SLOVENSKI STANDARD
SIST IEC 61241-1-2:1998

01-april-1998

Električ ne naprave za uporabo v prisotnosti gorljivega prahu - 1. del: Preskusne metode -2. oddelek: izbira, vgraditev, in vzdrģevanje

Electrical apparatus for use in the presence of combustible dust - Part 1-2: Electrical apparatus protected by enclosures and surface temperature limitation - Selection, installation and maintenance

Mat®riels ®lectriques destin®s Ňntre utilis®s en pr®sence de poussiļ res combustibles - Partie 1-2: Mat®riels ®lectriques prot®g®s par enveloppes et limitation de la temp®rature de surface - S®lection, installation et maintenance

Ta slovenski standard je istoveten z: **IEC 61241-1-2 Ed. 2.0**

ICS:

29.260.20	Električ ni aparati za eksplozivna ozraļ ja	Electrical apparatus for explosive atmospheres

SIST IEC 61241-1-2:1998 **en**

NORME INTERNATIONALE
INTERNATIONAL STANDARD

CEI
IEC
1241-1-2

Première édition
First edition
1993-08

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

Partie 1:
Matériels électriques protégés par enveloppes –
Section 2: Sélection, installation et entretien du matériel

Electrical apparatus for use in the presence of combustible dust –

Part 1:
Electrical apparatus protected by enclosures –
Section 2: Selection, installation, and maintenance

Bureau Central de la Commission Electrotechnique Internationale 3, rue de Varembé Genève, Suisse

IEC
Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE Q

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST –

Part 1: Electrical apparatus protected by enclosures –

Section 2: Selection, installation, and maintenance

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.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

International Standard IEC 1241-1-2 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)11	31H(CO)16

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, Methods for determining minimum ignition temperature of dust
  - Section 2: 199X, Methods for determining electrical resistivity of dust in layers.

Further parts and sections are under consideration.

INTRODUCTION

Combustible dust can be ignited by electrical apparatus in several 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, 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 to be kept below the temperature limitation specified in this section of IEC 1241-1;

- 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.

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 without damage by 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 2: Selection, installation, and maintenance

1 General

1.1 Scope

This section of IEC 1241-1 is applicable to electrical apparatus protected by enclosures for use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard. This standard is not applicable to electrical apparatus for use in mines susceptible to fire-damp. Nor does it take account of any risk arising from an emission of flammable or toxic gas from the dust.

This standard is generally applicable to apparatus suitable for use and storage at ambient temperatures between –20 °C and +40 °C inclusive. It is also applicable to apparatus for use in specific applications with different temperature ranges.

This section gives guidance on the selection of apparatus, on the installation of the apparatus before it is put into service, and on the maintenance of the apparatus to guard against it becoming a source of risk.

This section specifies requirements for electrical apparatus based on the limitation of the maximum surface temperature of the enclosure and on the restriction of dust ingress to the enclosure by the use of "dust-tight" or "dust-protected" enclosures.

This standard does not apply where the dusts arise from explosives which do not require atmospheric oxygen for combustion, or 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 include other types of protection, and is only applicable to protection by enclosure.

Where the equipment should meet other environmental requirements, for example, protection against ingress of water, and resistance to corrosion, the method of protection used should not adversely affect the integrity of the enclosure.

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

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 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 79-14: 1984, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in explosive gas atmospheres (other than mines)*

IEC 364: *Electrical installations of buildings*

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

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

IEC 1241-2-1: 199X, *Electrical apparatus for use in the presence of combustible dust – Part 2: Test methods – Section 1: Method for determining minimum ignition temperature of dust*

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 this 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 - This 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.

3 Area classification

The dust exclusion efficiency of the apparatus needs to be matched to the environmental conditions likely to be encountered, and a two-way zone system has been adopted.

The present zonal classification of gases and vapour is for three Zones: 0, 1 and 2, but general discussions have shown that a common zonal classification for both gases and dust is not feasible.

Unlike the gas or vapour zones, areas where combustible dust may be present cannot be divided into normal or abnormal conditions dependent upon time, since dust, unlike gas or vapour, is not necessarily self-correcting by ventilation over a stipulated period. In fact, it can be the very opposite, in that accelerated ventilation may lead to dust clouds and therefore give a greater, not a lesser, hazardous condition.

Once a dust layer has been formed, it is cumulative and semi-permanent, unless it is physically cleared or can be safely exhausted into a collector. Therefore, equipment which is placed in a dust atmosphere shall be dust-tight and have a surface temperature limitation below the temperature at which a dust cloud or layer will ignite.

Equipment placed in areas outside the main dust hazard zone, but which may be temporarily subjected to a dust-laden atmosphere occasionally by a failure in the plant, or any untoward happening, shall be dust-protected and have a surface temperature limitation below the dust ignition temperatures.

These two areas, the dust hazard zone and the surrounding fringe zone, have been designated Zone 21 and Zone 22 respectively, with the following definitions.

3.1 Zone 21

Areas in which combustible dust, as a cloud, is present, or which may be present, during normal processing, handling, or cleaning operations in sufficient quantity that is 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.

3.2 Zone 22

Areas, not classified as Zone 21, in which ignitable dust clouds may occur infrequently, and persist for only a short period, or in which accumulations or layers of combustible or ignitable 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 as Zone 21.

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 in hazardous levels (e.g. milling rooms in which dust can escape from mills).

4 Practices A and B

Two different types of practice are specified in this standard, both intended to provide an equivalent level of protection against ignition.

4.1 Practice A

Design details and test methods according to the following:

– Ignition temperatures of a dust layer determined for a 5 mm layer thickness as specified in IEC 1241-2-1 (under consideration).

– Maximum surface temperature measured under dust-free conditions as specified in 4.3.2 of IEC 1241-1-1.

– Maximum permissible surface temperature for apparatus, in presence of dust clouds as specified in 5.1.1 and having dust layers up to 5 mm thickness calculated as specified in 5.1.2.1.

– Construction of enclosure meeting the general requirements as specified in clause 3 of IEC 1241-1-1.

– Dust tightness tested by the method specified in IEC 529 for Category 1 (using artificial depression) meeting the requirements of:

Zone 21 Zone 22 with conductive dust	Zone 22
IP6X Marking DIP A21	IP5X Marking DIP A22

4.2 Practice B

Design details and test methods according to the following:

– Ignition temperature of a dust layer determined for a 12,5 mm layer thickness as specified in IEC 1241-1-1.

– Maximum surface temperatures measured under dust-blanket conditions as specified in 4.3.3 of IEC 1241-1-1.

– Maximum permissible surface temperature for apparatus, in presence of dust clouds as specified in 5.1.1 and having dust layers up to 12,5 mm thickness calculated as specified in 5.1.2.2 of this section.

– Construction of enclosure meeting the general requirements as specified in clause 3 of IEC 1241-1-1.

– Dust tightness tested by the heat cycling dust test using the inherent depression of the apparatus, as specified in 4.2.3 of IEC 1241-1-1.

Zone 21 Zone 22 with conductive dust	Zone 22
Dust-tight as specified in 4.2.3.1 of IEC 1241-1-1 Additional requirements as specified in 3.2 of IEC 1241-1-1 Marking DIP B21	Dust-protected as specified in 4.2.4.1 of IEC 1241-1-1 subclause 3.2 of IEC 1241-1-1 is not applicable Marking DIP B22