BS EN 13463-5:2011

BSI Standards Publication

Non-electrical equipment intended for use in potentially explosive atmospheres

Part 5: Protection by constructional safety 'c'

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 13463-5:2011. It supersedes BS EN 13463-5:2003 which is withdrawn.

BSI, as a member of CEN, is obliged to publish EN 13463-5:2011 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK committee voted against its approval as a European Standard.

The UK committee objected to the method of measurement for transmission belt conductivity as described in Annex B, Clause 3. Current UK practice in belt conductivity measurement is found in BS 3790, which was derived in part from ISO 1813. The UK committee recommends consulting these standards, as well as ISO 9563, as informative texts with respect to belt drives.

The CEN Working Group responsible for the development of this standard was not presented with any theoretical or practical basis for rejecting the ISO standards. The Working Group was not made aware of any experience of ignitions of explosive atmospheres caused by equipment made to the ISO standards.

However, users should be aware that EN 13463-5 is a mandated standard under the ATEX Directive and compliance with it therefore offers a presumption of conformity that does not apply to the ISO standards referred to above.

The UK participation in its preparation was entrusted to Technical Committee EXL/23, Explosion and fire precautions in industrial and chemical plant.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 201

ISBN 978 0 580 78513 9

ICS 13.230

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2012.

Amendments issued since publication

Date	Text affected
31 March 2012	Correction of national forward

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13463-5

July 2011

ICS 13.230

Supersedes EN 13463-5:2003

English Version

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'

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

This European Standard was approved by CEN on 11 June 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 13463-5:2011: E

Contents

Page

Tables

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.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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)*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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 mechanically generated sparks.

7.2 Belt drives

7.2.1 There are two main categories of belt drives:

a) friction (flat, V, wedge and v-ribbed) belt drives, where high surface temperatures are foreseeable and may present a hazard; and

b) synchronous (timing) belt drives, with positive interaction between belt teeth and pulley grooves such that friction heat build up does not normally occur.

7.2.2 Power transmission belts shall not be capable of developing an incendive electrostatic discharge during operation, see Annex B for conductivity criteria and measurement requirements.

NOTE 1 ISO 1813 - friction belt drives, and ISO 9563 - synchronous belt drives, specify methods of measuring belt electrical resistance, and give resistance values intended for use where belt drives work in explosive atmospheres. However, the state of the art is set out in CLC/TR 50404. The Technical Report particularly gives advice on the use of belt drives for particular categories and explosive atmospheres.

Where the electrical resistance of a belt is known to increase over time in normal service, the manufacturer shall specify a time period for re-testing or replacement of the belt.

NOTE 2 Whilst conductive of electrostatic charges, belts should not be considered a suitable earth path between the drive and driven pulleys, for lower voltage potentials.

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 A correctly designed and installed belt drive, operating near the limit of its capability, may produce surface temperatures in **normal** running of up to:

Friction drives 50 K above ambient

Synchronous drives 25 K above ambient.

Temperature rises greater than the above will likely reduce the working life of belts.

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 MΩ.

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.

7.2.7 Where a belt drive is equipped with a device to detect a stalled output, slippage, broken belts or misalignment, this shall be taken into account when assessing the maximum temperature during a fault condition.

NOTE The instructions for use will normally include the power transmission capability, the maximum belt speed, the correct tension range, and how this can be measured, and alignment tolerance of the pulley system.

7.3 Flexible couplings

7.3.1 When operated within their design parameters, flexible couplings shall not generate hot surfaces, which exceed the permitted maximum surface temperature, nor disintegrate in a way which would create the risk of an ignition source, through for example contact between moving metal parts. Manufacturers shall define the design parameters using established calculation methods or testing.

NOTE Suitable calculation methods are given in DIN 740-2.

7.3.2 Flexible couplings shall be of a design and built of materials such as to exclude the possibility of an incendive electrostatic discharge.

NOTE This does not necessitate an electrical conductive path (through the flexible coupling) between the coupled shafts unless specified as necessary to complete an earth path from other parts of the coupled machinery.

7.3.3 Where flexible couplings employing non-metallic elements are used to separate metallic components which could otherwise contact and cause incendive sparks, user instructions shall specify the installation and maintenance procedures needed to prevent metal/metal contact during normal use.

7.3.4 Flexible couplings designed to accommodate shaft misalignment shall be installed such that misalignment does not exceed the manufacturers' maximum values, with due regard to any foreseeable movement or flexure of machinery after installation. In particular, the bores in the hubs shall be sufficiently accurate to ensure concentric running of coupling hubs, and of appropriate diameter tolerance to help ensure secure and accurate shaft fixing.

7.3.5 The manufacturers instructions for safe use shall include maximum torque, maximum rotational speed, limits on angular and linear alignment deviations, the temperature rise of polymeric or metal spring components during normal operation at the limiting parameters, and any other information necessary for safe use.

7.4 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 information for use (see EN 13463-6).

7.5 Other Drives

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

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

7.6 Hydrostatic/Hydrokinetic/Pneumatic – equipment

7.6.1 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.

7.6.2 Hydrostatic/hydrokinetic equipment shall comply with the requirements of EN ISO 4413.

7.6.3 Pneumatic equipment shall comply with the requirements of EN ISO 4414.

7.6.4 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 1 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 EN 13463-6).

NOTE 2 Hydraulic power transmission drives can create electrostatic charges. This can be controlled by using proper selection of materials and earth bonding, see CLC/TR 50404.

7.6.5 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 Other Extractive Industries (SHCMOEI) document - Requirements and tests applicable to fire-resistant hydraulic fluids used for power transmission and control (Hydrostatic and Hydrokinetic)", 1994 [1].

NOTE 2 National legislation in member states can require the use of different fire resistant fluids in certain hydraulic systems.

7.6.6 Air compressors used for pneumatic equipment shall:

— incorporate a filter on the intake system to prevent the ingress of dust or similar foreign material into the parts where compression takes place;

— contain only lubricants which are resistant to carbonisation.

NOTE 1 Carbonisation of compressor lubricant (caused by exposure to elevated temperatures) results in the formation of oily carbon deposits in the compressor delivery which can cause it to overheat and explode.

NOTE 2 For fluids operating at high pressure (e.g. inside compressors) allowance should be made for the fact that the ignition temperature is lowered by increased operating pressure.

7.7 Clutches and variable speed couplings

7.7.1 Clutches and couplings, shall be arranged or monitored (see EN 13463-6) so that no fixed or moving part that is exposed to the potentially explosive atmosphere exceeds the maximum surface temperature of the equipment. In the case of plastic or other non-metallic parts of a clutch or coupling, their material or arrangement shall exclude the possibility of an incendive electrostatic discharge.

NOTE Examples of the above types of clutch and coupling are friction plate clutches, bell type centrifugal clutches, fluid couplings and scoop-controlled fluid couplings.

7.7.2 During the period of full engagement, there shall be no slipping, or similar relative movement between the input and output mechanisms likely to cause a hot surface exceeding the maximum surface temperature.

NOTE The above requirements can be achieved by one or more of the following preventative methods (see EN 13463-6):

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

— fitting an overload/ over-temperature protection device, for example a fusible plug in a fluid coupling which "ruptures" to release the power transmission fluid from the coupling during overload/over-temperature; or

— fitting a control device(s), so arranged as to remove the input drive power, if any part of the coupling or clutch assembly, or its housing, attains the maximum surface temperature, or

— a control device, or devices, so arranged as to remove the drive power, if slippage occurs, because of malfunction, incorrect adjustment, or excessive wear on the mechanisms / friction pads (e.g. clutch plates).

7.7.3 So as to prevent unsafe frictional heating, the maximum time taken for mechanisms to achieve full-engagement from a standing start, or full disengagement, shall not cause the equipment to exceed the maximum surface temperature. One method of achieving this is to determine the maximum safe engaging time as described in B.2.

8 Requirements for brakes and braking systems

8.1 Brakes used only for stopping in emergency

Brakes, designed to be used only for emergency stopping of equipment, shall be constructed so that allowing for the maximum kinetic energy to be dissipated, neither shall the maximum surface temperature be exceeded nor shall incendive sparks be generated at any part exposed to the potentially explosive atmosphere.

NOTE For a low likelihood of response of an emergency stopping device the ignition hazard assessment according to EN 13463-1 can come to the result that no further means of protection relating to equipment in this category are necessary.

8.2 Service brakes (including friction brakes and fluid based retarders)

Service brakes shall be constructed to allow for the maximum kinetic energy to be dissipated so that neither shall the maximum surface temperature be exceeded nor shall incendive sparks be generated at any part exposed to the potentially explosive atmosphere.

NOTE It will frequently be strongly recommended to take other protective measures to prevent sources of ignition from developing.

8.3 Parking brakes

Parking brakes shall be fitted with an interlock which prevents the drive power being applied if the brake is not fully released. Alternatively a control device shall be fitted which prevents the power continuing to be applied if the brakes do not release correctly.

9 Requirements for springs and absorbing elements

Springs and absorbing elements shall be constructed and, where necessary, provided with lubrication and/or cooling, so that no part exposed to the potentially explosive atmosphere either produces a hot surface exceeding the maximum surface temperature or incendive mechanically generated sparks if they fracture or break in service.

10 Requirements for conveyor belts

10.1 Conveyor belts shall be incapable of developing an incendive electrostatic discharge during operation (see CLC/TR 50404 and ISO 284)

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

10.2 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 13501-1:2007+A1:2009 (see EN 13478). Their selection shall be made under consideration of the risk analysis.

NOTE 1 The requirements for conveyor belts used in underground mining comply with these requirements and are laid down in EN 1710.

NOTE 2 Member state mining legislation can require mining conveyor belts to pass more stringent fire resistance tests, based on the application of a propane gas burner to a test sample; a full scale fire test in a mining gallery, and a rotating conveyor drive roller in contact with a stationery conveyor belt.

NOTE 3 Requirements for mining equipment are given in EN 1710, EN ISO 340, EN 1554 and EN 14973.

10.3 Conveyor belt systems capable of producing hot surfaces exceeding the maximum surface temperature, as a result of slackening or slipping of the belt on the conveyor drive, or other rollers, shall be fitted with a means to ensure that the correct belt tension, as recommended by the manufacturer, is maintained.

NOTE This can be achieved by either monitoring the tension in the belt, or by comparing the relative speeds of the drive roller and the belt. If the relative speeds of the drive roller and the belt are being compared, a difference exceeding 10 % should cause the drive power to be removed.

10.4 Conveyor belt systems capable of producing hot surfaces exceeding the maximum surface temperature, by running out of alignment, shall be fitted with a means to detect incorrect alignment.

NOTE As an alternative to the protective means referred to in 10.3 and 10.4, the belt drive assembly can be fitted with temperature controlling devices, arranged to ensure that any potentially incendive hot surfaces are prevented from occurring (see EN 13463-6).

10.5 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 1MΩ.

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 electrical motor, can be taken into account.

11 Marking

11.1 In addition to the marking requirements of EN 13463-1, the specific marking necessary for compliance with this standard shall include:

— the symbol 'c' (designating the type of explosion protection).

11.2 Example of the marking in relation to the explosion protection for Group II, Category 2 equipment, intended for use in a potentially explosive atmosphere of gas:

11.3 Example of the marking in relation to the explosion protection for Group I, Category M 2 equipment:

Annex A
(informative)

Examples for an ignition hazard assessment report for typical equipment parts and potential ignition sources

A.1 General remarks regarding ignition hazard assessment

The full ignition hazard assessment according to EN 13463-1 is done by the manufacturer of the complete equipment. Examples are given there. The following examples demonstrate specific aspects of the application of EN 13463-5 to particular parts and sources of ignition in parts of equipment.

A.2 Stuffing box seal

For the assessment of a stuffing box seal it is necessary to keep in mind where the contact to the explosive atmosphere is possible. The inner parts with frictional contact to the shaft may be covered under liquid or without contact to explosive atmosphere. The probability of an inner or an outer ignition source to become effective may be different. It is not possible to protect the inner parts by means of control of ignition sources like temperature limitation placed outside. The heat generating parts are the moving shaft or the packing gland. The packing gland has a bad heat conductance and the maximum heat generating area may vary over its service life. To monitor the moving part is complicated. Therefore, it is necessary to make a statement in the marking, accordingly to distinguish between the inner and the outer parts.

Table A.1 — Stuffing box seal

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence incl. measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	category of equipment resulting in respect of this ignition hazard	necessary restrictions
1	hot surface	friction between the moving and the stationary parts of a stuffing box seal	x				frictional heating in normal operation	determination of the surface temperature during normal operation under most adverse conditions in a test	EN 13463-1:2009 8.2	record of the test, measured temperature = 170 °C		x			3	T3

Table A.1 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence incl. measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
2	hot surface	**Additional application of EN 13463-5 and resulting frequency of ignition source** friction between the moving and the stationary parts of a stuffing box seal	x				frictional heating in normal operation in a liquid pump application	determination of the surface temperature during normal operation under most adverse conditions in a test, the contact force between the shaft and the stuffing box is limited by a stop to prevent excessive force when the equipment is correctly adjusted and a minimum leakage is present	EN 13463-1:2009 clause 8.2, EN 13463-5:2011	record of the test, measured temperature = 170 °C, users manual			x		2	T3

A.3 Slide ring seal

The following table shall demonstrate a possible method to carry out an ignition hazard assessment for a slide ring seal. To fulfil the different requirements for the necessary categories, the seal has to be assessed concerning the possible occurrence of malfunctions. A slide ring seal designed and manufactured to the state of the art is capable to fulfil requirements of category 3 without any additional measures (line 1). To reach the higher level of category 2 additional measures are required. These measures are described in line 2. An example for category 1 is given in line 3.

For this level of protection (cat. 1) rare malfunctions of the equipment as well as the malfunction of the ignition prevention system need to be considered. In this example the malfunction of the ignition prevention system is acceptable when an ignition prevention level 1 (IPL 1, EN 13463-6:2005) is demonstrated.

The ignition prevention system shall be able to detect the monitoring parameter without any unsafe time delay in the activation of the ignition prevention system. It is necessary to demonstrate the capability to switch the ignition source into a safe status. The coupling of the sensors to the ignition source is very important. It is not possible to detect e.g. a temperature gradient because of a rare malfunction at the wear point in an admissible time, when the sensor is placed in the storage tank of the protective liquid of the slide ring seal. For some applications an additional monitoring of the cooling liquid flow is required to avoid excessive local heat. The protective liquid needs to be selected under consideration of the ambient temperatures to avoid evaporation of the liquid in the seal gap.

In total the slide ring seal can only be assessed when a dynamic routine test is carried out on every single unit and the assessment is carried out under consideration of the mounting position of the unit in the assembly.

Table A.2 — Slide ring seal

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
1	hot surface	**Application of EN 13463-1 and resulting frequency of ignition source** friction between the moving and the stationary parts of a slide ring seal with product lubrication	x				frictional heating during normal operation	determination of the surface temperature during normal operation under most adverse conditions in a type test; measured temperature <130°C (135°C minus 5K for type testing)	EN 13463-1:2009, 8.2	record of the type test, requirements for maintenance in the instruction manual		x			3	T4

Table A.2 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
2	hot surface	**Additional application of EN 13463-5 and resulting frequency of ignition source** friction between the moving and the stationary parts of a slide ring seal with product lubrication	x				frictional heating during normal operation; absence of lubrication liquid is foreseeable because of normal leakage quantities	determination of the surface temperature during normal operation under most adverse conditions in a type test; measured temperature <130°C (135°C minus 5K for type testing); lubrication with an additional thermosiphon cooling device with forced circulation, ensured e.g. by a suitable monitoring device or a pump (specification of maintenance procedure and time period for replacement of the fluid)	EN 13463-1:2009, 8.2, EN 13463-5:2011	record of the type test, requirements for maintenance in the instruction manual			x		2	T4

Table A.2 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
3	hot surface	**Additional application of EN 13463-5 and a second independent type of protection resulting frequency of ignition source** friction between the moving and the stationary parts of a slide ring seal with product lubrication	x				frictional heating during normal operation; absence of lubrication liquid is foreseeable because of normal leakage quantities; wrong operating pressure and blocked or interrupted lubrication system are considered as rare malfunctions	determination of the surface temperature during normal operation under most adverse conditions in a type test a); measured temperature <100 °C (less than 80% of 135 °C as required for cat. 1 equipment with T4); lubrication with an additional thermosiphon cooling device with forced circulation, ensured e.g. by a suitable monitoring device or a pump (specification of maintenance procedure and time period for replacement of the fluid);	EN 13463-1:2009, 8.2, EN 13463-5:2011 EN 13463-6:2005	record of the type test, requirements in the instruction manual, ignition prevention system with one ignition prevention level 1, marked (b1) and additional measures for ignition protection of the monitoring device;				x	1	T4

Table A.2 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
3	hot surface	friction between the moving and the stationary parts of a slide ring seal with product lubrication (continued)	x					additional monitoring of liquid in dependence on failure modes by 1) ensuring the temperature of the stationary part of the slide ring seal are controlled to less than 80 % of the required temperature class limit and 2) liquid fill level and/or 3) pressure and/or 4) flow							x	1	T4

[a)] Type Test: The type test can be performed by the manufacturer or a test house according to the conformity assessment procedure.

A.4 Radial seal

The radial seal is used through all categories. In the following table a typical assessment shall be demonstrated. It is necessary to distinguish between the function of ingress protection and the zone separation. For the zone separation for example the natural ventilation or an overpressure of a protective gas may be necessary.

The combination of the malfunction of the seal and the release of flammable liquid or combustible gas shall be considered according to increased ignition risks because of leakage.

Table A.3 — Radial seal

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
1	hot surface	**Application of EN 13463-1 and resulting frequency of ignition source** friction between the shaft and the radial sealing	x				frictional heating in normal operation	determination of the surface temperature under most adverse conditions during a type test	EN 13463-1:2009 clause 8.2	record of the test		x			3	T4

Table A.3 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					Measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
2	hot surface	**Additional application of EN 13463-5 and resulting frequency of ignition source** friction between the shaft and the radial sealing	x				frictional heating in normal operation, the seal may run dry or a failure of mounting may occur	determination of the surface temperature under most adverse conditions during a test, measured temperature <130°C (135°C minus 5K for type testing); the dry run can be excluded, specific measures are described in the operating manual, e.g. original radial sealing spare parts are used, lubrication is assured	EN 13463-1:2009, 8.4.2 EN 13463-5:2011, 4.5.1	record of the test, instructions in the users manual			x		2	T4

Table A.3 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
		Additional application of EN 13463-5 and a second independent type of protection resulting frequency of ignition source														

Table A.3 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
3	hot surface	friction between the shaft and the radial sealing	x				frictional heating in normal operation, the seal may run dry or a failure of mounting may occur, a seizure of the seal can not be excluded	determination of the surface temperature under most adverse conditions during a type test [a)], measured temperature <130 °C (135 °C minus 5 K for type testing); the seal is protected by means of control of ignition sources, the temperature rising in a failure of the seal is checked as noncritical, instructions in the operating manual are given, the capability of the ignition prevention system to IPL 1 is demonstrated	EN 13463-1:2009, 8.2 EN 13463-5:2011, 4.4.1 EN 13463-6:2005	record of the type test, instructions in the users manual, ignition prevention system marked is (b1)				x	1	T4

Table A.3 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
4	hot surface	**Alternative application of EN 13463-5 and resulting frequency of ignition source** friction between the shaft and the radial sealing	x				variation to line 3 frictional heating in normal operation, the seal may run dry or a failure of mounting may occur, a scuffing of the seal can not be excluded	determination of the surface temperature under most adverse conditions during a type test, measured temperature <130 °C (135 °C minus 5 K for type testing);	EN 13463-1:2009, 8.2 EN 13463-5:2011, 4.4.1	record of the type test, instructions in the users manual				x	1	T4

Table A.3 *(continued)*

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
4	hot surface	friction between the shaft and the radial sealing (continued)	x				frictional heating in normal operation, the seal may run dry or a failure of mounting may occur, a scuffing of the seal can not be excluded	the seal is tested with dry run conditions and a failure of mounting, the temperature rising in a failure of the seal is checked as noncritical, instructions in the operating manual are given	EN 13463-1:2009, 8.2 EN 13463-5:2011, 4.4.1	record of the type test, instructions in the users manual				x	1	T4

[a] Type Test: The type test can be performed by the manufacturer or a test house according to the conformity assessment procedure.

A.5 Belt drives

The following example demonstrates a typical solution for V-belt drives. The example below describes only the ignition risk from hot belt surfaces.

The electrostatic properties like resistance or charge generating processes should also be mentioned. It is required to check the amount of generated charge in relation to the conducted charge to ground. Therefore the speed of the belt drive needs to be limited or a test has to be carried out.

Measurements made of the surface temperature of the belt and pulleys at different belt tensions.

For a drive with more than 1 belt, the effect of running with a failed belt has been included in the tests.

Tests take into account the possible presence of dust, liquid or foreign objects, depending on the type of ingress protection provided.

If seizure of the output pulley is a foreseeable malfunction, tests include this case, unless a device to detect this is provided as described in 7.2.6

Instructions for use include the details given in the note to 7.2.7 and a recommendation of the type of belt to be fitted in case of replacement (specification may be taken from other standards).

Table A.4 — Belt drives

	1		2					3			4					
	ignition hazard		assessment of the frequency of occurrence without application of an additional measure					measures applied to prevent the ignition source becoming effective			frequency of occurrence including measures applied					
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f
No.	potential ignition source	description / basic cause (Which conditions originate which ignition hazard ?)	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	reasons for assessment	description of the measure applied	basis (citation of standards, technical rules, experimental results)	technical documentation	during normal operation	during foreseeable malfunction	during rare malfunction	not relevant	resulting equipment category in respect of this ignition hazard	necessary restrictions
1	hot surface	slippage of the belt drive	x				frictional heating in normal operation	determination of the surface temperature under most adverse conditions during a test (<190°C)	EN 13463-1:2009, clause 8.2	record of the test, instructions for use in the users manual		x			3	T3
3	hot surface	**Additional application of EN 13463-5 and resulting frequency of ignition source** slippage of the belt drive	x				frictional heating in normal operation additional heating in case of incorrect tension of the belt	determination of the surface temperature under most adverse conditions during a test (< 190 °C), maintenance is required in regular intervals	EN 13463-1:2009, 8.2 EN 13463-5:2011, 7.2.3	record of the test, instructions for use in the users manual			x		2	T3

Annex B
(normative)

Test requirements

B.1 "Dry run" test for lubricated sealing arrangements

The test attempts to simulate the heating which can occur when the lubrication provided for lubricated type sealing elements, between fixed and moving parts of equipment, is lost. Examples of the sealing arrangements concerned, are gasketed seals, shell type seals and other similar seals used for sliding or rotating shafts.

Before the test, remove the lubricant without the use of a solvent so that minimum residual lubrication is retained. Then subject the sealing arrangement to a "dry run" test of at least one hour with the moving part operating at its maximum normal operating speed.

Measure the temperature on the fixed part of the equipment as near as possible to the place where the seal makes contact with the moving parts. For example, an accurate determination can usually be made by inserting a thermocouple into a small hole drilled at an angle near the seal so that it extends underneath the sealing element. Towards the end of the test several temperature readings may need to be taken to ensure that a final "steady state" temperature has been attained. Note the temperature readings together with the ambient temperature and the speed of moving part during the test. The highest temperature recorded during the test shall not exceed the maximum surface temperature, see EN 13463-1:2009, 8.2.

B.2 Type test for determining the maximum engaging time of clutch assembly

B.2.1 Apparatus

B.2.1.1 One clutch assembly – of the type intended to be used in the potentially explosive atmosphere. If the clutch assembly forms part of series having different input and output characteristics, select the assembly designed to transmit the largest amount of power and torque from its input shaft to its output shaft.

NOTE If the clutch assembly is fitted with an overload prevention device, such as a shear pin (for friction pad types), or fusible link/plug (for liquid filled types), this can need to be defeated during the test to prevent it effecting the results.

B.2.1.2 Temperature sensor(s) - able to measure temperatures up to and including at least the maximum surface temperature for the explosive atmosphere in which the clutch is intended to be used. The sensor(s) also need to be capable of measuring the temperature of fixed and moving parts exposed to the surrounding atmosphere. Suitable sensor(s) are for example specially calibrated infra-red heat detectors, arranged to measure the actual temperature of moving parts without being mechanically connected to them.

B.2.1.3 Drive motor – able to transmit the clutch assembly manufacturer's maximum recommended input power and torque to the assembly.

B.2.1.4 Locking mechanism – able to prevent the output shaft of the clutch assembly from rotating when the manufacturer's maximum recommended input drive power and torque is applied to the input shaft.

B.2.1.5 Timer/recorder - arranged to start when the drive power is first applied to the input shaft and stopped when the temperature sensor detects that a part of the assembly has attained the maximum surface temperature allowed for the atmosphere.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

B.2.1.6 Conditioning chamber – able to condition the clutch assembly whilst it is connected to the drive motor and locking mechanism.

B.2.2 Procedure

B.2.2.1 Condition the clutch assembly at (20 ± 5) °C for 8 h.

B.2.2.2 Simultaneously start the drive motor (to apply power to the clutch input shaft) and the timer.

B.2.2.3 Determine and record the "Maximum engaging time" for the assembly, which is the time taken in seconds, from the instant when drive power is applied to the assembly, to the instant when the temperature sensor ascertains that part of the clutch assembly has reached the maximum surface temperature allowed for the atmosphere in which it is intended to be used.

B.2.2.4 Stop the drive motor

B.2.3 Results

The test report shall contain:

— the clutch assembly manufacturer's name;

— the manufacturer identification for the assembly;

— the "maximum engaging time" for the clutch assembly in seconds.

B.2.4 Reporting

The "Maximum safe engaging time" shall be given in the information for use supplied with the equipment.

B.3 Conductivity criteria for transmission belts

NOTE 1 This information is taken from 4.5.6, CLC/TR 50404:2003. This Technical Report is being revised by IEC (IEC 60079-32).

The belt material is sufficiently dissipative if:

$R \times B \lneqq 10^5\ \Omega m$

where

R is the resistance measured at the inner side of the mounted transmission belt between an electrode halfway between the two pulleys and earth;

B is the width of the flat belt or double the width of the side face of the V-belt.

In cases where the belt consists of layers of different materials the belt is considered to be dissipative if the resistance across it does not exceed $10^9\ \Omega$ (resistance measured at 23 °C and 50 % relative humidity). Care should be taken to ensure that repairs do not increase the value given. Hint shall be given in the operating instructions.

NOTE 2 The fulfilment of the R x B criterion depends on the distance between the two pulleys. The longer the distance the lower the resistance of the transmission belt should be. An alternative requirement depending only on the belt resistance is given in ISO 9563 and ISO 1813. According to these standards a transmission belt is considered to be dissipative if $R \times B / L \leq 600\ k\Omega$ where L is the distance between two conductive electrodes (e.g. graphite, silver paint, metal electrode) on a transmission belt. If the distance between two pulleys exceeds 0,67 m the requirements of the ISO standards are automatically fulfilled by the R x B criterion stated above.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Annex C
(informative)

Significant technical changes between this European Standard and EN 13463-5:2003

The significant changes with respect to the first edition of EN 13463-5 are as listed below:

Table C.1 — Significant changes between this European Standard and EN 13463-5:2003

		Type		
Significant Changes	Clause	Minor and editorial changes	Extension	Major technical changes
Wording has changed	Scope	X		
Requirements on lubricated seals have been modified	4		X	
Some sub-clauses have been moved from Clause 5 to Clause 4	4	X		
New requirement for IP20 ingress protection has been added	4	X		
Information relating to heating of slow moving parts is now found in EN 13463-1	5	X		
New requirement for self-priming pumps in the instructions for safe use has been added	5		X	
Electrical resistance of the leakage path has been modified	7	X		
Distinction between flat and synchronous belts has been made	7	X		
Reference to CLC TR 50404 has been added regarding the state of the art.	7		X	
Tests on belts which support combustion have been removed	7			
New requirement for instructions for safe use has been added	7		X	

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Table C.1 (continued)

Clauses of this European Standard		Type		
		Minor and editorial changes	Extension	Major technical changes
Requirement on resistance path has been reduced from 1 GΩ to 1 MΩ	7	X		
New sub-clause on flexible couplings has been added	7		X	
New alternative for parking brakes and disengagement has been added	8		X	
Fire tests for conveyor belts based on a different EN standard have been added	10		X	
Electrical resistance of the leakage path has been modified	10	X		
Ex hexagon mark has been added in the examples	11	X		
Conductivity criteria for transmission belts and requirements for belt drives have been added	Annex B	X		
New conductivity test methods for belts have been added	Annex B		X	

[a] ESR = Essential Health and Safety Requirements (Annex II of Directive 94/9/EC)

NOTE The technical changes referred include the significant technical changes from the EN revised but is not an exhaustive list of all modifications from the previous version.

Explanations:

Minor and editorial changes clarification
decrease of technical requirements
minor technical change
editorial corrections

Changes in a standard classified as "Minor and editorial changes" refer to changes regarding the previous standard, which modify requirements in an editorial or a minor technical way. Also changes of the wording to clarify technical requirements without any technical change are classified as "Minor and editorial changes".

A reduction in level of existing requirement is also classified as "Minor and editorial changes".

Extension addition of technical options

Changes in a standard classified as "extension" refers to changes regarding the previous standard, which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore these ‘extensions’ will not have to be considered for products in conformity with the preceding edition.

Major technical change addition of technical requirements
increase of technical requirements

Changes in a standard classified as "Major technical change" refer to changes regarding the previous standard, which add new or increase the level of existing technical requirements, in a way that a product in conformity with the preceding standard will not always be able to fulfil the requirements given in the standard. "Major technical changes" have to be considered for products in conformity with the preceding edition.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 94/9/EC

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 94/9/EC

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 94/9/EC	Qualifying remarks/Notes
4.1	1.1.3	
4.2	1.3.4 1.4.1	Clause has some limited relevance to ESR 1.2.4
4.3	1.1.1	
4.4.1	1.3.1	
4.4.2	1.2.3 1.3.2	
4.5	1.0.6a 1.3.1	
5.1	1.0.6a 1.1.3	
5.2	1.3.4	
5.3	1.3.1	
6.1	1.0.6a and 1.0.6c 1.2.1	
6.2	1.3.1	
6.3	1.1.3	
7.1.1	1.1.3 1.3.1 1.3.4	
7.1.2	1.3.1	
7.2.1	1.3.1	
7.2.2	1.3.1	
7.2.3	1.3.2	

Table ZA.1 *(continued)*

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive …	Qualifying remarks/Notes
7.2.4	1.3.1 2.2.1.2	
7.2.5 7.2.5 note	1.2.8 1.0.6a	
7.4	1.5.1	
7.5	1.1.3 1.3.1 1.3.4	
7.6.1	1.3.1	
7.6.4	1.3.1	
7.6.5	1.2.2	
7.6.6	1.2.1 1.3.1	
7.7.1	1.3.1 1.3.2	
7.7.2	1.3.1 2.2.1.2	
7.7.3	1.3.1 2.2.1.1	
8.1	1.1.1 1.3.1	
8.2	1.1.1 1.3.1	
8.3	1.5.1 2.2.1.1	
9	1.3.1	
10.1	1.3.2	
10.2	1.1.1 1.1.3	
10.3	1.3.1 1.5.1	
10.4	1.3.1 1.5.1	
10.5	1.3.2	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Bibliography

[1] *Requirements and tests applicable to fire-resistant hydraulic fluids used for power transmission and control (hydrostatic and hydrokinetic), seventh edition, doc. N° 4746/10/91 EN, Luxembourg, April 1994*

[2] EN ISO 340, *Conveyor belts — Laboratory scale flammability characteristics — Requirements and test method (ISO 340:2004)*

[3] EN 1554, *Conveyor belts — Drum friction testing*

[4] EN 1710, *Equipment and components intended for use in potentially explosive atmospheres in underground mines*

[5] EN 14973, *Conveyor belts for use in underground installations — Electrical and flammability safety requirements*

[6] EN 14986, *Design of fans working in potentially explosive atmospheres*

[7] EN 50303, *Group I, Category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust*

[8] ISO 1813, *Belt drives — V-ribbed belts, joined V-belts and V-belts including wide section belts and hexagonal belts — Electrical conductivity of antistatic belts: Characteristics and methods of test*

[9] ISO 9563, *Belt drives — Electrical conductivity of antistatic endless synchronous belts — Characteristics and test method*

[10] DIN 740-2, *Power transmission engineering; flexible shaft couplings; parameters and design principles*

[11] CLC/TR 50404:2003, *Electrostatics — Code of practise for the avoidance of hazards due to static electricity*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™