

SLOVENSKI STANDARD

SIST-TP CLC/TR 60079-32-1:2015

01-julij-2015

Nadomešča:

SIST-TP CLC/TR 50404:2003

Eksplozivne atmosfere - 32-1. del: Elektrostatske nevarnosti - Navodilo (IEC/TS 60079-32-1:2013)

Explosive atmospheres -- Part 32-1: Electrostatic Hazards - Guidance (IEC/TS 60079-32-1:2013)

Explosionsgefährdete Bereiche - Teil 32-1: Elektrostatische Gefährdungen, Leitfaden (IEC/TS 60079-32-1:2013)

Atmosphères explosives - Partie 32-1: Risques électrostatiques - Guide (IEC/TS 60079-32-1:2013)

<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196f1fd1af/sist-tp-clc-tr-60079-32-1-2015>

Ta slovenski standard je istoveten z: CLC/TR 60079-32-1:2015

ICS:

13.230	Varstvo pred eksplozijo	Explosion protection
13.260	Varstvo pred električnim udarom. Delo pod napetostjo	Protection against electric shock. Live working

SIST-TP CLC/TR 60079-32-1:2015 en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CLC/TR 60079-32-1:2015

<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196f1d1af/sist-tp-clc-tr-60079-32-1-2015>

TECHNICAL REPORT
RAPPORT TECHNIQUE
TECHNISCHER BERICHT

CLC/TR 60079-32-1

April 2015

ICS 29.260.20

Supersedes CLC/TR 50404:2003

English Version

**Explosive atmospheres - Part 32-1: Electrostatic Hazards -
Guidance
(IEC/TS 60079-32-1:2013)**

Atmosphères explosives - Partie 32-1: Risques
électrostatiques - Guide
(IEC/TS 60079-32-1:2013)

Explosionsgefährdete Bereiche - Teil 32-1: Elektrostatische
Gefährdungen, Leitflächen
(IEC/TS 60079-32-1:2013)

This Technical Report was approved by CENELEC on 2014-06-02.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

(standards.iteh.ai)

[SIST-TP CLC/TR 60079-32-1:2015](https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fdd1af/sist-tp-clc-tr-60079-32-1-2015)

<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fdd1af/sist-tp-clc-tr-60079-32-1-2015>



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (CLC/TR 60079-32-1:2015) consists of the text of IEC/TS 60079-32-1:2013 prepared by IEC/TC 31 "Equipment for explosive atmospheres".

This document supersedes CLC/TR 50404:2003

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

Endorsement notice

The text of the International Standard IEC/TS 60079-32-1:2013 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 standards indicated:

IEC 60243-1	NOTE	Harmonized as EN 60243-1.
IEC 60243-2	NOTE	Harmonized as EN 60243-2.
IEC 60247	NOTE	Harmonized as EN 60247.
IEC 61340-2-1	NOTE	Harmonized as EN 61340-2-1.
IEC 61340-4-5	NOTE	Harmonized as EN 61340-4-5.
IEC 61340-4-7	NOTE	Harmonized as EN 61340-4-7.
ISO 8028	NOTE	Harmonized as EN ISO 8028.
ISO 8330	NOTE	Harmonized as EN ISO 8330.
ISO 13688	NOTE	Harmonized as EN ISO 13688.
ISO 20344	NOTE	Harmonized as EN ISO 20344.
ISO 20345	NOTE	Harmonized as EN ISO 20345.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CLC/TR 60079-32-1:2015
<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fd11af/sist-tp-clc-tr-60079-32-1-2015>

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When 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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60079-0	-	Explosive atmospheres -- Part 0: Equipment - General requirements	EN 60079-0	-
-	-		+A11	-
IEC 60079-10-1	-	Explosive atmospheres -- Part 10-1: Classification of areas - Explosive gas atmospheres	EN 60079-10-1	-
IEC 60079-10-2	-	Explosive atmospheres -- Part 10-2: Classification of areas - Combustible dust atmospheres	EN 60079-10-2	-
IEC 60079-14	-	Explosive atmospheres -- Part 14: Electrical installations design, selection and erection	EN 60079-14	-
IEC 60079-20-1	-	Explosive atmospheres -- Part 20-1: Material characteristics for gas and vapour classification. Test methods and data	EN 60079-20-1	-
IEC 60079-32-2	-	Explosive atmospheres -- Part 32-1: Electrostatic hazards - Tests	-	-
IEC 60093	-	Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials	HD 429 S1	-
IEC 60167	-	Methods of test for the determination of the insulation resistance of solid insulating materials	HD 568 S1	-
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	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 61340-4-3	-
IEC 61340-4-4	2012	Electrostatics - Part 4-4: Standard test methods for specific applications - Electrostatic classification of flexible intermediate bulk containers (FIBC)	EN 61340-4-4	2012
ISO 284	-	Conveyor belts - Electrical conductivity - Specification and test method	EN ISO 284	-

ISO 6297	-	Petroleum products - Aviation and distillate fuels - Determination of electrical conductivity	-
ISO 8031	-	Rubber and plastics hoses and hose assemblies - Determination of electrical resistance and conductivity	EN ISO 8031 -
ISO 9563	-	Belt drives; electrical conductivity of antistatic endless synchronous belts; characteristics and test method	- -
ISO 12100-1	-	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology	EN ISO 12100-1 -
ISO 16392	-	Tyres - Electrical resistance - Test method for measuring electrical resistance of tyres on a test rig	- -
ISO 21178	-	Light conveyor belts - Determination of electrical resistances	EN ISO 21178 -
ISO 21179	-	Light conveyor belts - Determination of the electrostatic field generated by a running light conveyor belt	EN ISO 21179 -
ISO 21183-1	-	Light conveyor belts - Part 1: Principal characteristics and applications	EN ISO 21183-1 -
ASTM D257	-	Standard Test Methods for DC Resistance or Conductance of Insulating Materials	- -
ASTM D2624-07a	-	Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels	- -
ASTM D4308-95	-	Standard Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter	- -
ASTM E2019-03	-	Standard test method for minimum ignition energy of a dust cloud in air	- -
ASTM E582-88	-	Standard test method for minimum ignition energy and quenching distance in gaseous mixtures	- -
ASTM F150	-	Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring	- -
ASTM F1971	-	Standard Test Method for Electrical Resistance of Tires Under Load On the Test Bench	- -
BS 5958-1	-	Code of practice for control of undesirable static electricity - Part 1: General considerations	- -
BS 5958-2	-	Code of practice for control of undesirable static electricity - Part 2: Recommendations for particular industrial situations	- -
BS 7506-2	-	Methods for measurements in electrostatics - Part 2 Test methods	- -
DIN 51412-1	-	Testing of petroleum products; determination of the electrical conductivity - Part 1: laboratory method	- -
DIN 51412-2	-	Testing of petroleum products; determination of the electrical conductivity - Part 2: field method	- -
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	- -

EN 1149-5	-	Protective clothing - Electrostatic properties - Part 5: Material performance and design requirements	-	-
EN 13463-1	-	Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements	-	-
EN 1360	-	Rubber and plastic hoses and hose assemblies for measured fuel dispensing systems - Specification	-	-
EN 1361	-	Rubber hoses and hose assemblies for aviation fuel handling - Specification	-	-
EN 14125	-	Thermoplastic and flexible metal pipework for underground installation at petrol filling stations	-	-
EN 14973	-	Conveyor belts for use in underground installations - Electrical and flammability safety requirements	-	-
ISGOTT	-	International Safety Guide for Oil Tankers and Terminals (ISGOTT), fifth edition, International chamber of shipping, 2006	-	-
JNIOOSH TR 42	-	Recommendations for Requirements for Avoiding Electrostatic Hazards in Industry	-	-
NFPA 77	-	Recommended practice on static electricity -	-	-
SAE J1645	-	Surface vehicle recommended practice - Fuel systems and Components - Electrostatic Charge Mitigation	-	-

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST-TP CLC/TR 60079-32-1:2015](https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fd1af/sist-tp-clc-tr-60079-32-1-2015)

<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fd1af/sist-tp-clc-tr-60079-32-1-2015>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CLC/TR 60079-32-1:2015

<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196f1d1af/sist-tp-clc-tr-60079-32-1-2015>



TECHNICAL SPECIFICATION

Explosive atmospheres –
Part 32-1: Electrostatic hazards, guidance

STANDARD PREVIEW
(standards.iteh.ai)

[SIST-TP CLC/TR 60079-32-1:2015](https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fd1af/sist-tp-clc-tr-60079-32-1-2015)
<https://standards.iteh.ai/catalog/standards/sist/c7fe3a9b-1fa4-4370-a786-cf196fd1af/sist-tp-clc-tr-60079-32-1-2015>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XH**

ICS 29.260.20

ISBN 978-2-8322-1055-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	10
INTRODUCTION.....	12
1 Scope.....	13
2 Normative references	13
3 Terms and definitions	16
4 Nomenclature	19
5 General	20
6 Static electricity in solid materials	21
6.1 General considerations	21
6.2 The use of conductive or dissipative materials in place of insulating ones	23
6.2.1 General considerations	23
6.2.2 Dissipative solid materials	23
6.2.3 Earthing of conductive and dissipative items.....	24
6.3 Precautions required when using insulating solid materials	25
6.3.1 General	25
6.3.2 Restrictions on the size of chargeable insulating surfaces	26
6.3.3 Earthed metal meshes	27
6.3.4 Insulating coatings on earthed conductive surfaces	27
6.3.5 Conductive or dissipative coatings on insulating materials	28
6.3.6 Static dissipative agents	29
6.3.7 Humidification.....	29
6.3.8 Ionisation / Charge Neutralisation	29
6.3.9 Methods to determine the incendivity of discharges	30
6.4 Conveyor belts and transmission belts	31
6.4.1 General	31
6.4.2 Conveyor belts	31
6.4.3 Transmission belts.....	32
7 Static electricity in liquids	33
7.1 General considerations	33
7.1.1 Occurrence of flammable atmospheres	33
7.1.2 Ignition sensitivity and limitations to the scope of advice.....	34
7.1.3 Charging mechanisms	35
7.1.4 Charge accumulation and conductivity classifications	35
7.1.5 Incendive discharges produced during liquid handling operations	36
7.2 Summary of precautions against ignition hazards during liquid handling operations.....	37
7.2.1 Earthing and avoidance of isolated conductors	37
7.2.2 Restricting charge generation	37
7.2.3 Avoidance of a flammable atmosphere	38
7.2.4 Promoting charge dissipation.....	38
7.3 Tanks and Containers	38
7.3.1 General	38
7.3.2 Conductive tanks and containers	39
7.3.3 Tanks and containers made entirely of dissipative material.....	52

7.3.4	Tanks and containers with insulating surfaces	52
7.3.5	Use of liners in containers	56
7.4	High viscosity liquids	57
7.5	High charging equipment	57
7.5.1	Filters, water separators and strainers	57
7.5.2	Pumps and other equipment	58
7.6	Gauging and sampling in tanks	59
7.6.1	General	59
7.6.2	Precautions during gauging and sampling	59
7.7	Pipes and hose assemblies for liquids	60
7.7.1	General	60
7.7.2	Pipes	60
7.7.3	Hoses and hose assemblies	63
7.8	Special filling procedures	69
7.8.1	Aircraft fuelling	69
7.8.2	Road tanker deliveries	70
7.8.3	Retail filling stations	71
7.8.4	Mobile or temporary liquid handling equipment	75
7.9	Plant processes (blending, stirring, mixing, crystallisation and stirred reactors)	75
7.9.1	General	75
7.9.2	Earthing	75
7.9.3	In-line blending	75
7.9.4	Blending in vessels or tanks	76
7.9.5	Jet mixing	76
7.9.6	High speed mixing	77
7.10	Spraying liquids and tank cleaning	77
7.10.1	General	77
7.10.2	Tank cleaning with low or medium pressure water jets (up to about 12 bar)	77
7.10.3	Tank cleaning with low conductivity liquids	78
7.10.4	Tank cleaning with high pressure water or solvent jets (above 12 bar)	78
7.10.5	Steam cleaning tanks	78
7.10.6	Water deluge systems	79
7.11	Glass systems	79
7.11.1	General	79
7.11.2	Precautions to be taken for low conductivity liquids	79
8	Static electricity in gases	80
8.1	General	80
8.2	Grit blasting	80
8.3	Fire extinguishers	81
8.4	Inerting	81
8.5	Steam cleaning	81
8.6	Accidental leakage of compressed gas	81
8.7	Spraying of flammable paints and powders	82
8.7.1	General	82
8.7.2	Earthing	82
8.7.3	Plastic spray cabinets	82

8.8	Vacuum cleaners, fixed and mobile	82
8.8.1	General	82
8.8.2	Fixed systems.....	82
8.8.3	Portable systems	83
8.8.4	Vacuum trucks.....	83
9	Static electricity in powders	83
9.1	General.....	83
9.2	Discharges, occurrence and incendivity	84
9.3	Procedural measures	85
9.3.1	General	85
9.3.2	Humidification.....	85
9.3.3	Hoses for pneumatic transfer	85
9.3.4	Ionisation.....	85
9.4	Bulk materials in the absence of flammable gases and vapours	86
9.4.1	General	86
9.4.2	Equipment and objects made of conductive or dissipative materials.....	86
9.4.3	Equipment and objects made of insulating materials	86
9.4.4	Dust separators	87
9.4.5	Silos and Containers.....	87
9.5	Additional requirements for bulk material in the presence of flammable gases and vapours.....	93
9.5.1	General	93
9.5.2	Measures for resistivity greater equal 100 MΩ m	93
9.5.3	Measures for resistivity less than 100 MΩ m.....	93
9.5.4	Filling of bulk material into a container	94
9.6	Flexible intermediate bulk containers (FIBC)	95
9.6.1	General	95
9.6.2	Additional precautions when using FIBC	97
10	Static electricity when handling explosives and electro-explosive devices.....	98
10.1	Explosives manufacture, handling and storage.....	98
10.1.1	General	98
10.1.2	First degree protection.....	98
10.1.3	Intermediate protection	98
10.1.4	Second degree protection	98
10.2	Handling of electro-explosive devices	99
10.2.1	General	99
10.2.2	Earthing.....	99
10.2.3	Precautions during storage and issue	100
10.2.4	Precautions during preparation for use	100
11	Static electricity on people.....	100
11.1	General considerations	100
11.2	Static dissipative floors	101
11.3	Dissipative and conductive footwear	101
11.4	Supplementary devices for earthing of people	102
11.5	Clothing	102
11.6	Gloves	104
11.7	Other Items.....	104
12	Electrostatic shock	104

12.1	Introduction.....	104
12.2	Discharges relevant to electrostatic shocks.....	105
12.3	Sources of electrostatic shock.....	105
12.4	Precautions to avoid electrostatic shocks.....	106
12.4.1	Sources of electrostatic shocks.....	106
12.4.2	Reported shocks from equipment or processes.....	106
12.4.3	Shocks as a result of people being charged.....	106
12.5	Precautions in special cases.....	107
12.5.1	Pneumatic conveying.....	107
12.5.2	Vacuum cleaners.....	107
12.5.3	Reels of charged film or sheet.....	107
12.5.4	Fire extinguishers.....	108
13	Earthing and bonding.....	108
13.1	General.....	108
13.2	Criteria for the dissipation of static electricity from a conductor.....	109
13.2.1	Basic considerations.....	109
13.2.2	Practical criteria.....	109
13.3	Earthing requirements in practical systems.....	111
13.3.1	All-metal systems.....	111
13.3.2	Metal plant with insulating parts.....	112
13.3.3	Insulating materials.....	113
13.3.4	Conductive and dissipative materials.....	114
13.3.5	Earthing via intrinsic safety circuits.....	114
13.3.6	Earthing of ships.....	114
13.4	The establishment and monitoring of earthing systems.....	114
13.4.1	Design.....	114
13.4.2	Monitoring.....	115
Annex A (informative)	Fundamentals of static electricity.....	116
A.1	Electrostatic charging.....	116
A.1.1	Introduction.....	116
A.1.2	Contact charging.....	116
A.1.3	Contact charging of liquids.....	116
A.1.4	Charge generation on liquids flowing in pipes.....	117
A.1.5	Charge generation in filters.....	120
A.1.6	Charge generation during stirring and mixing of liquids.....	120
A.1.7	Settling potentials.....	120
A.1.8	Breakup of liquid jets.....	120
A.1.9	Contact charging of powders.....	120
A.1.10	Charging by induction.....	121
A.1.11	Charge transfer by conduction.....	121
A.1.12	Charging by corona discharge.....	121
A.2	Accumulation of electrostatic charge.....	121
A.2.1	General.....	121
A.2.2	Charge accumulation on liquids.....	122
A.2.3	Charge accumulation on powders.....	123
A.3	Electrostatic discharges.....	124
A.3.1	Introduction.....	124
A.3.2	Sparks.....	124
A.3.3	Corona.....	125

A.3.4	Brush discharges	125
A.3.5	Propagating brush discharges	126
A.3.6	Lightning like discharges	126
A.3.7	Cone discharges	127
A.4	Measurements for risk assessment	127
Annex B (informative)	Electrostatic discharges in specific situations	129
B.1	Incendive discharges involving insulating solid materials	129
B.1.1	General	129
B.1.2	Sparks from isolated conductors	129
B.1.3	Brush discharges from insulating solid materials	129
B.1.4	Propagating brush discharges from insulating solid materials	129
B.2	Incendive discharges produced during liquid handling	130
B.2.1	General	130
B.2.2	Calculated maximum safe flow velocities for filling medium-sized vertical axis storage tanks	130
B.3	Incendive discharges produced during powder handling and storage	132
B.3.1	General	132
B.3.2	Discharges from bulk powder	132
B.3.3	Discharges from powder clouds	132
B.3.4	Discharges involving insulating containers and people	132
B.3.5	The use of liners in powder processes	132
B.3.6	Spark discharges in powder processes	133
B.3.7	Brush discharges in powder processes	133
B.3.8	Corona discharges in powder processes	133
B.3.9	Propagating brush discharges in powder processes	133
Annex C (informative)	Flammability properties of substances	135
C.1	General	135
C.2	Effect of oxygen concentration and ambient conditions	135
C.3	Explosive limits for gases and liquids	135
C.4	Inerting	135
C.5	Flash point	136
C.6	Minimum ignition energies	136
C.7	Combustible powders	139
C.8	Biofuels	139
Annex D (informative)	Classification of hazardous areas	140
D.1	Concept of zoning	140
D.2	Classification	140
D.3	Explosion groups	140
D.3.1	General	140
D.3.2	Group I	140
D.3.3	Group II	141
D.3.4	Group III	141
Annex E (informative)	Classification of equipment protection level	142
Annex F (informative)	Flow chart for a systematic electrostatic evaluation	143
Annex G (informative)	Tests	145
G.1	General	145
G.2	Surface resistance	145
G.2.1	General	145

	G.2.2	Principle	145
	G.2.3	Apparatus	145
	G.2.4	Test sample	146
	G.2.5	Procedure	147
	G.2.6	Acceptance criteria	147
	G.2.7	Test report	147
G.3		Surface resistivity	147
G.4		Leakage resistance	148
	G.4.1	General	148
	G.4.2	Principle	148
	G.4.3	Apparatus	148
	G.4.4	Test sample	148
	G.4.5	Procedure	149
	G.4.6	Acceptance criteria	149
	G.4.7	Test report	149
G.5		In-use testing of footwear	149
	G.5.1	General	149
	G.5.2	Principle	149
	G.5.3	Apparatus	149
	G.5.4	Procedure	150
	G.5.5	Acceptance criteria	150
	G.5.6	Test report	150
G.6		In-use testing of gloves	150
	G.6.1	General	150
	G.6.2	Principle	150
	G.6.3	Apparatus	151
	G.6.4	Procedure	151
	G.6.5	Acceptance criteria	151
	G.6.6	Test report	151
G.7		Powder resistivity	151
	G.7.1	General	151
	G.7.2	Principle	151
	G.7.3	Apparatus	152
	G.7.4	Procedure	152
	G.7.5	Acceptance criteria	153
	G.7.6	Test report	153
G.8		Liquid conductivity	153
	G.8.1	General	153
	G.8.2	Principle	153
	G.8.3	Apparatus	153
	G.8.4	Procedure	154
	G.8.5	Acceptance criteria	154
	G.8.6	Test report	154
G.9		Capacitance	155
	G.9.1	General	155
	G.9.2	Principle	155
	G.9.3	Apparatus	155
	G.9.4	Test sample	155
	G.9.5	Procedure for moveable items	155