

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Explosive atmospheres –  
Part 25: Intrinsically safe electrical systems**  
**ITeH STANDARD PREVIEW**  
**(standards.iteh.ai)**

**Atmosphères explosives –  
Partie 25: Systèmes électriques de sécurité intrinsèque**  
IEC 60079-25:2020  
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IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

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# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Explosive atmospheres –**  
**Part 25: Intrinsically safe electrical systems**

**Atmosphères explosives –**  
**Partie 25: Systèmes électriques de sécurité intrinsèque**

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**EXPLOSIVE ATMOSPHERES –****Part 25: Intrinsically safe electrical systems****FOREWORD**

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International Standard IEC 60079-25 has been prepared by subcommittee 31G: Intrinsically safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

This third edition cancels and replaces the second edition published in 2010 and constitutes a technical revision.

The significance of the changes between IEC 60079-25, Edition 2 (2010) and IEC 60079-25, Edition 3 (2019) are as listed below:

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
References to 'electrical systems' changed to 'systems' and note added that installation requirement for Group I are being considered.	1	X		
Normative references updated to remove references that were outdated or not mentioned in the body of the standard.	2	X		
Reference to IEC Electropedia and ISO Online Browsing platform added, abbreviations dropped from title. Definition of 'system designer' deleted, definitions of 'certified intrinsically safe electrical system', and 'uncertified intrinsically safe electrical system' dropped.	3	X		
'Intrinsically safe electrical system' changed to 'intrinsically safe system'.	3.1	X		
Definition for 'multi-circuit cable' added.	3.2	X		
'Maximum' changed to 'total' on definitions of cable capacitance and cable inductance.	3.4, 3.5	X		
'Maximum' deleted on definition of cable inductance to resistance ratio.	3.6	X		
FISCO changed to definition from abbreviation.	3.9	X		
The requirement for the system designer to sign and date the document dropped, editorial changes for clarity made, and a reference to Annex E made to show typical descriptive system documents.	4	X		
Title of clause changed to 'Grouping and temperature classification', ambient temperature range added to things to be included in the system document and reworded for clarity.	5		X	
Notes moved and reworded among the clauses.	6.1, 6.2, 6.3, 6.4	X		
Changed from 'Ambient temperature rating' which was moved to Clause 5, and new section renamed 'Non-intrinsically safe circuits' added.	7		X	
Clause reorganized into sections and some rewording done for clarity.	8	X		
Title changed to 'Requirements of single and multi-circuit cables'.	9	X		
Requirement for insulation thickness moved into this clause, and it now applies to all cables.	9.1		X	
Title changed to 'Dielectric strength' and consolidation of requirements for single circuit and multi-circuit cables. Requirement for dielectric testing changed to twice the circuit voltage with a minimum of 500VAC.	9.2		X	
Dielectric strength requirements for single circuit cables consolidated here.	9.2.1	X		
Dielectric strength requirements for multi- circuit cables consolidated here.	9.2.2	X		
Multi-circuit cables shall not be used for intrinsically safe circuits with voltages exceeding 90 V.	9.2.2			C1
Title changed to 'Intrinsic safety parameters of cables'	9.3	X		

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Title changed to 'Enclosures'	10	X		
Most of the old Clause 12 moved to IEC 60079-14.	11			C2
This clause was Clause 13 in the previous edition, and the entire clause has been re-arranged for clarity and easier reading.	12	X		
This General clause has been re-written in list format to make it easier to understand, and analysis of single and multiple power supplies moved to 12.4 and 12.5 respectively.	12.1		X	
This clause added to clarify fault applications in assemblies of certified equipment.	12.2		X	
This clause added to provide guidance on how to handle non-certified items in larger assemblies.	12.3		X	
Analysis of single power source information consolidated here and amplified.	12.4		X	
Analysis of multiple power sources information consolidated in this clause. Information added for clarity.	12.5		X	
The circuit analysis example dropped in text for simple apparatus, new Annex F added with more information.	12.6	X		
Section added to provide more information on determining capacitance, inductance and L/R that was moved from Annex A.	12.7		X	
Requirements for Type A, B, and C cables reworded for clarity.	12.8	X		
Information on evaluation of capacitance and inductance moved to 12.7.	Annex A	X		
Changed from normative to informative	Annex B	X		
Reordered and rewritten for greater clarity.	Annex C	X		
Annex updated for clarity.	Annex E	X		
The former Annex F on surge protection has been removed.	Annex F			C3
Annex G in the previous edition was on testing of cable parameters and has been removed from this edition. Annex G is now FISCO systems.	Annex G	X		

NOTE 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 version. More guidance may 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 equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products 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 a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below.

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NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

**B) Information about the background of 'Major Technical Changes'**

B1 – A limitation of 90 V for multi-circuit system has been added since for this voltage level a dielectric test of at least 500 V AC or 700 V DC is normally used to validate the insulation.

B2 – Most of the earthing and bonding requirements have been removed and moved to IEC 60079-14, and the surge protection requirements that were in the old Clause 12 were added here in Clause 11. The rest of the old Clause 12 was also removed and moved to IEC 60079-14.

B3 – The former Annex F on surge protection has been removed and will be covered in IEC 60079-14. Annex F is now Simple Apparatus, which was Annex H in the previous edition.

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

FDIS	Report on voting
31G/318/FDIS	31G/321/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 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 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.

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## EXPLOSIVE ATMOSPHERES –

### Part 25: Intrinsically safe electrical systems

#### 1 Scope

This part of IEC 60079 contains the specific requirements for design, construction and assessment of intrinsically safe systems, Type of Protection “i”, intended for use, as a whole or in part, in locations in which the use of Group I, II or III Ex Equipment is required.

NOTE 1 This standard is intended for use by the designer of the system e.g. a person who could be a manufacturer, a specialist consultant or a member of the end-user’s staff.

This document supplements and modifies the general requirements of IEC 60079-0 and the intrinsic safety standard IEC 60079-11. Where a requirement of this standard conflicts with a requirement of IEC 60079-0 or IEC 60079-11, the requirement of this standard takes precedence.

The installation requirements of Group II or Group III systems designed in accordance with this standard are specified in IEC 60079-14.

NOTE 2 Group I installation requirements are presently not provided in IEC 60079-14. Installation requirements for Group I are being considered.

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#### 2 Normative references

[IEC 60079-25:2020](#)

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

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

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

#### 3 Terms and definitions

For the purposes of this document, the following terms and definitions, specific to intrinsically safe systems, apply. They supplement the terms and definitions which are given in IEC 60079-0 and IEC 60079-11.

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

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

**3.1****intrinsically safe system**

assembly of interconnected items of apparatus, described in a descriptive system document, in which the circuits or parts of circuits, intended to be used in an explosive atmosphere, are intrinsically safe circuits

**3.2****multi-circuit cable**

multi-core cable containing more than one intrinsically safe circuit

**3.3****descriptive system document**

document in which the items of apparatus, their intrinsic safety parameters and those of the interconnecting wiring are specified

**3.4****total cable capacitance** $C_c$ 

total capacitance of the interconnecting cable that can be connected into an intrinsically safe circuit

**3.5****total cable inductance** $L_c$ 

total inductance of the interconnecting cable that can be connected into an intrinsically safe circuit

**3.6****cable inductance to resistance ratio** [IEC 60079-25:2020](https://standards.iteh.ai/catalog/standards/sist/c360c1da-9936-456c-ab36-0c1688ee0d/iec-60079-25-2020) $L_c/R_c$ 

value of the ratio inductance ( $L_c$ ) to resistance ( $R_c$ ) of the interconnecting cable connected into an intrinsically safe circuit

**3.7****linear power source**

power source from which the available output current is determined by a resistor; the output voltage decreasing linearly as the output current increases

**3.8****non-linear power source**

power source where the output voltage and output current have a non-linear relationship

Note 1 to entry: For example, a supply with a constant voltage output that can reach a constant current limit controlled by semiconductors

**3.9****FISCO****Fieldbus Intrinsically Safe Concept**

intrinsically safe system architecture that is bus-powered and designed in accordance with specific requirements

Note 1 to entry: The requirements are specified in IEC 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*.

## 4 Descriptive system document

A descriptive system document shall be created for all intrinsically safe systems. The descriptive system document shall include the technical justification for the combination of the apparatus and shall include at a minimum the following:

- a) a block diagram of the system listing all the items of apparatus within the system including simple apparatus and the interconnecting wiring;
- b) a statement of the equipment Group subdivision (for equipment Groups II and III), the Level of Protection and the Equipment Protection Level (EPL) for each part of the system, the temperature classification, and the ambient temperature rating in accordance with Clauses 5 and 6;
- c) the requirements and permitted parameters of the interconnecting wiring in accordance with Clause 8;
- d) details of the earthing and bonding points on which intrinsic safety depends;
- e) where applicable, the confirmation of apparatus as simple apparatus in accordance with IEC 60079-11;
- f) the result of the assessment of intrinsically safe systems in accordance with Clause 12; and
- g) a unique document identification.

The requirements found in Clauses 5 through 12 shall be used to determine the content of the descriptive system document.

NOTE The descriptive system document is not the same as the control drawing referred to in IEC 60079-11.

Annex E shows an example of a typical diagram, illustrating the requirements of the descriptive system document.

[IEC 60079-25:2020](https://standards.iteh.ai/catalog/standards/sist/c360c1da-9936-456c-ab36-6c1183300120/iec-60079-25-2020)

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## 5 Grouping and temperature classification

Parts of intrinsically safe systems that are intended for use in an explosive atmosphere shall be grouped in accordance with the equipment grouping requirements of IEC 60079-0 and be assigned a temperature class or a maximum surface temperature in accordance with the temperature requirements of IEC 60079-0 and IEC 60079-11.

Associated apparatus not intended for use in an explosive atmosphere shall only be grouped in accordance with the equipment grouping requirements of IEC 60079-0.

Where the intrinsically safe system or parts of the intrinsically safe system are specified as being suitable for operation outside the normal ambient temperature range of  $-20\text{ °C}$  and  $+40\text{ °C}$ , then this shall be specified in the descriptive system document.

NOTE Different parts of the same intrinsically safe system can have different groups. The apparatus used can have different temperature classes and different ambient temperature ratings.

## 6 Levels of Protection

### 6.1 General

Each part of an intrinsically safe system intended for use in an explosive atmosphere shall have a Level of Protection “ia”, “ib” or “ic” in accordance with IEC 60079-11 and an EPL in accordance with IEC 60079-0. Separate parts of the system may have a different Level of Protection or EPL.

NOTE For Group I applications, an intrinsically safe system can be “ib” in normal operation with external power, but when power is removed under defined safety circumstances (e.g. ventilation failure) then the system could become “ia” under back up battery power. The Level of Protection will be clearly defined for intended circumstances.

## 6.2 Level of Protection “ia”

Where the requirements applicable to apparatus of Level of Protection “ia” (see IEC 60079-11) are satisfied by an intrinsically safe system or part of a system considered as an entity, then that system or part of a system shall be assigned a Level of Protection “ia”.

## 6.3 Level of Protection “ib”

Where the requirements applicable to apparatus of Level of Protection “ib” (see IEC 60079-11) are satisfied by an intrinsically safe system or part of a system considered as an entity, then that system or part of a system shall be assigned a Level of Protection “ib”.

EXAMPLE A Level of Protection “ia” field instrument powered via a Level of Protection “ib” associated apparatus would be considered as a Level of Protection “ib” system or a Level of Protection “ib” field instrument powered via a Level of Protection “ia” associated apparatus would also be considered as a Level of Protection “ib” system.

## 6.4 Level of Protection “ic”

Where the requirements applicable to apparatus of Level of Protection “ic” (see IEC 60079-11) are satisfied by an intrinsically safe system or part of a system considered as an entity, then that system or part of a system shall be assigned a Level of Protection “ic”.

EXAMPLE A Level of Protection “ia” field instrument powered via a Level of Protection “ic” associated apparatus would be considered as Level of Protection “ic” system or a Level of Protection “ic” field instrument powered via a Level of Protection “ia” associated apparatus would also be considered as a Level of Protection “ic” system.

## 7 Non-intrinsically safe circuits

The descriptive system document shall define the limitations for connection of circuits to the non-intrinsically safe terminals of associated apparatus, such as the  $U_m$  value(s).

[IEC 60079-25:2020](https://standards.iteh.ai/catalog/standards/sist/c360c1da-9936-456c-ab36-0a1188e9045e/iec-60079-25-2020)

[https://standards.iteh.ai/catalog/standards/sist/c360c1da-9936-456c-ab36-](https://standards.iteh.ai/catalog/standards/sist/c360c1da-9936-456c-ab36-0a1188e9045e/iec-60079-25-2020)

## 8 Interconnecting wiring / cables used in an intrinsically safe system

### 8.1 General

The intrinsic safety parameters of the interconnecting wiring upon which intrinsic safety depends, and their derivation, shall be specified in the descriptive system document. If a specific type of wiring is specified, then the justification for its use shall be included in the documentation.

Cables for the interconnecting wiring shall comply with the applicable requirements of Clause 9.

Cable faults shall be assessed in accordance with the requirements of 12.8.

### 8.2 Cables containing a single intrinsically safe circuit

Cables containing a single intrinsically safe circuit shall comply with the requirements of 9.1, 9.2.1, 9.3 and, where applicable, 9.4.

### 8.3 Cables containing more than one intrinsically safe circuit

The descriptive system document shall specify the permissible types of multi-circuit cables according to Clause 9, if used for particular circuits. In the particular case where faults between separate circuits have not been taken into account, a note shall be included on the block diagram of the descriptive system document stating the following: ‘Where the interconnecting cable utilizes part of a multi-circuit cable containing other intrinsically safe circuits, the multi-circuit cable shall be in accordance with the requirements of a multi-circuit cable Type A or Type B, as specified in IEC 60079-14.’

A multi-circuit cable containing circuits classified as Level of Protection “ia”, “ib” or “ic” shall not contain non-intrinsically safe circuits.

Where Level of Protection “ia”, “ib” or “ic” circuits are run together in a cable of Type A or Type B as specified in 9.5.2 and 9.5.3, each circuit retains its Level of Protection and equipment grouping.

Where Level of Protection “ia”, “ib” or “ic” circuits are run together in a cable of Type C as specified in 9.5.4, the combination of circuits shall be assessed according to 12.8 to determine the Level of Protection, EPL and applicable equipment grouping.

NOTE Assessment according to 12.8 might determine that the combination is no longer intrinsically safe.

## 9 Requirements of single and multi-circuit cables

### 9.1 General

If the cable is specified as part of the system, then:

- individual conductors or strands of multi-stranded conductors within the hazardous area shall have a diameter of at least 0,1 mm; and
- the radial thickness of the insulation of each core of multi circuit cable shall be appropriate to the conductor diameter and the nature of the insulation with a minimum of 0,2 mm.

NOTE This clause is not intended to prevent the use of bare conductors that are intended to be bridged out in a signalling system. Such conductors are considered as simple apparatus and not interconnecting wiring.

### 9.2 Dielectric strength

#### 9.2.1 Cables containing a single intrinsically safe circuit

The insulation of cables used for intrinsically safe circuits shall be capable of withstanding a dielectric strength test with twice the voltage of the intrinsically safe circuit or 500  $V_{RMS}$  (or 700 V DC), whichever is the greater.

#### 9.2.2 Cables containing more than one intrinsically safe circuit

Multi-circuit cables shall not be used for intrinsically safe circuits with voltages exceeding 90 V.

Multi-circuit cables shall be capable of withstanding a dielectric strength test of at least:

- a) 500  $V_{RMS}$  or 700 V DC applied between any armouring and/or screen(s) joined together and all the cores joined together; and
- b) 1 000  $V_{RMS}$  or 1 400 V DC applied between a bundle comprising one half of the cable cores joined together and a bundle comprising the other half of the cores joined together. This test is not applicable to multi-circuit cables with conducting screens for individual circuits.

If information from the cable manufacturer is not available, then the dielectric strength test shall be carried out in accordance with an appropriate cable standard or dielectric strength tests of IEC 60079-11.

NOTE It is not a requirement of this standard that the conformity of the manufacturer's specification of the cable needs to be verified.

### 9.3 Intrinsic safety parameters of cables

The intrinsic safety parameters ( $C_c$  and  $L_c$ , or  $C_c$  and  $L_c/R_c$ ) for all cables used within an intrinsically safe system shall be determined according to one of the following: