

Electrical apparatus for use in the presence of combustible dust —

Part 14: Selection and installation

The European Standard EN 61241-14:2004 has the status of a
British Standard

ICS 29.260.20

National foreword

This British Standard is the official English language version of EN 61241-14:2004. It is identical with IEC 61241-14:2004. It partially supersedes BS EN 50281-1-2:1999 which is being kept current until publication of BS EN 61241-17 and which will be withdrawn on 2007-09-01. It also partially supersedes BS 6467-1:1985 and BS 6467-2:1988 which are being kept current until publication of BS EN 61241-0, BS EN 61241-1 and BS EN 61241-17.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Electrical apparatus for explosive atmospheres, to Subcommittee GEL/31/20, Electrical apparatus for use in the presence of combustible dusts, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Electrical apparatus for use in the presence of combustible dust
Part 14: Selection and installation
(IEC 61241-14:2004)

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en présence de poussières combustibles
Partie 14: Sélection et installation
(CEI 61241-14:2004)

Elektrische Betriebsmittel zur Verwendung
in Bereichen mit brennbarem Staub
Teil 14: Auswahl und Errichten
(IEC 61241-14:2004)

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Foreword

The text of document 31H/174/FDIS, future edition 1 of IEC 61241-14, prepared by SC 31H, Apparatus for use in the presence of combustible dust, of IEC TC 31, Electrical apparatus for explosive atmospheres, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61241-14 on 2004-09-01.

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Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61241-14:2004 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60079-0 NOTE Harmonized as EN 60079-0:2004 (not modified).

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INTRODUCTION

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 electrical apparatus in locations where such combustible materials are present, and suitable precautions must therefore be taken to ensure that all such apparatus is adequately protected so as to reduce the likelihood of ignition of the external explosive atmosphere. In electrical apparatus, potential ignition sources include electrical arcs and sparks, hot surfaces and frictional sparks.

Areas where dust, flyings and fibres in air occur in dangerous quantities are classified as hazardous and are divided into three zones according to the level of risk.

Generally, electrical safety is ensured by the implementation of one of two considerations, i.e. that electrical apparatus be located where reasonably practicable outside hazardous areas, and that electrical apparatus be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

Combustible dust can be ignited by electrical apparatus in several 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 (e.g. electromagnetic radiation);
- by mechanical sparking or frictional sparking 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 this standard;
- any electrical sparking parts, or parts having a temperature above the temperature limit specified in this standard
 - 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.

Compliance with this part of IEC 61241 will only provide the required level of safety if 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.

Several techniques are available for the explosion protection of electrical apparatus in hazardous areas. This standard describes the safety features of these types of explosion protection techniques and specifies the installation procedures to be adopted. It is most important that the correct selection and installation procedures be followed to ensure the safe use of electrical apparatus in hazardous areas.

In this standard, for “protection by enclosure tD” only, two different types of practice, A and B, are specified and are intended to provide an equivalent level of protection.

Both of these practices are in common use and the requirements of each should be followed without mixing either the apparatus requirements or selection/installation requirements of the two practices. They adopt different methodology with the primary differences being:

Practice A	Practice B
Written principally as performance based requirements	Written as both performance and prescriptive based requirements
Maximum surface temperature is determined with 5 mm layer of dust and installation rules require 75 °C margin between the surface temperature and ignition temperature of the particular dust	Maximum surface temperature is determined with 12,5 mm layer of dust and installation rules require 25 °C margin between the surface temperature and ignition temperature of the particular dust
A method of achieving the required dust ingress protection by the use of resilient seals on joints and rubbing seals on rotating or moving shafts or spindles and determining dust ingress according to IEC 60529 – IP Code	A method of achieving the required dust ingress protection by specified widths and clearances between joint faces and, in the case of shafts and spindles, specified lengths and diametrical clearances between moving and stationary parts and determining dust ingress according to the heat cycling test

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST –

Part 14: Selection and installation

1 Scope

This part of IEC 61241 specifies general requirements, additional to those required for basic electrical safety, for the selection of electrical apparatus and instruments and associated equipment, and for the installation of electrical apparatus to ensure safe use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard.

NOTE Various parts of the IEC 61241 series specify requirements for the design, construction and testing of electrical apparatus. Apparatus within the scope of this standard may also be subjected to additional requirements in other standards.

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 which are not within the scope of this standard.

This standard includes several types of protection that protect either from ingress of dust or have insufficient energy to cause ignition and provide surface temperature limitation.

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

Where the apparatus is required 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 should not adversely affect the integrity of the enclosure. The requirements of this standard apply only to the use of electrical apparatus under normal or near normal atmospheric conditions. For other conditions, additional precautions may be necessary. For example, most flammable materials and many materials which are normally regarded as non-flammable might burn vigorously under conditions of oxygen enrichment. Other precautions might also be necessary in the use of electrical apparatus under conditions of extreme temperature and pressure. Such precautions are beyond the scope of this standard.

This standard does not apply to dust from explosives which do not require atmospheric oxygen for combustion; neither does it apply to pyrophoric substances.

This standard is not applicable to electrical apparatus intended for use in underground parts of mines, nor those parts of surface installations of such mines endangered by firedamp 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.

The requirements specified in this standard are supplementary to and not alternative to any requirements that would apply to apparatus and installations in non-hazardous areas.

2 Normative references

The following referenced documents are indispensable for the application 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 60364 (all parts), *Electrical installations of buildings*

IEC 60364-4-41, *Electrical installations of buildings – Part 4-41: Protection for safety – Protection against electric shock*

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

IEC 61024-1, *Protection of structures against lightning – Part 1: General principles*

IEC 61024-1-1, *Protection of structures against lightning – Part 1: General principles – Section 1: Guide A – Selection of protection levels for lightning protection systems*

IEC 61241-0, *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements*

IEC 61241-1, *Electrical apparatus for use in the presence of combustible dust – Part 1: Protection by enclosures “tD”*

IEC 61241-10, *Electrical apparatus for use in the presence of combustible dust – Part 10: Classification of areas where combustible dusts are or may be present*

IEC 61241-18, *Electrical apparatus for use in the presence of combustible dust – Part 18: Protection by encapsulation “mD”*¹

IEC 61558-1:1997, *Safety of power transformers, power supply units and similar – Part 1: General requirements and tests*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

area

three-dimensional region or space

3.2

bushing

insulating device carrying one or more conductors through an internal or external wall of an enclosure

3.3

certificate

document confirming that the apparatus is in conformity with the requirements, the type tests and, where appropriate, the routine tests in the standard referred to therein

¹ To be published.

NOTE 1 A certificate can relate to Ex apparatus or an Ex component.

NOTE 2 A certificate may be produced by the manufacturer, the user, or a third party, for example, an IEC Accepted Certification Body (ExCB), a National Certification Body, or an authorized person.

3.4

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

3.5

conductive dust

dust, fibres or flyings with electrical resistivity equal to or less than $10^3 \Omega \cdot m$

3.6

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)

3.7

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

NOTE Dust should not accumulate in a position within the enclosure where it is liable to cause an ignition hazard.

3.8

dust-tight enclosure

enclosure capable of preventing the ingress of all observable dust particles

3.9

dust excluding enclosure "tD"

dust-tight enclosure capable of preventing the ingress of all observable dust particles or a dust-protected 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

NOTE Dust should not accumulate in a position within the enclosure where it is liable to cause an ignition hazard.

3.10

electrical apparatus

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

NOTE These include, among others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion and consumption of electrical energy and items for telecommunications.

3.11

encapsulation "mD"

type of protection whereby parts that are capable of igniting an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way as to avoid ignition of a dust layer or cloud

3.12

equipotential bonding

electrical connection of exposed metal parts so that they are at substantially the same voltage under normal and fault conditions

3.13

Ex component

part of electrical apparatus for potentially explosive atmospheres, which is not intended to be used alone in such atmospheres and requires additional certification when incorporated into electrical apparatus or systems for use in potentially explosive atmospheres

3.14

explosion protection

technique of protection that is applied to apparatus or part of apparatus to prevent the ignition of combustible dusts in hazardous areas

3.15

explosive dust atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres or flyings in which, after ignition, combustion spreads throughout the unconsumed mixture

[IEV 60426-02-4, modified]

3.16

hazardous area

area in which combustible dust in cloud form is, or can be expected to be, present in quantities such as to require special precautions for the construction and use of equipment in order to prevent ignition of an explosive dust/air mixture

NOTE Hazardous areas are divided into zones based upon the frequency and duration of the occurrence of explosive dust/air mixtures.

3.17

ignition source

source of energy which may comprise naked flames, hot surfaces, exposed incandescent material, incendive sparks or hot particles, sufficient to ignite an explosive atmosphere

3.18

intrinsic safety “iD”

type of protection based on the restriction of electrical energy within apparatus and of interconnecting wiring exposed to the potentially explosive atmosphere to a level below that which can cause ignition by either sparking or heating effects

NOTE Because of the method used by which intrinsic safety is achieved, it is necessary to ensure that not only the electrical apparatus exposed to the potentially explosive atmosphere but also other electrical apparatus to which it is interconnected is suitably structured

3.19

instrument

apparatus for the measurement, control or computation of physical or chemical quantities

3.20

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 61241-20-1, modified]

3.21
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 61241-20-1, modified]

3.22
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 layer conditions at the specified maximum ambient temperature

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

3.23
maximum permissible surface temperature

highest temperature that a surface of electrical apparatus is allowed to reach in practical service to avoid ignition

NOTE 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. For details see 6.3.

3.24
type of protection "pD" (pressurization)

technique of applying a protective gas to an enclosure in order to prevent the formation of an explosive dust atmosphere inside the enclosure by maintaining an overpressure against the surrounding atmosphere

3.25
pyrophoric

substance that takes fire spontaneously on exposure to air (e.g. phosphorus) or water (e.g. potassium or sodium)

3.26
source of release

point or location from which a flammable material may be released into the atmosphere so that an explosive atmosphere can form

3.27
type of protection

specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere by such apparatus

3.28
verification dossier

set of documents showing the compliance of electrical apparatus and installations

3.29
wiring, open

system of wiring in which unsheathed cables are installed without further protection

3.30
"X" symbol

suffix to a certificate reference to denote special conditions for safe use

NOTE The symbols "X" and "U" should not be used together.

3.31

"U" symbol

suffix to a certificate reference to denote an Ex component

NOTE The symbols "X" and "U" should not be used together.

3.32

zones

areas classified for explosive dust atmospheres based upon the frequency and duration of the occurrence of explosive dust/air atmospheres

3.33

zone 20

place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, frequently or for long periods

3.34

zone 21

place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur occasionally in normal operation

3.35

zone 22

place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only

4 General requirements for all types of protection

In addition to the requirements of IEC 60364 for installations in areas free of combustible dust, further requirements for installation for use in the presence of combustible dust are described below.

Where electrical apparatus is installed in zone 20, special consideration shall be given to the selection of apparatus.

4.1 Access for inspection

Installations should be designed and apparatus and materials installed with a view to providing safe and easy access for inspection and maintenance (IEC 61241-17).

4.2 Associated equipment located in non-hazardous areas

Consideration shall be given to the specification and installation of apparatus associated with hazardous area apparatus, but which is located in a non-hazardous area, e.g. protection devices, variable speed controllers, fuses etc.

4.3 Segregation

The ultimate level of safety can only be assured when the hazardous materials are segregated. Where practicable, electrical apparatus generally, and switchgear and controlgear particularly, should be installed in a non-hazardous area.

The apparatus may be installed in a non-hazardous area in open air, segregated in a room or compartment that is non-hazardous or, in some instances, behind an impervious barrier that separates the apparatus from the hazardous area.