

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**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 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 l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) 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 IEC

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

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



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

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.220.99, 29.020

ISBN 978-2-8322-8889-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	9
4 Personnel safety.....	10
5 ESD control program	10
5.1 General.....	10
5.1.1 ESD control program requirements	10
5.1.2 ESD control program manager or coordinator	10
5.1.3 Tailoring	10
5.2 ESD control program administrative requirements.....	10
5.2.1 ESD control program plan.....	10
5.2.2 Training plan	11
5.2.3 Product qualification plan	11
5.2.4 Compliance verification plan	12
5.3 ESD control program plan technical requirements.....	12
5.3.1 General	12
5.3.2 Grounding/equipotential bonding systems.....	12
5.3.3 Personnel grounding.....	14
5.3.4 ESD protected areas (EPA)	15
5.3.5 Packaging.....	18
5.3.6 Marking	18
Annex A (informative) Tailoring examples	19
Bibliography.....	21
Figure 1 – Schematic of an EPA with a ground reference.....	13
Figure 2 – Schematic of an equipotential bonding system	14
Table 1 – Grounding/bonding requirements.....	14
Table 2 – Personnel grounding requirements	15
Table 3 – EPA technical requirements	17
Table 4 – Packaging requirements	18

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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

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.

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

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.

A list of all 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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.