

INTERNATIONAL STANDARD

IEC
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Second edition
1999-06

**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**

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

*Partie 1-1: <https://standards.iteh.ai/standards/iec/61241-1-1-1999>
Matériels électriques protégés par enveloppes et limitation
de la température de surface –
Spécification pour les matériels*



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International Electrotechnical Commission
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

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 co-operation 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.
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International Standard IEC 61241-1-1 has been prepared by subcommittee 31H: Apparatus for use in the presence of combustible dust, of IEC technical committee 31: Electrical apparatus for explosive atmospheres.

This second edition cancels and replaces the first edition, published in 1993, and constitutes a technical revision.

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

FDIS	Report on voting
31H/90/FDIS	31H/96/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.

A bilingual version of this standard may be issued at a later date.

IEC 61241 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 and surface temperature limitation
- Part 2: Test methods
- Part 3: Classification of areas where combustible dusts are or may be present
- Part 4: Type of protection pressurization "p"¹⁾
- Part 5: Intrinsically safe apparatus¹⁾

Withdrawing

iTech Standards
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Document Preview

<https://standards.iteh.ai/catalog/standards/iec/61241-1-1-1999>

¹⁾ Under consideration.

INTRODUCTION

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

- by surfaces of the apparatus 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;
- 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 (for example 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 61241-1-2;
- any electrical sparking parts, or parts having a temperature above the minimum 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 over-currents, 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 by the electrical apparatus without damage.

Two different types of practice, 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 1-1: Electrical apparatus protected by enclosures and surface temperature limitation – Specification for apparatus

1 Scope

This part of IEC 61241 is applicable to electrical apparatus protected by enclosures and surface temperature limitation for use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard. It specifies requirements for design, construction and testing of electrical apparatus.

NOTE – IEC 61241-1-2 gives guidance on the selection, installation and maintenance of the apparatus. Apparatus within the scope of this standard may also be subject to additional requirements in other standards – for example, IEC 60079-0.

The ignition protection is based on the limitation of the maximum surface temperature of the enclosure and other surfaces which could be in contact with dust and on the restriction of dust ingress into the enclosure by the use of "dust-tight" or "dust-protected" enclosures.

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

Where the apparatus has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional methods of protection may be necessary. The method used is not to adversely affect the integrity of the enclosure.

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

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

This standard is not applicable to electrical apparatus intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by fire damp and/or combustible dust. This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

This standard does not include other types of protection and is only applicable to protection by enclosures and surface temperature limitation.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61241. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61241 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60034-5:1991, *Rotating electrical machines – Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)*

IEC 60050(426):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 426: Electrical apparatus for explosive atmospheres*

IEC 60079-0:1998, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-7:1990, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety "e"*

IEC 60079-11:1991, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60192:1973, *Low-pressure sodium vapour lamps*

IEC 60243-1:1998, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60216-1:1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 1: General guidelines for ageing procedures and evaluation of test results*

IEC 60216-2:1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 2: Choice of test criteria*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60662:1980, *High-pressure sodium vapour lamps*

IEC 60947-3:1990, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 61241-1-2:199X, *Electrical apparatus for use in the presence of combustible dust – Part 1-2: Electrical apparatus protected by enclosures – Selection, installation and maintenance*

IEC 61241-2-1:1994, *Electrical apparatus for use in the presence of combustible dust – Part 2: Test methods – Section 1: Methods for determining the minimum ignition temperatures of dust*

IEC 61241-3:1997, *Electrical apparatus for use in the presence of combustible dust – Part 3: Classification of areas where combustible dusts are or may be present*

ISO 178:1993, *Plastics – Determination of flexural properties*

ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 4225:1994, *Air quality – General aspects – Vocabulary*

3 Definitions

For the purpose of this part of IEC 61241, the following definitions apply:

3.1

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)

3.2

combustible dust

dust, fibres or flyings that can burn or glow in air and could form explosive mixtures with air at atmospheric pressure and normal temperatures

3.3

conductive dust

dust fibres or flyings with electrical resistivity equal to or less than $10^3 \Omega\text{m}$

3.4

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

[IEV 426-02-04]

3.5

minimum ignition temperature of a dust layer

lowest temperature of a hot surface at which ignition occurs in a dust layer of specified thickness on this hot surface

[see 3.3 of IEC 61241-2-1, modified]

3.6

minimum 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

[see 3.5 of IEC 61241-2-1, modified]

3.7

dust ignition protection (DIP)

all relevant measures specified in this standard (for example, dust ingress protection and surface temperature limitation) applied to electrical apparatus to avoid ignition of a dust layer or cloud

3.8

dust-tight enclosure

enclosure capable of preventing the ingress of all observable dust particles

3.9

dust-protected enclosure

enclosure in which the ingress of dust is not totally prevented but does not enter in sufficient quantity to interfere with the safe operation of the equipment. Dust should not accumulate in a position within the enclosure where it is liable to cause an ignition hazard

3.10

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 blanket conditions

NOTE – This temperature is attained under the test condition. Increasing the layer thickness can increase this temperature due to the thermal insulation properties of dust.

3.11**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, whether as a cloud or layer, if a layer, its thickness, and the application of a safety factor [see IEC 61241-1-2, clause 6]

3.12**zones**

see 2.10 of IEC 61241-3

3.13**zone 20**

see 2.11 of IEC 61241-3

3.14**zone 21**

see 2.12 of IEC 61241-3

3.15**zone 22**

see 2.13 of IEC 61241-3

4 Construction

4.1 Electrical apparatus for use in potentially explosive dust atmospheres shall comply with the requirements of this standard.

NOTE – If the electrical apparatus has to withstand particularly adverse service conditions (for example rough handling, humidity effects, ambient temperature variations, effects of chemical agents, corrosion), these should be specified to the manufacturer by the user and are not the responsibility of the testing station.

4.2 Enclosures for use in zone 20 or 21 which can be opened more quickly than the time necessary

- to allow incorporated capacitors, charged by a voltage of 200 V or more, to discharge to a value of residual energy of 0,2 mJ; or
- to allow the cooling of enclosed hot components to a surface temperature below the temperature class of the electrical apparatus

shall be marked with the following or equivalent warning:

“AFTER DE-ENERGIZING, DELAY X MINUTES BEFORE OPENING”

“X” being the value in minutes of the delay required.

Alternatively the apparatus may be marked with the warning:

“DO NOT OPEN WHEN AN EXPLOSIVE DUST ATMOSPHERE IS PRESENT”.

4.3 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.

5 Enclosure materials

5.1 Non-metallic enclosures and non-metallic parts of enclosures

The following requirements apply to non-metallic enclosures and non-metallic parts of enclosures on which the type of protection depends. In addition, the requirements of 20.4.7 apply to enclosures for use in zone 20 or 21.

5.1.1 Documents submitted to the manufacturer shall specify both the material and the manufacturing process of the enclosure or part of the enclosure.

5.1.2 The specification for plastic materials shall include

- a) the name of the manufacturer;
- b) the exact and complete reference of the material including its colour, percentage of fillers and any other additives if used;
- c) the possible surface treatments, such as varnishes, etc.;
- d) the temperature index "TI" corresponding to the 20 000 h point on the thermal endurance graph without loss of flexural strength exceeding 50 %, determined in accordance with IEC 60216-1 and IEC 60216-2 and based on the flexing property in accordance with ISO 178. If the material does not break in this test before exposure to the heat, the index shall be based on the tensile strength in accordance with ISO 527 with test bars of type 1.

The data by which these characteristics are defined shall be supplied by the manufacturer.

5.1.3 The testing station is not required to verify compliance of the material with its specification.

5.1.4 Thermal endurance

5.1.4.1 Plastic materials shall have a temperature index "TI" corresponding to the 20 000 h point of at least 20 K greater than the temperature of the hottest point of the enclosure or the part of the enclosure (see 20.4.7.1), having regard to the maximum ambient temperature in service.

5.1.4.2 The endurance to heat and to cold of the enclosures, or parts of enclosures, of plastic materials shall be satisfactory (see 20.4.7.3 and 20.4.7.4).

5.1.5 Electrostatic charges on enclosures or parts of enclosures of plastic material for use in zone 20 or 21.

5.1.5.1 The following requirements apply only to plastic enclosures, to plastic parts of enclosures and to other exposed plastic parts of electrical apparatus for

- non-fixed electrical apparatus;
- fixed apparatus with plastic parts that are likely to be rubbed or cleaned on site.

5.1.5.2 Enclosures of plastic material with surface area projected in any direction of more than 100 cm² shall be so designed that under normal conditions of use, maintenance and cleaning, danger of ignition due to electrostatic charges is avoided.