

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Explosive atmospheres –
Part 14: Electrical installation design, selection and installation of equipment,
including initial inspection**

**Atmosphères explosives –
Partie 14: Conception des installations électriques, sélection et installation des
appareils, comprenant l'inspection initiale**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –**Part 14: Electrical installations design, selection
and installation of equipment, including initial inspection**

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IEC 60079-14 has been prepared by subcommittee 31J: Classification of hazardous areas and installation requirements, of IEC technical committee 31: Equipment for explosive atmospheres. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2013. This edition constitutes a technical revision.

Edition 6 is a major restructure and introduces a number of technical changes from the previous edition (2013). Table 1, "Table of significant changes" is provided to highlight the technical and more significant editorial changes from the previous edition. Minor editorial changes are not listed as there are too many changes to include in the "Table of significant changes".

Table 1 – Table of significant changes

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
List of possible ignition sources completed	Introduction	x		
Additional standard mentioned (IEC 60204 series for electrical safety of machinery)	Introduction	x		
Introduction of a new title "Electrical installation design, selection and installation of equipment, including initial inspection"	Scope			C1
New definition: certificates	3.1.4		x	
New definition: Ex Equipment	3.1.5		x	
New definition: Ex Equipment Certificates	3.1.6		x	
New definition: Equipment Protection Level	3.2.13	x		
definition: associated apparatus	3.5.2	x		
Modification definition: liquid immersion (formerly oil immersion)	3.9.1	x		
Definition equipment, portable	3.14.3	x		
Definition equipment, personal	3.14.4	x		
New definition: cables	3.16		x	
Zones and Equipment Protection Levels	4.1.1		x	
Requirements for all Ex Equipment	4.1.2		x	
Electrical ratings	4.1.3		x	
Use of Ex Components	4.1.4		x	
Static electricity (Reference to IEC TS 60079-32-1)	4.3.2	x		
RFID tags	4.3.6		B1	
Installation information (additional bullet points c) and e)	5.4		x	
TN type of system earthing	6.2.5.2	x		
Cathodically protected metallic parts	6.2.7		x	
Cables subjected to thermal insulation	6.6.2		x	
Overhead wiring	6.6.3		x	
Electrical machines with converter supply	6.7.3.4 b)		B2	
Electric heating systems	6.8		x	
Plugs, socket outlets and couplers	6.9	x		
Type of protection "e" – Increased safety	6.13	x		
Intrinsically safe circuits with only one source of power with linear characteristic	6.14.3.3	A1		
Earthing of conducting screens – Special cases	6.14.4	x		
Simple apparatus	6.14.11 Annex Q			C2
Junction boxes	6.14.12	x		
Junction boxes with non-intrinsically safe and intrinsically safe circuits	6.14.12.2	x		
Pressurized rooms	6.19	x		
Analyser houses	6.20	x		
Selection of pollution degree	7.3.5		x	
Selection of specific process hazards	7.3.6		x	

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Selection of cables	7.4	A2		
Cables for direct entries into flameproof enclosures	7.4.3		x	
Cables for direct entries into restricted breathing enclosures	7.4.4		x	
UV or solar radiation	7.4.6		x	
Cables for intrinsic safety circuits	7.4.10		x	
Breathing and draining devices	7.5.4		x	
Entry devices for fibre optic cables	7.5.5		x	
Other entry devices	7.5.6		x	
New Flowchart: Selection of cable entry devices	7.5.7			C3
Conduits	7.6	x		
Luminaires	7.7.1	x		
Rotating electric machines	7.8	x		
New clause "General" in 8 "Installation of equipment"	8.1		x	
Equipotential bonding connections	8.2.2	x		
Penetration in structures	8.2.4	x		
Jointing	8.2.7		x	
Entry devices and other fittings	8.3	A3		
Cable entry devices	8.3.2	x		
Conduit systems	8.4	x		
Electric heating systems	8.5		x	
Protective coating of Ex Equipment	8.6		x	
Unused cores in cables	8.9.3.4	x		
Initial inspection	9		x	
Knowledge, skills and competencies of designers, electricians and technicians	Annex A	x		
New normative Annex: Pressure test for cables – test procedure	Annex C			C4
New informative Annex: Transportable, portable and personal equipment	Annex I		x	
New informative Annex: Electrical machines operated from converters	Annex J		x	
New informative Annex: Surge protection of an intrinsically safe circuit	Annex K		x	
New informative Annex: Guidance on the different duty types S1 to S10 of motors	Annex M		x	
New informative Annex: Inspection tables for initial inspections (from IEC 60079-17)	Annex O			C5
New informative Annex: Degree of protection (IP Code) in accordance to Type of Protection	Annex P		x	
New normative Annex: Simple apparatus	Annex Q			C2

NOTE 1 The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous edition. More guidance can be found by referring to the Redline Version of the standard.

Explanations:**A) Definitions****Minor and editorial changes**

- clarification
- decrease of technical requirements
- minor technical change
- editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

Extension

- addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for the design, selection and installation of existing installations that were fully compliant with the previous standard. Therefore, these will not have to be considered for existing installations in conformity with the preceding edition.

Major technical changes

- addition of technical requirements
- increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that an existing installation in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition.

B) Information about the background of changes

- A1 Clarification of the application of the 1 % rule to make users aware that the application of permissible pairs is considered first and when not available, the 1 % rule is to be applied.
- A2 The cable requirements from IEC 60079-14:2013, 9.3.2 have been changed to only include the minimum aspects removing any product requirement in this installation standard.
- A3 The application of adapters and reducers have been changed to align with product standard requirements.
- B1 The manufacturer of the RFID tag has to demonstrate and document that there is no explosion hazard.
- B2 Additionally to the use of a certified combination of an electrical machine in Type of Protection "eb" together with the converter, an electrical machine in the Type of Protection "eb" (type tested for converter supply) can be operated with an unspecified type of converter.
- C1 The title is changed to "Electrical installation design, selection and installation of equipment, including initial inspection" to ensure that all areas, including initial inspection, are mentioned in the title. The term "Installation of equipment" is replacing the word "Erection" in the title as more common wording.
- C2 The requirements for simple apparatus have been aligned with IEC 60079-11.
- C3 The flowchart is revised to include consideration of equipment groups, cable lengths and enclosures with a volume $\leq 2\,000\text{ cm}^3$. (Additional information can be found in the supporting document SC 31J SD 001.)

C4 The previous informative Annex C to improve details relevant to testing cables and alignment to the selection requirements in 7.5.7. (see also C3)

C5 The previous normative tables in the section "Initial inspection" are included in the informative Annex O. This allows checklists to be customized for specific installations.

All Ex Equipment and their wiring in hazardous areas are designed, selected and installed in accordance with:

- Clause 6 for design; and
- Clause 7 for selection; and
- Clause 8 for installation; and
- Subclauses given in Table 2 for specific types of equipment; and
- Subclauses given in Table 3 for additional requirements for Type of Protections.

Table 2 – Clauses of this document for requirements for special types of equipment

Type of equipment	Design	Selection	Installation
Cables and wiring systems	6.6	7.4	8.2
Conduits			8.4
Entry devices and other fittings		7.5	8.2.7
Luminaires and lamps		7.7	
Electrical machines	6.7	7.8	
Electrical heating systems	6.8		
Plugs and socket outlets	6.9		
RFID tags	4.3.6		
Cells and batteries	6.10		
Gas detectors and related systems	6.11		
Transportable, portable and personal equipment	Annex I		

Table 3 – Clauses of this document for additional requirements for Types of Protection

Type of Protection	Design	Selection	Installation
"d" – Flameproof Enclosure	6.12		8.7
"e" – Increased Safety	6.13		8.8
"i" – Intrinsic Safety	6.14		8.9
"m" – Encapsulation	6.15		
"n" – Type of Protection "n"	6.16		8.8 and 8.10
"o" – Liquid Immersion (former: oil)	6.17		8.11
"op" – Optical Radiation			
"p" – Pressurization	6.18		
Pressurized Rooms	6.19		
Analyser Houses	6.20		
"q" – Powder Filling	6.21		
"t" – Dust Protection by Enclosure			
"s" – Special Protection			

NOTE 2 Empty cells mean that additional requirements are not detailed in this document and would be included as part of manufacturer's instructions or certification documents.

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

Draft	Report on voting
31J/366/FDIS	31J/367/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 60079 series, published under the general title *Explosive atmospheres*, 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

Preventive measures to reduce explosions of flammable materials are based on three principles, which are normally applied in the following order:

- 1) substitution;
- 2) control; and
- 3) mitigation.

Substitution involves, for example, replacing a flammable material by one which is either not flammable or one that is less flammable.

Control involves, for example:

- a) reducing the quantity of flammables;
- b) avoiding or minimising releases;
- c) controlling the release;
- d) preventing the formation of an explosive atmosphere;
- e) collecting and containing releases; and
- f) avoiding ignition sources.

NOTE 1 With the exception of item f), all of the above is part of the process of hazardous area classification.

Mitigation involves, for example:

- a) reducing the number of people exposed;
- b) providing measures to avoid the propagation of an explosion;
- c) providing explosion pressure relief;
- d) providing explosion pressure suppression; and
- e) providing suitable personal protective equipment.

NOTE 2 The above items are part of consequence management when considering hazards.

Once the principles of substitution and control (items a) to e)) have been applied, the remaining hazardous areas should be classified into zones according to the likelihood of an explosive atmosphere being present (see IEC 60079-10-1 or IEC 60079-10-2). Such classification, which may be used in conjunction with an assessment of the consequences of an ignition, allows Equipment Protection Levels (EPL) to be determined and hence appropriate Types of Protection to be specified for each location.

For an explosion to occur, an explosive atmosphere and a source of ignition such as an electrical fault, high process temperature or open flames need to co-exist. This document only deals with the recommended protective measures required to reduce to an acceptable level, the likelihood that the electrical installation could become a source of ignition. By careful design of the electrical installation, it is frequently possible to locate much of the equipment in less hazardous or non-hazardous areas.

When Ex Equipment is installed in areas where explosive concentrations and quantities of flammable gases, vapours or dusts could be present in the atmosphere, protective measures are applied to reduce the likelihood of explosion due to ignition either in normal operation or under specified fault conditions.

In general, possible ignition sources are:

- Hot surfaces;
- Flames and hot gases (including hot particles);
- Mechanically generated impact, friction and abrasion;
- Electrical equipment and components;
- Stray electric currents, cathodic corrosion protection;
- Static electricity;
- Lightning;
- Radio frequency (RF) electromagnetic waves from 10^4 Hz to 3×10^{11} Hz;
- Electromagnetic waves from 3×10^{11} Hz to 3×10^{15} Hz (optical radiation);
- Ionizing radiation;
- Ultrasonic waves;
- Adiabatic compression and shock; and
- Exothermic reactions, including self-ignition of dust.

The focus of this document is the electrical installation, which is designed to reduce potential ignition sources from causing a fire or explosion including, for example, electrical arcs and sparks, static electricity, effects of lightning and hot surfaces caused by transformation of electrical energy to heat energy or caused by friction of moving parts of electrical equipment.

Many types of dust that are generated, processed, handled and stored, are combustible. When ignited they can burn rapidly and with considerable explosive force if mixed with air in the appropriate proportions. It is often necessary to use Ex Equipment in locations where such materials are present, and suitable precautions should therefore be taken to ensure that all such equipment is adequately protected so as to reduce the likelihood of ignition of the external explosive atmosphere.

Combustible dust can be ignited by equipment in ways including, but not limited to, the following:

- by surfaces of the equipment that are above the minimum ignition temperature of the dust concerned. The temperature at which a type of dust ignites is a function of the properties of the dust, whether the dust is in a cloud or layer, the thickness of the layer and the geometry of the heat source; or
- by arcing or sparking of electrical parts such as switches, contacts, commutators, brushes, or the like; or
- by discharge of an accumulated electrostatic charge; or
- by radiated energy (for example electromagnetic radiation); or
- by mechanical sparking or frictional sparking associated with the equipment.

In order to avoid dust ignition hazards it is important that:

- the temperature of surfaces on which dust can be deposited, or which would be in contact with a dust cloud, is kept below the temperature limitation specified in this document; and
- any electrical sparking parts, or parts having a temperature above the temperature limit specified in this document:
 - i) are contained in an enclosure which adequately prevents the ingress of dust, or
 - ii) the energy of electrical circuits is limited so as to avoid arcs, sparks or temperatures capable of igniting dust; and
- any other ignition sources are avoided.

Several Types of Protection are available for Ex Equipment in hazardous areas (see IEC 60079-0). This document provides the specific requirements for the design of electrical systems, selection, installation and the required initial inspection of electrical Ex Equipment in hazardous areas including requirements for documentation and personnel competency. This document is also based on manufacturer's instructions being followed. On-going inspection, maintenance and repair aspects also play an important role in control of hazardous area installations and the user's attention is drawn to IEC 60079-17, IEC 60079-19 and manufacturer's instructions for further information concerning these aspects.

This part of IEC 60079 is supplementary to other relevant IEC standards, for example the IEC 60364 series as regards electrical installation requirements or IEC 60204 series for electrical safety of machinery. This part also refers to IEC 60079-0 and its associated standards for the construction, testing and marking requirements of suitable electrical Ex Equipment.

In any industrial installation, there can be numerous sources of ignition apart from those associated with electrical Ex Equipment. Precautions are necessary to ensure safety from other possible ignition sources, but guidance on this aspect is outside the scope of this document.

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EXPLOSIVE ATMOSPHERES –

Part 14: Electrical installations design, selection and installation of equipment, including initial inspection

1 Scope

This part of IEC 60079 contains the specific requirements for the design of electrical systems, selection, installation and the required initial inspection of electrical installations of Ex Equipment in, or associated with, explosive atmospheres including requirements for documentation and personnel competency.

These requirements are in addition to the requirements for installations in non-hazardous areas.

NOTE 1 For voltages up to 1 000 V AC or 1 500 V DC requirements of this document are based on installation requirements in the IEC 60364 series and for higher voltages in the IEC 61936 series, but other relevant national requirements can apply. For offshore, the IEC 61892 series is applicable.

NOTE 2 Maximum voltages are limited by specific Types of Protection according to other parts of the IEC 60079 series and will be given in the documentation for the Ex Equipment.

This document applies to all electrical Ex Equipment including fixed, transportable, portable and personal, and installations, permanent or temporary.

NOTE 3 Guidance on transportable, portable or personal equipment can be found in Annex I and IEC TS 60079-48.

This document does not apply to:

- electrical installations in mines susceptible to firedamp;

NOTE 4 This document might apply to electrical installations in mines where explosive gas atmospheres other than firedamp can be formed and to electrical installations in the surface installation of mines.

- inherently explosive situations and dust from explosives or pyrophoric substances (for example explosives manufacturing and processing);
- rooms used for medical purposes;
- electrical installations in areas where the hazard is due to flammable mist; and
- installation of non-electrical Ex Equipment (unless being part of an equipment assembly according IEC TS 60079-46).

NOTE 5 Additional guidance on the requirements for hazards due to hybrid mixtures of dust or flyings and flammable gas or vapour is provided in Annex H.

NOTE 6 The use of portable tools having an Ex Equipment certificate might introduce an ignition source which is beyond the scope of this document, for example: a drill which could create a high temperature at the work piece.

No account is taken in this document of the toxic hazards that are associated with flammable gases, liquids and dusts in concentrations that are usually very much less than the lower flammable limit. In locations where personnel could be exposed to potentially toxic concentrations of flammable material, appropriate precautions are necessary. Such precautions are outside the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

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

IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"*

IEC 60079-7, *Explosive atmospheres – Part 7: Equipment protection by increased safety "e"*

IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60079-17, *Explosive atmospheres – Part 17: Electrical installations inspection and maintenance*

IEC 60079-19, *Explosive atmospheres – Part 19: Equipment repair, overhaul and reclamation*

IEC 60079-25, *Explosive atmospheres – Part 25: Intrinsically safe electrical systems*

IEC 60079-28, *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation*

IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*

IEC 60079-29-4, *Explosive atmospheres – Part 29-4: Gas detectors – Performance requirements of open path detectors for flammable gases*

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

IEC TS 60079-47, *Explosive atmospheres – Part 47: Equipment protection by 2-wire intrinsically safe ethernet concept (2-WISE)*

IEC 60228, *Conductors of insulated cables*

IEC 60245-4, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 61557-8, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1 General

3.1.1

competent person or body

individual or organization which can demonstrate appropriate technical knowledge and relevant skills to make the necessary assessments of the safety aspect under consideration

3.1.2

verification dossier

set of documents showing assurance of conformity of equipment and installations

3.1.3

electrical equipment

items applied as a whole or in part for the utilization of electrical energy

Note 1 to entry: These include, amongst others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion and consumption of electrical energy and items for telecommunications.

3.1.4

certificate

document that conveys the assurance of the conformity of a product, process, system, person, or organization with specified requirements

Note 1 to entry: The certificate is either the supplier's declaration of conformity (1st party declaration) or the purchaser's recognition of conformity (2nd party acceptance) or certification (3rd party attestation). Declaration, acceptance, and certification are defined in ISO/IEC 17000.

[SOURCE: IEC 60079-0:2017, 3.12, modified (modification of Note 1 to entry)]

3.1.5

Ex Equipment

explosion-protected equipment

Note 1 to entry: Such equipment often includes Ex Components, but additional evaluation is always required as part of their incorporation into equipment.

[SOURCE: IEC 60079-0:2017, 3.37]

3.1.6

Ex Equipment certificate

certificate prepared for Ex Equipment

[SOURCE: IEC 60079-0:2017, 3.12.2]