SLOVENSKI STANDARD
SIST EN 13463-5:2004

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Neelektriļ na oprema za uporabo v potencialno eksplozivnih atmosferah ï 5. del: Zaġļ ita s konstrukcijsko varnostjo ñcò

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 a etre utilisés en atmospheres 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”

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

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Foreword

This document EN 13463-5:2003 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of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

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.

Annex A is informative. Annex B is normative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, 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 ATEX Directive 94/9/EC 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'.

The purpose of this standard, is therefore to specify the requirements for equipment, protected by the type of protection 'c' which meets the essential safety and health requirements described in Directive 94/9/EC.

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

1.3 Equipment complying with the relevant clauses of this standard meet the requirements for the following categories:

— Equipment Group I Category M2;

— Equipment Group II Category 2G or 2D;

— Equipment Group II Category 1G or 1D;

NOTE The requirements for Group I, Category M1 equipment, are given in EN 50303 which specifies the requirements for both electrical and non-electrical equipment.

1.4 The type of ignition protection described in the standard can be used either on it's own or in combination with other types of ignition protection to meet the requirements for equipment of Group I, categories M1 and M2 or Group II, categories 1 and 2 depending on the ignition hazard assessment in EN 13463-1.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 982, *Safety of machinery - Safety requirements for fluid power systems and their components – Hydraulics.*

EN 983, *Safety of machinery - Safety requirements for fluid power systems and their components – Pneumatics.*

EN 1127-1:1997, *Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology.*

EN 1127-2:2002, *Explosive atmospheres - Explosion prevention and protection – Part 2: Basic concepts and methodology for mining.*

EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres - Part 1: Basic method and requirements.*

prEN 13463-6, *Non-electrical equipment for 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, *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).*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 13463-1:2001, EN 1127-1:1997 and EN 1127-2:2002 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
mechanical 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 Parts of equipment

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

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 or water entering the equipment which could:

i) reduce the ignition level to a lower value, 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

ii) make contact with moving parts, resulting in the creation of a potential ignition source, unsafe malfunction or fire.

The following subclauses, 4.3.3 to 4.3.5 below, 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 gas/vapour atmospheres, where entry of foreign objects can cause ignition, but entry of dust is harmless, entry of falling objects shall be prevented.

4.3.3 In the case of equipment intended for use in 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.

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

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 which are subject to rubbing contact in normal operation or during foreseeable malfunction, shall not contain light metals. Sleeves made of elastomeric material, PTFE or similar material, graphite and ceramics are 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

Stuffing-box seals shall only be used if a temperature rise above the maximum surface temperature can be excluded.

NOTE A device to monitor temperatures and switch off equipment should be employed.

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 shall be designed to ensure the sufficient presence of lubricant or shall be protected by one of the following means:

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

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

- 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.

The manufacturer's instructions 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 mechanical 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.

5 Requirements for moving parts

5.1 General

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

NOTE Slow moving parts with a circumferential speed of less than 1 m/s do not normally need protection against heating by friction and mechanical sparks. For equipment with very high speed moving parts Constructional Safety "c" might not be suitable. In these cases other types of protection should be considered, for example, a flameproof 'd' enclosure or a pressurised 'p' enclosure.

5.2 Vibration

Unintentional vibration from moving parts leading to the creation of potentially incendive hot surfaces or mechanical sparks, shall be avoided. Unintentional vibration can arise from equipment itself, or from the place where it is mounted. Potential incendive hot surfaces or mechanical sparks from this cause shall be avoided. 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 prEN 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 mechanical 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).

5.3 Clearance

Clearances between non-lubricated moving parts and fixed parts shall be dimensioned so that frictional contact, able to produce potentially incendive hot surfaces and/or mechanical sparks, are avoided (see the above note for some of the precautions which may be adopted for the purpose of foreseeable malfunction).

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

5.4 Lubrication

Moving parts which depend on the presence of a lubricating medium to prevent a temperature rise exceeding the maximum surface temperature, or the creation of incendive mechanical sparks shall be constructed to ensure the presence of the lubricating medium. This can be achieved by 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 prEN 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 manufacturer's instructions, as required by EN 13463-1.

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 (see 4.1), 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, 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 water 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);
- 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 manufacturer's instructions 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.

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 foreseeable lifetime operating revolutions, or foreseeable 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 are not affected, because it is not possible to calculate their service life. Lubrication should be ensured as specified in 6.2.

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

The manufacturer's instructions for the equipment shall include details of necessary servicing, service frequency and appropriate maintenance.

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 mechanical 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 prEN 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 manufacturer's instructions, as required by EN 13463-1.

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.

7 Requirements for power transmission systems

7.1 Gear drives

7.1.1 Gear drives shall comply with the requirements of clause 5. Where the ignition hazard assessment (4.1) shows there could still be an ignition source another form of ignition protection shall be used (e.g. EN 13463-8 protection by liquid immersion).

7.1.2 Where equipment includes facilities to change the gear ratios (manually, or automatically), the gear changing mechanisms shall be so arranged as to ensure that they are incapable of producing either temperatures exceeding the maximum surface temperature or incendive mechanical sparks.

7.2 Belt drives

7.2.1 Power transmission belts shall be incapable of developing an incendive electrostatic discharge during operation (see ISO 1813 and CENELEC Technical Report – CLC/TR 50404: 2003-6).

7.2.2 The materials used in the construction shall be non-combustible and/or not supporting or propagating combustion. These are e.g. materials classified as A1, A2 or B according to EN 13501-1 (see EN 13478). Their selection shall be made under consideration of the risk analysis.

7.2.3 For drives which could cause surfaces to exceed the maximum surface temperature if the belt becomes slack or slips on the pulley, the correct belt tension shall be maintained.

NOTE Devices used to ensure correct belt tension can also serve to detect broken belts.

7.2.4 With drives which could cause surfaces to exceed the maximum temperature if they run out of alignment, true alignment shall be maintained (see 7.2.3).

NOTE Alternatively, belt drives can be fitted with devices to monitor temperature, in order to prevent surfaces becoming an ignition risk (see prEN 13463-6).

7.2.5 The supporting frame, chassis, or structure, of equipment containing belt(s) shall be constructed of electrically conducting material and shall be so arranged as to provide a leakage path to earth for any static electricity which occurs on the belt(s). The frame, chassis or structure includes the driving pulley or drum and any idler pulleys or rollers associated with the belt drive. Specific electrical bonding between the separate parts and earth shall be provided where the electrical resistance of the leakage path to earth exceeds 1 Giga-Ohm.

NOTE Where the drive pulley or drive roller is powered by a mains fed electrical motor the electrical connection to earth, normally provided for the electric motor, can be taken into account.

7.2.6 Drives capable of producing hot surfaces exceeding the maximum surface temperature, as a result of the stalling of the output power shaft, while the input continues to rotate, shall have means to detect the stalled output, and prevent ignition.

7.3 Chain drives

Chain drives shall comply with the requirements of clause 5.

Chain drives operating at speeds greater than 1 m/s and containing a potential ignition source (identified by the ignition hazard assessment required by EN 13463-1), shall be fitted with means to ensure continuous positive engagement of the chain with its associated sprocket. Where this is not possible, it shall be fitted with a device that removes the driving power to the drive sprocket in the event of the chain breaking, becoming disengaged, or slackening beyond a limit specified by the manufacturer's instructions (see prEN 13463-6).

7.4 Other Drives

Other drives shall fulfil the requirements set out in clause 5.

7.5 Hydrostatic/Hydrokinetic/Pneumatic – equipment

7.5.1 Hydrostatic/hydrokinetic and pneumatic power transmission equipment shall be constructed of pipes, enclosures and/or other external parts, which do not produce hot surfaces exceeding the maximum surface temperature, even when operating continuously at maximum normal rating.

7.5.2 Hydrostatic/hydrokinetic equipment shall comply with the requirements of EN 982.

7.5.3 Pneumatic equipment shall comply with the requirements of EN 983.

7.5.4 The maximum temperature of any power transmission fluid which can be released shall not exceed the maximum surface temperature of the equipment, if this can create an ignition risk.

NOTE A suitable over-temperature protection device, can be a fusible plug in a fluid coupling which melts to release the power transmission fluid from the coupling during overload/over-temperature (see prEN 13463-6).

7.5.5 To prevent ignition of the explosive atmosphere by burning liquid the power transmission fluid shall have a suitable fire resistance rating.

NOTE 1 For Group I equipment this can be achieved by using a liquid with a fire resistance rating of at least "2", when tested in accordance with the 'Community of Six Spray ignition Test' and a persistence of flame not exceeding 30 s, when tested in accordance with the 'Wick test', as described in 3.1.1 and 3.2 of the European Safety and Health Commission for Mining and