

AS/NZS IEC 60079.32.2:2022
IEC 60079-32-2:2015



Australian/New Zealand Standard™

Explosive atmospheres

Part 32.2: Electrostatic hazards – Tests



AS/NZS IEC 60079.32.2:2022

This Joint Australian/New Zealand Standard™ was prepared by Joint Technical Committee EL-014, Equipment for Explosive Atmospheres. It was approved on behalf of the Council of Standards Australia on 27 January 2022 and by the New Zealand Standards Approval Board on 02 February 2022.

This Standard was published on 11 February 2022.

The following are represented on Committee EL-014:

- Auckland Regional Chamber of Commerce
- Australian Chamber of Commerce and Industry
- Australian Industry Group
- Australian Petroleum Production and Exploration Association
- Australian Pipelines and Gas Association
- Aviation and Marine Engineers Association
- Better Regulation Division (Fair Trading, Safework NSW, TestSafe)
- Bureau of Steel Manufacturers of Australia
- Business New Zealand
- Communications, Electrical and Plumbing Union — Electrical Division
- Department of Regional, NSW
- Electrical Compliance Testing Association of Australia
- Electrical Regulatory Authorities Council, Australia
- Electrical Safety New Zealand
- Engineering New Zealand
- Engineers Australia
- Engineers Australia / Mining Electrical and Mining Mechanical Engineering Society
- Institute of Electrical Inspectors
- Institute of Instrumentation, Control & Automation Aust
- Joint Accreditation System of Australia & New Zealand
- Master Electricians New Zealand
- Resources Safety & Health Queensland
- University of Newcastle
- Worksafe New Zealand - Energy Safety

This Standard was issued in draft form for comment as DR AS/NZS IEC 60079.32.2:2021.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

www.standards.govt.nz

ISBN 978 1 76113 646 7

Australian/New Zealand Standard™

Explosive atmospheres

Part 32.2: Electrostatics hazards – Tests

First published as AS/NZS IEC 60079.32.2:2022.



© IEC Geneva Switzerland 2022 — All rights reserved

© Standards Australia Limited/the Crown in right of New Zealand, administered by the New Zealand Standards Executive 2022

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of either the IEC or the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth) or the Copyright Act 1994 (New Zealand). If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please see the contact details on the back cover or the contact us page of the website for further information.

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-014, Equipment for Explosive Atmospheres.

The objective of this document is to describe test methods concerning the equipment, product and process properties necessary to avoid ignition and electrostatic shock hazards arising from static electricity. It is intended for use in a risk assessment of electrostatic hazards or for the preparation of product family or dedicated product standards for electrical or non-electrical machines or equipment.

The purpose of this document is to provide standard test methods used for the control of static electricity, such as surface resistance, earth leakage resistance, powder resistivity, liquid conductivity, capacitance, and evaluation of the incendivity of provoked discharges. It is especially intended for use with existing Standards of the AS/NZS IEC 60079 series.

This document presents the latest state of knowledge which may, however, slightly differ from requirements in other standards, especially concerning test climates. When a requirement of this document conflicts with a requirement specified in AS/NZS IEC 60079.0, to avoid the possibility of re-testing previously approved equipment, the requirement in AS/NZS IEC 60079.0 applies only for equipment within the scope of AS/NZS IEC 60079.0. In all other cases, the statements in this document apply.

This document is identical with, and has been reproduced from, IEC 60079-32-2:2015, *Explosive atmospheres – Part 32-2: Electrostatics hazards – Tests*.

As this document has been reproduced from an International Standard, the following applies:

- (a) In the source text “this part of IEC 60079” should read “this document”.
- (b) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

NOTES

CONTENTS

FOREWORD	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 Test methods.....	10
4.1 General.....	10
4.2 Surface resistance	11
4.2.1 General	11
4.2.2 Principle	12
4.2.3 Apparatus.....	12
4.2.4 Test sample.....	13
4.2.5 Procedure.....	13
4.2.6 Acceptance criteria	14
4.2.7 Test report.....	14
4.3 Surface resistivity	14
4.4 Volume resistivity.....	14
4.5 Leakage resistance.....	15
4.5.1 General	15
4.5.2 Principle	15
4.5.3 Apparatus.....	15
4.5.4 Test sample.....	15
4.5.5 Procedure.....	16
4.5.6 Acceptance criteria	16
4.5.7 Test report.....	16
4.6 In-use testing of footwear.....	16
4.6.1 General	16
4.6.2 Principle	16
4.6.3 Apparatus.....	17
4.6.4 Procedure.....	17
4.6.5 Acceptance criteria	17
4.6.6 Test report.....	17
4.7 In-use testing of gloves	17
4.7.1 General	17
4.7.2 Principle	18
4.7.3 Apparatus.....	18
4.7.4 Procedure.....	18
4.7.5 Acceptance criteria	18
4.7.6 Test report.....	18
4.8 Powder resistivity.....	18
4.8.1 General	18
4.8.2 Principle	19
4.8.3 Apparatus.....	19
4.8.4 Procedure.....	20
4.8.5 Acceptance criteria	20
4.8.6 Test report.....	20
4.9 Liquid conductivity	

4.9.1	General	21
4.9.2	Principle	21
4.9.3	Apparatus	21
4.9.4	Procedure	22
4.9.5	Acceptance criteria	23
4.9.6	Test report	23
4.10	Capacitance	23
4.10.1	General	23
4.10.2	Principle	24
4.10.3	Apparatus	24
4.10.4	Test sample	24
4.10.5	Procedure for moveable items	24
4.10.6	Procedure for installed items	25
4.10.7	Acceptance criteria	25
4.10.8	Test report	25
4.11	Transferred charge	25
4.11.1	General	25
4.11.2	Principle	26
4.11.3	Apparatus	26
4.11.4	Test sample	27
4.11.5	Procedure	27
4.11.6	Acceptance criteria	28
4.11.7	Test report	28
4.12	Ignition test	29
4.12.1	General	29
4.12.2	Apparatus	29
4.12.3	Procedure	32
4.12.4	Acceptance criteria	32
4.12.5	Test report	32
4.13	Measuring of charge decay	33
4.13.1	General	33
4.13.2	Principle	33
4.13.3	Apparatus	33
4.13.4	Test sample	34
4.13.5	Procedure	34
4.13.6	Acceptance criteria	35
4.13.7	Test report	35
4.14	Breakdown voltage	35
4.14.1	General	35
4.14.2	Principle	35
4.14.3	Apparatus	35
4.14.4	Test procedure	36
4.14.5	Acceptance criteria	37
4.14.6	Test report	37
Bibliography		38

Figure 1 – Test sample with applied electrodes (dimensions in mm) 12

Figure 2 – Measuring cell for powder resistivity 19

Figure 3 – Measuring cell for liquid conductivity	22
Figure 4 – Ignition probe	31
Figure 5 – Perforated plate of ignition probe	32
Figure 6 – Example of an arrangement for measurement of charge decay	34
Figure 7 – Electrodes for measuring breakdown voltage of sheets	36
Table 1 – Volume concentrations of flammable test gas mixtures	30

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –

Part 32-2: Electrostatics hazards – Tests

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) 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 60079-32-2 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

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

FDIS	Report on voting
31/1164/FDIS	31/1176/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 of the IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this 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.

EXPLOSIVE ATMOSPHERES –

Part 32-2: Electrostatics hazards – Tests

1 Scope

This part of IEC 60079 describes test methods concerning the equipment, product and process properties necessary to avoid ignition and electrostatic shock hazards arising from static electricity. It is intended for use in a risk assessment of electrostatic hazards or for the preparation of product family or dedicated product standards for electrical or non-electrical machines or equipment.

The purpose of this part of IEC 60079 is to provide standard test methods used for the control of static electricity, such as surface resistance, earth leakage resistance, powder resistivity, liquid conductivity, capacitance and evaluation of the incendivity of provoked discharges. It is especially intended for use with existing standards of the IEC 60079 series.

NOTE IEC TS 60079-32-1, *Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance*, was published in 2013. This international standard is not intended to supersede standards that cover specific products and industrial situations.

This part of IEC 60079 presents the latest state of knowledge which may, however, slightly differ from requirements in other standards, especially concerning test climates. When a requirement of this standard conflicts with a requirement specified in IEC 60079-0, to avoid the possibility of re-testing previously approved equipment, the requirement in IEC 60079-0 applies only for equipment within the scope of IEC 60079-0. In all other cases, the statements in this part of IEC 60079 apply.

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 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

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

IEC 60093, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60243-1, *Electric 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 60247, *Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor ($\tan \delta$) and d.c. resistivity*

IEC TS 61241-2-2, *Electrical apparatus for use in the presence of combustible dust – Part 2: Test methods – Section 2: Method for determining the electrical resistivity of dust in layers*

IEC 61340-2-1, *Electrostatics – Part 2-1: Measurement methods – Ability of materials and products to dissipate static electric charge*

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 61340-4-4, *Electrostatics – Part 4-4: Standard test methods for specific applications – Electrostatic classification of flexible intermediate bulk containers (FIBC)*

ISO 14309, *Rubber, vulcanized or thermoplastic – Determination of volume and/or surface resistivity*

ASTM E582, *Standard test method for minimum ignition energy and quenching distance in gaseous mixtures*

EN 1081, *Resilient floor coverings – Determination of the electrical resistance*

EN 1149-3, *Protective clothing – Electrostatic properties Part 3: Test methods for measurement of charge decay.*

3 Terms and definitions

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

3.1

conductive

having a resistivity or resistance below the dissipative range (see 3.4) allowing stray current arcs and electric shocks to occur

Note 1 to entry: Conductive materials or objects are neither dissipative nor insulating and are incapable of retaining a significant electrostatic charge when in contact with earth.

Note 2 to entry: Boundary limits are given in IEC TS 60079-32-1 for the conductive range for solid materials, enclosures, some objects and bulk materials.

Note 3 to entry: Product standards and other standards covering electrostatic properties often include specific definitions of “conductive” which apply only to items covered by those standards and may be different from the definitions given here. See e.g. ISO 8031 and ISO 8330 for hose assemblies, ISO 284 for belts and EN 1149-1, -2, -3 and -5 for protective clothing.

3.2

conductivity (electrical conductivity)

reciprocal of volume resistivity, expressed in siemens per metre (see 3.14)

3.3

conductor

conductive object

3.4

dissipative (electrostatic dissipative)

having an intermediate resistivity or resistance that lies between the conductive and insulating ranges (see 3.1 and 3.7)

Note 1 to entry: Dissipative materials or objects are neither conductive nor insulating but, like conductive items, safely limit contact charging and/or dissipate even the maximum charging currents associated with their designed application when in contact with earth

Note 2 to entry: Boundary limits are given in IEC TS 60079-32-1 for the dissipative range for solid materials, enclosures, some objects and bulk materials.

Note 3 to entry: Product standards often include specific definitions of “dissipative” which apply only to items covered by those standards and may be different to the definitions given here. See 3.1, Note 3 to entry.

3.5

enclosure

walls, doors, covers, cable glands, rods, spindles, shafts, coatings, etc. which surround and enclose equipment

Note 1 to entry: For electrical equipment, the enclosure is likely to be identical to the enclosure defined in IEC 60079-0.

Note 2 to entry: Flexible Intermediate Bulk Containers (FIBC) and other similar containers are not equipment enclosures and, therefore, are considered separately in IEC TS 60079-32-1.

3.6

hazardous area

area in which flammable or explosive gas/vapour-air or dust-air mixtures are, or can be, present in such quantities as to require special precautions against ignition

Note 1 to entry: See IEC 60079-10-1 and IEC 60079-10-2.

3.7

insulating

having a resistivity or resistance that is higher than the dissipative range (see 3.4)

Note 1 to entry: Insulating materials or objects are neither conductive nor dissipative. Electrostatic charges can accumulate on them and do not readily dissipate even when they are in contact with earth.

Note 2 to entry: Boundary limits are given in IEC TS 60079-32-1 for the insulating range for solid materials, enclosures, some objects and bulk materials. For certain items, special definitions are maintained in other standards.

Note 3 to entry: Product standards and other standards covering electrostatic properties often include specific definitions of “insulating” which apply only to items covered by those standards and may be different to the definitions given here. See 3.1, Note 3 to entry.

Note 4 to entry: The adjective “non-conductive” has often been used as a synonym for insulating. It is avoided in this document as it could be taken to mean either “insulating” or “insulating or dissipative” and this may lead to confusion.

3.8

isolated conductor

conductive object which can accumulate charge due to an earth leakage resistance exceeding the values given in IEC TS 60079-32-1

3.9

leakage resistance (resistance to earth)

resistance expressed in ohms between an electrode in contact with the surface to be measured and earth

Note 1 to entry: The leakage resistance depends upon the volume and/or surface resistivity of the materials and the distance between the chosen point of measurement and earth.

3.10

resistance

quotient of voltage and current flowing through a sample

Note 1 to entry: Depending on the electrodes applied the following resistances are distinguished:

Insulation resistance (ohms), see 3.11

Leakage resistance (ohms), see 3.9

Surface resistance (ohms), see 3.11

Surface resistivity (ohms), see 3.12

Volume resistivity (ohm metres), see 3.14.

3.11

surface resistance

resistance expressed in ohms between two electrodes in contact with the surface to be measured

Note 1 to entry: This definition of surface resistance is not entirely correct as the resistance between two electrodes depends on the volume resistivity of the material under test too. However, surface resistance as defined above has practical significance when evaluating the ability of materials to dissipate charges by conduction.

Note 2 to entry: The surface resistance measured according to 3.11 nearly always decreases with increasing thickness. The amount of decrease is depending on the relationship between surface resistance and volume resistance.

Note 3 to entry: In IEC 60167, the surface resistance is named insulation resistance.

Note 4 to entry: In IEC 60093, the surface resistance is defined as pure surface resistance without any current flowing through the volume.

3.12

surface resistivity

resistance across opposite sides of a surface of unit length and unit width commonly expressed in ohms

Note 1 to entry: Ohms/square is sometimes used but should be avoided as it does not conform with SI.

Note 2 to entry: The surface resistivity is ten times higher than the surface resistance measured according to 4.2.

3.13

teraohm meter

resistance measuring instrument with an upper measuring range of at least 1 TΩ and a variable measuring voltage up to 1 kV or higher

3.14

volume resistivity

resistance of a body of unit length and unit cross-sectional area expressed in ohm metres measured according to IEC 60093 for insulating materials and IEC TR 61340-2-3 for dissipative materials

4 Test methods

4.1 General

Variations in the results of measuring electrostatic properties of materials are mainly due to variations in the sample (e.g. inhomogeneous surfaces, geometry and the state of the material) rather than uncertainties in voltage, current, electrode geometry or uncertainty of the measuring device. This is because electrostatic properties are strongly influenced by very small differences so that statistical effects play an important role.

For example, in ASTM E582 the minimum ignition energy of an explosive gas atmosphere is defined by 100 or 1 000 non-ignitions. This does not exclude that, nevertheless, the 1 001st trial may ignite. Due to this statistical effect, the accuracy and reproducibility of electrostatic properties is limited by statistical scatter.

Typically, the accuracy and reproducibility of electrostatic measurements is about 20 % to 30 %. This is much higher than for a typical electric measurement which is less than 1 %. For this reason, electrostatic threshold limits contain a certain safety margin to compensate for the occurring statistical scatter.