

TECHNICAL REPORT



Electrostatics – Part 1: Electrostatic phenomena – Principles and measurements



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67 000 electrotechnical terminology entries in English and French extracted from the Terms and definitions clause of IEC publications issued between 2002 and 2015. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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Electrostatics – Part 1: Electrostatic phenomena – Principles and measurements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROSTATICS –

Part 1: Electrostatic phenomena – Principles and measurements

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC TR 61340 edition 1.1 contains the first edition (2012-06) [documents 101/344/DTR and 101/355/RVC] and its corrigenda 1 (2013-03) and 2 (2017-12), and its amendment 1 (2020-06) [documents 101/598/DTR and 101/604/RVDTR].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 61340-1, which is a technical report, has been prepared by IEC technical committee 101: Electrostatics.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the 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 the base publication and its amendment 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,
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INTRODUCTION

Static electricity has been known for around 2 500 years but until recently had little impact on humankind. More recently in the last century the nature of static electricity became better understood and the principles of charge separation and accumulation could be described. Despite this improved understanding, it remains difficult to predict with certainty the polarity and magnitude of charges built up in any situation due to the many factors involved, and to, many electrostatics remains a “black art” rather than a science.

The development of modern materials, especially polymers, and their nearly ubiquitous application in fields such as floor materials, furnishings, clothing and engineering materials, has made static electricity an everyday phenomenon. In some industries, such as electronics manufacture and processes using flammable materials, unintended and invisible electrostatic discharges can lead to substantial component damage or unreliability, or fires or explosions. In everyday life, experience of electrostatic shocks to personnel has become commonplace. This has led to increasing need to understand such phenomena, and to specify materials, equipment and procedures for use in preventing and controlling electrostatic problems in the human environment.

This technical report gives an overview of the field of electrostatics and has been prepared to give the user a view of the background, principles, methods of measurement and industrial applications prepared in conformity with IEC TC101 publications.

ELECTROSTATICS –

Part 1: Electrostatic phenomena – Principles and measurements

1 Scope

This part of IEC 61340, which is a technical report, describes the fundamental principles of electrostatic phenomena including charge generation, retention and dissipation and electrostatic discharges.

Methods for measuring electrostatic phenomena and related properties of materials are described in a general way.

Hazards and problems associated with electrostatic phenomena and principles of their control are outlined.

Useful applications of electrostatic effects are summarized.

The purpose of this technical report is to serve as a reference for the development of electrostatics related standards, and to provide guidance for their end-users.

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 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Combustible dust atmospheres*

IEC TS 60079-32-1:2013, *Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance*

IEC 60079-32-2, *Explosive atmospheres – Part 32-2: Electrostatic hazards – Tests*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

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

IEC 61340-6-1, *Electrostatics – Part 6-1: Electrostatic control for healthcare – General requirements for facilities*

IEC 60243-1, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60243-2, *Electric strength of insulating materials – Test methods – Part 2: Additional requirements for tests using direct voltage*

~~IEC 61241-2-3, *Electrical apparatus for use in the presence of combustible dust – Part 2: Test methods – Section 3: Method for determining minimum ignition energy of dust/air mixtures*~~

~~BS EN 13821, *Potentially explosive atmospheres. Explosion prevention and protection. Determination of minimum ignition energy of dust/air mixtures*~~

ISO/IEC 80079-20-2, *Explosive atmospheres – Part 20-2: Material characteristics – Combustible dusts test methods*

ISO 80079-36:2016, *Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements*

3 Terms and definitions

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

3.1

antistatic additive

antistatic filler, antistatic treatment
substance added to, or process applied to a liquid or solid in order to reduce its tendency to acquire a charge by contact and rubbing, or to promote more rapid charge migration and so to reduce its ability to retain significant charge when in contact with earth

3.2

antistatic

refers to the property of a material that inhibits or limits triboelectric charging

3.3

bonding

electrical connection between two or more conducting objects that reduces the potential difference between them to an insignificant level

3.4

breakdown

failure, at least temporarily, of the insulating properties of an insulating medium under electric stress

3.5

breakdown voltage

voltage at which breakdown occurs, under prescribed conditions of test or use

3.6

charge decay

neutralization or migration of charge across or through a material leading to a reduction of charge density or surface potential at the point where the charge is deposited

3.7

charge decay time

charge relaxation time

time taken for charge to decay from a specified value to a specified lower value