SLOVENSKI STANDARD
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Neelektrična oprema za uporabo v potencialno eksplozivnih atmosferah - 5. del: Zaščita s konstrukcijsko varnostjo “c”

Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'

Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 5: Schutz durch Konstruktive Sicherheit 'c'

Appareils non électriques destinés à être utilisés en atmosphères explosibles - Partie 5: Protection par sécurité de construction 'c'

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Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'

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Foreword

This document (EN 13463-5:2011) has been prepared by Technical Committee CEN/TC 305 “Potentially explosive atmospheres - Explosion prevention and protection”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2012, and conflicting national standards shall be withdrawn at the latest by July 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13463-5:2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The present standard is composed of the following parts:

- EN 13463-1, *Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements*
- EN 13463-2, *Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements*

- EN 13463-3, *Non-electrical equipment for use in potentially explosive atmospheres - Part 3: Protection by flameproof enclosure 'd'*
- EN 13463-5, *Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'*
- EN 13463-6, *Non-electrical equipment for use in potentially explosive atmospheres - Part 6: Protection by control of ignition source 'b'*
- EN 13463-8, *Non-electrical equipment for potentially explosive atmospheres - Part 8: Protection by liquid immersion 'k'*

Annex C provides details of significant technical changes between this European Standard and the previous edition EN 13463-5:2003.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Non-electrical equipment has been used for over 150 years in industries having potentially explosive atmospheres and a great deal of experience has been gained in the application of protective measures to reduce the risk of ignition to an acceptably safe level. With the introduction of the Directive 94/9/EC (ATEX) and the inclusion of non-electrical equipment in its scope, it became necessary to produce ignition protection concept standards which clearly defined these protective measures and incorporated the extensive and diverse experience gained over the years.

One of the methods of applying ignition protection, had been to select types of equipment not containing an ignition source in normal service and then apply good engineering principles, so that risk of mechanical failures likely to create incendive temperatures or sparks, was reduced to a very low level. Such protective measures are referred to in this standard as ignition protection by "Constructional Safety", or "type of protection 'c'".

1 Scope

1.1 This European Standard specifies the requirements for the design and construction of non-electrical equipment, intended for use in potentially explosive atmospheres, protected by the type of protection Constructional Safety 'c'.

1.2 This European Standard supplements the requirements in EN 13463-1, the contents of which also apply in full to equipment constructed in accordance with this European Standard.

1.3 The type of ignition protection described in the standard can be used either on its own or in combination with other types of ignition protection to meet the requirements for equipment of Group I, category M2 or Group II, categories 1 and 2 depending on the ignition hazard assessment in EN 13463-1. Type of ignition protection 'c' is not applicable for Group I for M1. These requirements are specified in EN 50303.

NOTE Most category 3 equipment, only needs to meet the requirements of EN 13463-1, but some category 3 equipment may have to meet the requirements of this European Standard for some of the ignition sources identified in the ignition hazard assessment.

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.

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 1127-2, *Explosive atmospheres — Explosion prevention and protection — Part 2: Basic concepts and methodology for mining*

EN 13237, *Potentially explosive atmospheres — Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres*

EN 13463-1:2009, *Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 13463-6:2005, *Non-electrical equipment for use in potentially explosive atmospheres — Part 6: Protection by control of ignition source 'b'*

EN 13463-8, *Non-electrical equipment for potentially explosive atmospheres — Part 8: Protection by liquid immersion 'k'*

EN 13478, *Safety of machinery — Fire prevention and protection*

EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code), (IEC 60529:1989)*

EN ISO 284, *Conveyor belts — Electrical conductivity — Specification and test method*

EN ISO 4413, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414, *Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)*

IEC 60079-4, *Electrical apparatus for explosive gas atmospheres — Part 4: Method of test for ignition temperature*

ISO 281, *Rolling bearings — Dynamic load ratings and rating life*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13237, EN 13463-1, EN 1127-1 and EN 1127-2 and the following apply.

3.1
type of protection constructional safety 'c'
type of ignition protection in which constructional measures are applied so as to protect against the possibility of ignition from hot surfaces, sparks and adiabatic compression generated by moving parts

3.2
mechanically generated sparks
sparks, as well as showers of sparks, produced by impact or friction between two similar or dissimilar solid materials

4 General

4.1 Determination of suitability

Before a decision is made to protect equipment or pieces of equipment for use as an assembly including interconnecting parts by the measures described in this standard, it shall have been subjected to the ignition hazard assessment in accordance with EN 13463-1.

Furthermore, it shall also have been determined that, by enhancing or increasing the safety of certain vulnerable parts, the required level of protection is ensured against the possibility of ignition sources occurring.

4.2 General requirements for equipment

All parts shall be capable of functioning in conformity with the operational parameters established by the manufacturer throughout their expected lifetime. They shall be sufficiently firm and durable to withstand the mechanical and thermal stresses to which they are intended to be subjected.

This also applies to interconnecting parts of equipment including joints (e.g. cemented, soldered or welded joints).

4.3 Ingress Protection

4.3.1 General

The degree of ingress protection (IP) provided by the outer enclosures of equipment depends upon its intended duty and the type of environment it is designed to be used in. An appropriate rating, according to IP category 1, as specified in 13.4 of EN 60529:1991, shall be determined as part of the ignition hazard assessment (see 4.1) and shall be able to prevent foreign objects and/or water entering the equipment which could:

1) Increase the probability of ignition, by for example, allowing combustible dust, with a lower ignition temperature than the potentially explosive atmosphere, to form a layer on hot internal components or parts of the equipment; and/or

2) make contact with moving parts, resulting in the creation of an effective ignition source.

Subclauses 4.3.3 to 4.3.5 specify the minimum degree of ingress protection (IP) for enclosures used in the circumstances described.

4.3.2 In the case of equipment intended for use in potentially explosive gas/vapour atmospheres, where entry of foreign objects can cause ignition, but entry of dust is harmless, entry of objects shall be prevented. The degree of protection shall be determined in the ignition hazard assessment but shall be at least IP 20.

4.3.3 In the case of equipment intended for use in potentially explosive gas/vapour atmospheres, where the entry of dusts or liquids could cause malfunction leading to an ignition source, the enclosure shall be at least IP 54.

4.3.4 In the case of equipment intended for use in potentially explosive dust atmospheres, where ingress of dust can result in an ignition source or fire, the enclosure shall be at least IP 6X.

NOTE There are only a few examples where an IP 6X enclosure is needed.

4.3.5 In the case of equipment intended for use in potentially explosive dust atmospheres, where ingress of dust, foreign objects and liquids are not likely to cause an ignition, no enclosure is necessary for the purpose of ignition protection.

NOTE An enclosure can be required for other safety reasons, e.g. IP 2X to prevent parts of the body coming into contact with rotating parts.

4.4 Seals for moving parts

4.4.1 Unlubricated gaskets, seals, sleeves, bellows and diaphragms

Unlubricated gaskets, seals, sleeves, bellows and diaphragms shall not become an effective ignition source, e.g. If there is a risk of mechanically generated sparks which can become an effective ignition source, light metals shall not be used (see EN 13463-1).

NOTE Sleeves made e.g. of elastomeric material, PTFE or similar material, graphite and ceramics might be suitable.

Non-metallic materials shall be resistant to distortion and degradation without reducing the effectiveness of explosion protection (see EN 13463-1).

4.4.2 Stuffing box seals (packed glands)

Stuffing-box seals (packed glands) shall only be used if a temperature rise above the permitted maximum surface temperature can be excluded.

NOTE Otherwise a device to monitor temperatures and switch off equipment should be applied (see EN 13463-6).

4.4.3 Lubricated seals

Seals which normally require the presence of a replenishable lubricant to prevent hot surfaces occurring at their interface with equipment parts

a) shall be designed to ensure the sufficient presence of lubricant; or

b) shall be protected by one of the following means:

   1) provision of an effective means to monitor the continued presence of the lubricant; or

   2) provision of a temperature detection device to warn of increasing temperatures; or

3) design of the equipment to be capable of completing the "dry run" test, as described in Annex B, without exceeding the maximum surface temperature of the equipment and/or suffering damage which would reduce the effectiveness of its ignition protection properties.

NOTE Monitoring can be either continuous or by appropriate inspection and examination. Where the level of lubricant cannot be easily monitored (e.g. seal containing grease) safety is ensured through information for use.

The information for use shall include details relating to the correct lubrication, monitoring and maintenance of such seals.

4.5 Equipment lubricants/ Coolants/ Fluids

4.5.1 Lubricants and/or coolants, which are required for the prevention of potentially incendive hot surfaces or mechanically generated sparks (see EN 13463-8), shall have an ignition temperature (see IEC 60079-4) at least 50 K above the maximum surface temperature of the equipment where the liquid is being used.

4.5.2 Any fluid which can be released shall not cause an ignition.

NOTE For example due to high temperature or electrostatic charging.

4.6 Vibration

Effective ignition sources caused by hot surfaces or mechanically generated sparks or loss of protection, caused by vibration shall be avoided. Vibration can arise from the equipment itself or from the place where it is mounted.

The manufacturer shall provide any necessary installation, operation and maintenance instructions. In particular, the instructions shall specify the correct operating speed range of the equipment.

NOTE 1 Alternatively the equipment can be provided with a vibration controlling device arranged to control any potential source of ignition associated with excessive vibration of moving parts (see EN 13463-6).

NOTE 2 Where the melting point of the material used in the construction of moving parts is below the maximum surface temperature of the equipment, or is not capable of causing potentially incendive hot surfaces and/or mechanically generated sparks, additional protective measures are not normally necessary (e.g. the provision of a low melting point sacrificial wear plate; the use of a plastic fan inside a metal housing, or a metallic fan with sacrificial non-sparking low melting point fan blade-tips, see EN 14986).

5 Requirements for moving parts

5.1 General

The ignition hazard assessment (see 4.1) shall identify those moving parts which could lead to the occurrence of unsafe vibration or impact or friction. Such parts shall be constructed in such a way so that they do not become an effective ignition source during the lifetime of the equipment, taking the equipment category into consideration in combination with information for use, which shall specify the measures to be taken.

5.2 Clearance

Clearances between non-lubricated moving parts and fixed parts shall be dimensioned so that frictional contact, able to produce an effective ignition source in form of hot surfaces and/or mechanically generated sparks, is avoided.

NOTE 1 In the case of parts protected by fluids see EN 13463-8.

NOTE 2 See 4.6, Note 2 for the precautions which may be adopted for the purpose of expected malfunction.

5.3 Lubrication

For moving parts needing lubrication to prevent excessive temperatures or mechanically generated sparks effective lubrication shall be ensured, e.g. by:

— an oil splash lubricator, or

— an automatic greasing system, or

— a provision to check the lubricant level manually or visually together with adequate maintenance and inspection instructions.

Where this is not possible, alternative measures to control the potential ignition source shall be used. (e.g. temperature sensors for the purposes of alarm or control in accordance with EN 13463-6).

Where equipment is designed to process liquids as part of its duties and the presence of the process liquid is essential for the purpose of lubrication, cooling, quenching, or ignition prevention, this shall be stated in the instructions for safe use, as required by EN 13463-1.

The instructions for safe use shall state the correct way for bringing a self priming pump in operation.

6 Requirements for bearings

6.1 General

Bearings are basically divided into three types, sliding plane motion, sliding rotary motion and rolling element. When assessing bearings, as part of the ignition hazard assessment required by EN 13463-1, the following (which is not a definitive list) shall be taken into account:

— the bearing shall be designed for the equipment's intended duty e.g. speed, temperature, loading and variations of speed and loading;

— the bearing's basic rated life. As described in ISO 281 for rolling element bearings. (see also Note 1 below);

— the proper fit of the bearings in their housing and on the shaft (tolerances, roundness and surface quality), taking into consideration the vertical and axial loads on the bearing with respect to shaft and housing;

— the correct alignment of the bearings;

— the axial and radial loading of the bearings caused by thermal expansion of the shaft and the housing under the most severe operating conditions;

— protection of the bearing from ingress of unintended liquids and solids, if necessary to avoid premature failure;

— protection of the bearing from electrical currents, including stray circulating currents (which can cause, for example, incendive sparking, or spark erosion leading to premature failure, at the point of contact between the ball and ball race of a ball bearing). If bearings act as an insulator, constructive measures, e.g. earthing or bonding, shall be taken, so that the isolation of parts of the equipment is avoided (see EN 13463-1:2009, 6.7.2);

— the provision of adequate lubrication, according to the lubricating regime necessary for the type of bearing (e.g. for sliding bearings, boundary lubrication, mixed film, or full film hydrodynamic lubrication are the most commonly used regimes);

— recommended maintenance intervals;

— replacement after unacceptable wear or the end of its recommended life, whichever comes first;

— protection of the bearing from vibration, especially at standstill.

Where any of the above relies on the user performing manual checks to detect malfunction or impending malfunction, the necessary information shall be included in the information for use required by EN 13463-1.

For category 1 equipment the manufacturer shall specify any necessary running in period, during which time no source of a flammable atmosphere should exist around the equipment.

Bearings shall conform to the current state of technology. They shall be regularly inspected and/or monitored in order to prevent formation of an effective ignition source.

The information for use for the equipment shall include details of necessary servicing, service frequency and appropriate maintenance.

NOTE 1 At the present time, no suitable experimental test exists to demonstrate that a given type of bearing has a low risk of becoming an ignition source in service. Ball and roller bearing manufacturers do however quote a basic rated life corresponding to a probability of mechanical failure occurring during operation (e.g. failure by deformation of an element, or fatigue flaking or spalling occurring on one of its elements). This basic rating can be used in the ignition hazard assessment in an attempt to determine the risk of bearing malfunction that might lead to the production of an incendive hot surface or sparks. The basic rated life of a ball/roller bearing is based on the amount of radial and axial loading that a ball/roller bearing can theoretically endure for one million revolutions. It is usually expressed as an “L” value in terms of expected lifetime operating revolutions or expected lifetime hours of service. In an attempt to reduce the risk of malfunction in service to a minimum, it is paramount that the equipment manufacturer pays attention to good design, the ratio of the axial and radial loadings, construction, lubrication, cooling, and maintenance procedures. Also that regular examination is recommended during operation, in an attempt to detect impending malfunction.

NOTE 2 The service life of bearings depends greatly on the service conditions and it is therefore not possible to calculate their service life reliably.

NOTE 3 Plain bearings do not have an "L" value, because it is not possible to calculate their service life. Lubrication should be ensured as specified in 6.2.

6.2 Lubrication

Bearings which depend on the presence of a lubricating medium to prevent a temperature rise exceeding the maximum surface temperature, or the creation of incendive mechanically generated sparks shall be constructed to ensure the presence of the lubricating medium. This can be achieved by bearings that are sealed for life, an oil splash lubricator, or an automatic greasing system or a manual system of monitoring the oil level, together with suitable instructions about regular servicing and the recommended frequency of inspection. Where this is not possible, alternative measures to control the ignition risk shall be used (e.g. temperature sensors which operate an alarm before a potentially incendive temperature is reached, or a temperature sensor arranged to control the potential source of ignition (see EN 13463-6).

The requirements of 5.3 apply.

6.3 Chemical compatibility

Bearings shall be made of materials resistant to the liquids, or vapours, in which they are intended to be used. Similarly, the material used in the construction of the bearing, including any bearing cages, shall be resistant to any liquids or solvents which can come into contact with them. Particular attention shall be given to the possibility of swelling of non-metallic parts. Where liquids or vapours can dissolve in the lubricant of the bearings, the lubricant shall remain "fit for purpose" even in this condition.