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**Electrical apparatus for use in the presence of combustible dust - Part 1: Electrical apparatus protected by enclosures - Section 1: Specification for apparatus**

Electrical apparatus for use in the presence of combustible dust - Part 1-1: Electrical apparatus protected by enclosures and surface temperature limitation - Specification for apparatus

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Ta slovenski standard je istoveten z: IEC 61241-1-1 Ed. 2.0  
<http://standards.iteh.ai/catalog/standards/sist/d860949e-aa4d-405b-8243-0d177a9d0e83/sist-iec-61241-1-1-1998>

**Ta slovenski standard je istoveten z: IEC 61241-1-1 Ed. 2.0**

**ICS:**

29.260.20      Elektrski aparati za uporabo v eksplozivnih atmosferah  
Electrical apparatus for explosive atmospheres

**SIST IEC 61241-1-1:1998**      en

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NORME  
INTERNATIONALE  
INTERNATIONAL  
STANDARD

CEI  
IEC  
1241-1-1

Première édition  
First edition  
1993-08

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**Matériels électriques destinés à être utilisés  
en présence de poussières combustibles –**

**Partie 1:**

**Matériels électriques protégés par enveloppes –  
Section 1: Spécification pour les matériels**

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**Electrical apparatus for use in the presence  
of combustible dust –**

<https://standards.iteh.ai/en/standard/iec/61241-1-1-1998/9e-aa4d-405b-8243-0d177a9d0e83/sist-iec-61241-1-1-1998>

**Part 1:**

**Electrical apparatus protected by enclosures –  
Section 1: Specification for apparatus**

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE  
OF COMBUSTIBLE DUST -

## Part 1: Electrical apparatus protected by enclosures -

## Section 1: Specification for apparatus

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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. The 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 the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
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- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

International Standard IEC 1241-1-1 has been prepared by sub-committee 31H: Apparatus for use in the presence of combustible dust, of IEC technical committee 31: Electrical apparatus for explosive atmospheres.

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

DIS	Report on voting
31H(CO)10	31H(CO)15

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

IEC 1241 consists of the following parts, under the general title: *Electrical apparatus for use in the presence of combustible dust*:

- Part 1: Electrical apparatus protected by enclosures
  - Section 1: 1993, Specification of apparatus
  - Section 2: 1993, Selection, installation, and maintenance of apparatus
- Part 2: Test methods
  - Section 1: 199X, Method for determining electrical resistivity of dust in layers
  - Section 2: 199X, Method for determining minimum ignition temperature of dust

Further parts and sections are under consideration.

## INTRODUCTION

Combustible dust can be ignited by electrical apparatus in several main ways:

- by surfaces of the apparatus that are above the ignition temperature of the dust concerned. The temperature at which a 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;
- by arcing or sparking of electrical parts such as switches, contacts, commutators, brushes, or the like;
- by discharge of an accumulated electrostatic charge;
- by radiated energy (e.g. electromagnetic radiation);
- by mechanical sparking, or frictional sparking or heating associated with the apparatus.

In order to avoid ignition hazards, it is necessary 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 IEC 1241-1-2;
- any electrical sparking parts, or parts having a temperature above the ignition temperature of the dust:
  - are contained in an enclosure which adequately prevents the ingress of dust, or
  - the energy of electrical circuits is limited so as to avoid arcs, sparks, or temperatures capable of igniting combustible dust;
- any other ignition sources are avoided.

The protection specified in this standard will not provide the required level of safety unless the electrical apparatus is operated within its rating, and is installed and maintained according to the relevant codes of practice or requirements; for example, in respect of protection against overcurrents, internal short circuits, and other electrical faults. In particular, it is essential that the severity and duration of an internal or external fault be limited to values that can be sustained without damage to the electrical apparatus.

Two different types of practice, Practices A and B, are specified in this standard. Both are intended to provide an equivalent level of protection.

## ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST -

### Part 1: Electrical apparatus protected by enclosures -

#### Section 1: Specification for apparatus

##### 1 General

##### 1.1 Scope

This section of IEC 1241-1 is applicable to electrical apparatus protected by enclosure for use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard.

Apparatus within the scope of this standard may also be subjected to additional requirements in other publications - for example, IEC 79.

This section specifies requirements for design, construction, and testing of electrical apparatus. Section 2 of IEC 1241-1 gives guidance on the selection, installation, and maintenance of the apparatus. (standards.iteh.ai)

The ignition protection is based on the limitation of the maximum surface temperature of the enclosure, and on the restriction of dust ingress into the enclosure by the use of "dust-tight" or "dust-protected" enclosures.

This standard does not apply to dusts of explosives which do not require atmospheric oxygen for combustion, or to pyrophoric substances.

The application of electrical apparatus in atmospheres which may contain explosive gas as well as combustible dust, whether simultaneously or separately, requires additional protection measures.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

The principles of this standard can also be followed when combustible fibres or flyings cause a hazard.

Where the apparatus has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, the method of protection used shall not adversely affect the integrity of the enclosure.

## 1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 1241-1. At the time of publication of this standard, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 1241-1 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 34-5: 1991, *Rotating electrical machines – Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)*

IEC 50(426): 1990, *International Electrotechnical Vocabulary – Chapter 426: Electrical apparatus for explosive atmospheres*

IEC 79-0: 1983, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

Amendment 1 (1987)

Amendment 2 (1991)

IEC 93: 1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 243-1: 1988, *Methods of test for electric strength of solid insulating materials – Part 1: Tests at power frequencies*

IEC 529: 1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 1241-1-2: 1993, *Electrical apparatus for use in the presence of combustible dust – Part 1: Electrical apparatus protected by enclosures – Section 2: Selection, installation and maintenance of apparatus*

ISO 4225: 1980, *Air quality – General aspects – Vocabulary*

## 2 Definitions

For the purpose of this section of IEC 1241-1, the following definitions apply.

2.1 **dust:** Small solid particles in the atmosphere which settle out under their own weight, but which may remain suspended in air for some time (includes dust and grit as defined in ISO 4225).

2.2 **combustible dust:** Dust that is combustible or ignitable in mixtures with air.

2.3 **conductive dust:** Dust with electrical resistivity equal to or less than  $10^3 \Omega \cdot m$ .

2.4 **explosive dust atmosphere:** Mixture with air, under atmospheric conditions, of flammable substances in the form of dust or fibres in which, after ignition, combustion spreads throughout the unconsumed mixture (see IEV 426-02-04).



**2.5 ignition temperature of a dust layer:** Lowest temperature of a hot surface at which ignition occurs in a dust layer of specified thickness on that hot surface.

**2.6 ignition temperature of a dust cloud:** Lowest temperature of the hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein.

**2.7 dust ignition protection:** All relevant measures specified in this standard (e.g. dust ingress protection and surface temperature limitation) applied to electrical apparatus to avoid ignition of a dust layer or cloud.

**2.8 dust-tight enclosure:** Enclosure capable of preventing the ingress of all observable dust particles.

**2.9 dust-protected enclosure:** Enclosure in which the ingress of dust is not totally prevented, but dust does not enter in sufficient quantity to interfere with the safe operation of the equipment. Dust shall not accumulate in a position within the enclosure where it is liable to cause an ignition hazard.

**2.10 maximum surface temperature:** Highest temperature which is attained by any part of the surface of electrical apparatus when tested under the defined dust free or dust blanket conditions.

NOTE - The temperature is attained under the test conditions. Increasing the layer thickness can increase this temperature due to the thermal insulation properties of dust.

**2.11 maximum permissible surface temperature:** Highest temperature a surface of electrical apparatus is allowed to reach in practical service to avoid ignition. The maximum permissible surface temperature will depend upon the type of dust; its layer thickness, and the application of a safety factor.

NOTE - For details, see clause 5 of IEC 1241-1-2.

**2.12 zone 21:** Areas in which combustible dust, as a cloud, is present, or may be present, during normal process, handling, or cleaning operations in sufficient quantity to be capable of producing an explosible concentration of combustible or ignitable dust in mixtures with air.

NOTE - A dust layer may be present and should be taken into account (see IEC 1241-1-2).

**2.13 zone 22:** Areas not classified as zone 21, in which combustible dust clouds may occur infrequently, and persist for only a short period, or in which accumulations or layers of combustible dust may be present under abnormal conditions, and give rise to ignitable mixtures of dust in air. Where, following an abnormal condition, the removal of dust accumulations or layers cannot be assured, then the area shall be classified zone 21 (see IEC 1241-1).

NOTE - This zone can include, among others, areas in the vicinity of apparatus containing dust, from which dust can escape from leaks, and form dust deposits at hazardous levels (e.g. milling rooms, in which dust can escape from the mills and then settle).

### 3 Construction

#### 3.1 Requirements for all electrical apparatus

The following table gives the application of and deviations from IEC 79-0.

Requirements that shall be applied to achieve a "degree of dust ignition protection":

yes: signifies a requirement shall be applied;

no: signifies a requirement need not be applied.

Clause/Subclause in IEC 79-0	Apparatus for use in	
	zone 21	zone 22
5 General		
5.1	yes	yes
	without modification by a part of IEC 79	
5.2	yes	no
	with residual energy 0,2 mJ as for group I and IIA	
5.3	yes	yes
	without modification by a part of IEC 79	
6 Enclosures of plastic material		
6.1	yes	yes but no type test required
	<b>iTeh STANDARD PREVIEW</b> (standards.iteh.ai)	
6.2	yes	yes
	SIST IEC 61241-1-1:1998	
6.3	yes	no
	<p>Where electrical apparatus is constructed with outer plastic surfaces in excess of either 100 cm<sup>2</sup> or 400 cm<sup>2</sup> where the exposed area is surrounded by conductive earth frame, static discharges of the propagating brush type must be prevented.</p> <p>This can be achieved by the use of plastic material having one or more of the following characteristics:</p> <ul style="list-style-type: none"> <li>- insulation resistance <math>\leq 10^8 \Omega</math> (resistance against electrostatic discharge to earth through or across the surface of insulation, measured by the method described in IEC 93 with an effective area of the circular electrode of 20 cm<sup>2</sup>);</li> <li>- breakdown voltage <math>\leq 4</math> kV (measured across the thickness of the insulating material by the method described in IEC 243-1);</li> <li>- thickness <math>\geq 8</math> mm of the external insulation on metal parts. (External plastic layers of 8 mm and greater on metal parts, such as measurement probes or similar components, make propagating brush discharges unlikely to occur. When evaluating the minimum thickness of the insulation to be used or specified, it is necessary to allow for any expected wear under normal usage.)</li> </ul>	
7 Light-alloy enclosures	no	no

Clause/Subclause in IEC 79-0	Apparatus for use in	
	zone 21	zone 22
8 Fasteners		
8.1	yes	yes
8.2	no	no
9 Interlocking devices	yes	yes
10 Bushings and terminal studs	yes	yes but no type test required
11 Cementing and sealing materials	yes	yes
12 Connections	yes	yes
13 Connection facilities for earthing or equipotential bonding conductors		
13.1	yes	yes
13.2	yes	yes
13.3	yes	yes
13.4	yes	yes
13.5	yes	yes
13.6	yes	yes
14 Connection facilities and terminal compartments		
14.1	yes	yes
14.2	yes	yes
14.3	not relevant	not relevant
14.4	yes with the modification that the IEC publication for the type of apparatus shall be followed	yes
15 Cable and conduit entries		
15.1	yes	yes
15.2	yes	yes
15.3	yes	yes
15.4	yes threaded conduit entries shall be at least five full straight threads or three full tapered threads	yes
15.5	yes with the modification that the requirements for the degree of dust protection are satisfied	yes
15.6	yes	yes