall document where the records are stored. Training methods and the use of specific techniques are at the organization's discretion. The training plan shall include methods used by the organization to ensure trainee comprehension and training adequacy.

5.2.3 Compliance verification plan

A compliance verification plan shall be established to ensure the organization's fulfilment of the requirements of the plan. Process monitoring (measurements) shall be conducted in accordance with a compliance verification plan that identifies the technical requirements to be verified, the measurement limits and the frequency at which those verifications must occur. The compliance verification plan must document the test methods used for process monitoring and measurements. If the organization uses test methods that differ from the standards referenced in this standard, the organization must be able to show that the results achieved correlate with the referenced standards. Compliance verification records shall be established and maintained to provide evidence of conformity to the technical requirements.

The test equipment selected shall be capable of making the measurements defined in the compliance verification plan.

5.3 ESD control program plan technical requirements

The following subclauses describe the essential technical requirements used in the development of an ESD control program.

The required limits are based on the test methods or standards listed in each table of this subclause. The compliance verification plan must document the methods used to verify the limits. These procedures may or may not be based on the test methods in each table. Test methods and corresponding limits used by the organization that differ from the test methods or references in Tables 1 through 4 shall be documented with a technical justification that supports their use.

Some of the technical elements listed in Tables 1 through 4 do not have a defined lower resistance limit. However, a minimum resistance value may be required for safety reasons.

See relevant national requirements and/or IEC 61010-1, IEC/TS 60479-1, IEC/TS 60479-2, IEC 61140 and IEC 60364 series.