# Non-Electrical Explosion Protection

Part of the Basic Explosion Protection Compendium

Compendium

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This brochure forms is aimed at managers who deal with non-electrical explosion protection at hazardous plants. According to 2014/34/EU. this brochure gives an overview on the procedure of the ignition hazard assessment, on potential ignition sources, and on the constructional countermeasures according to EN ISO 80079-36 and EN ISO 80079-37.

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**Disclaimer**
The content of this publication has been compiled by the editor with due and thorough regard of the legal regulations valid at the date of publication and of established technical measures. Nevertheless, incomplete, inaccurate or ambiguous assertions cannot be excluded in the publication. The publication consists of several individual brochures containing general fundamental information on explosion protection. The content of the publication is not intended for and is not suitable for assessing the potential danger of a specific plant.

All regulations on explosion protection are established by German law, including the German Protection at Work Act, and national and international standards. Adherence to these regulations and the German Protection at Work Act are fundamental obligations of the plant designer, plant operator, and employer.

The regulations on explosion protection are subject to legal guidelines and can vary by country.

Furthermore, industrial plants can differ greatly from one another in their design, materials used, and methods of operation. The individual brochures of this compendium provide an overview of topics relating to explosion protection. With this in mind, the technical and organizational measures for explosion protection can only be detailed generally and thus incompletely. In a given specific case, each plant operator must determine his requirements and approach on the basis of an individual hazard assessment, and implement and document these in a fashion verifiable in accordance with the national regulations.

Where necessary, we refer to the relevant IEC/EN standards. Many other countries have comparable national standards. References to national standards are given where required for purposes of clarity and accuracy.

Ask us if you have any questions—we will be happy to help!


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# Introduction

Processing plants often handle chemical substances that cause a potentially explosive atmosphere. This setup calls for comprehensive explosion protection measures. This requires plant operators to know the safety-relevant properties of chemical substances. Non-electrical explosion protection is another important aspect in being able to take appropriate measures. Non-electrical explosion protection encompasses non-electrical devices that, as a potential ignition source, could ignite a potentially explosive atmosphere. Examples of this are ventilators, fans, compressors, (vacuum) pumps, agitators including gears/drive belts, centrifuges, material handling equipment, vibration drives, mechanical mills, and lifting gear.

The explosion protection of non-electrical devices has been regulated within the framework of European legislation and has become increasingly important in recent years. The legal basis for non-electrical explosion protection is EU Directives 2014/34/EU and 1999/92/EC (also called "ATEX Directives").

Directive 1999/92/EC describes the minimum requirements for occupational safety, hygiene, and health for workers who can be endangered by a potentially explosive atmosphere. The Directive is aimed at employers and is the basis for safe operation of a plant.

Directive 2014/34/EU harmonizes the legal and administrative regulations of the Member States concerning devices and protective systems intended for use in hazardous areas. The Directive is aimed at manufacturers and distributors of electrical and non-electrical apparatus suitable for explosive atmospheres.

In accordance with 2014/34/EU, manufacturers of devices must always assess the ignition hazard of these devices if the devices have a potential ignition source and can cause an explosion. The ignition hazard must be excluded in accordance with the underlying safety requirements. For this purpose, the Directive divides the devices in Group II (hazardous area without mining) into 3 categories with different safety levels. The adoption of the predecessor of this Directive already formed the basis for a comprehensive harmonization of European law in the field of explosion protection. This is thus the first time that the basic health and safety requirements are being defined for non-electrical devices that are being used in hazardous areas.

**Spark Generation**

# Standards

Non-electrical devices are essentially assessed according to the following standards for explosion protection:

- DIN EN 1127-1:2011 Explosive atmospheres - Explosion prevention and protection - Basic concepts and methodology: This standard is a basic guide to prevent explosions and to protect against the effects of an explosion. Operators of devices, protective systems, and components can consult it to assess the risk of explosion in the workspace and to select the appropriate devices, protective systems, and components.
- DIN EN ISO 80079-36:2016-12: Non-electrical equipment for explosive atmospheres - Basic method and requirements and ISO/EN 80079-37:2016-12: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c," control of ignition sources "b," liquid immersion "k:" The standards help to assess the ignition hazard of non-electrical devices in hazardous areas. The standard can be used to implement basic health and safety requirements of Directive 2014/34/EU.

## Previously Applicable Standards for Non-Electrical Explosion Protection

Standards DIN EN ISO 80079-36 and DIN EN ISO 80079-37 have replaced the previously applicable standards from the DIN EN 1346 series on non-electrical explosion protection.

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

DIN EN 13463–2:2005 -- Non-electrical equipment for use in potentially explosive atmospheres - Part 2 : protection by flow restricting enclosures 'fr'

DIN EN 13463–3:2005 -- Non-electrical equipment for use in potentially explosive atmospheres - Part 3: Protection by flameproof enclosure 'd'

DIN EN 13463–5:2011 -- Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'

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

DIN EN 13463–8:2004 -- Non-electrical equipment for potentially explosive atmospheres - Part 8: Protection by liquid immersion 'k'

## Other Standards for Non-Electrical Explosion Protection

DIN EN 1127-1: Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology

DIN EN 1834–1 ... -3:2000 - Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres

DIN EN 1755:2016 - Industrial Trucks - Safety requirements and verification - Supplementary requirements for operation in potentially explosive atmospheres

DIN EN 12874:2001 - Flame arresters - Performance requirements, test methods and limits for use

DIN EN 1010-1:2011 - Safety of machinery - Safety requirements for the design and construction of printing and paper converting machines

DIN EN 14986:2017 - Design of fans working in potentially explosive atmospheres

DIN EN 50303:2001 - Group 1, category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust

# Provisions of Directive 2014/34/EU

In addition to the basic safety requirements, equipment and non-electrical devices must satisfy other requirements. In chapter 3 "Conformity assessment procedures," Directive 2014/34/EU sets out the following requirements:

- Type of equipment checks that the manufacturers have to carry out
- Assignment of devices based on equipment groups and categories
- Documents and approvals that can serve as a basis for placing the equipment on the market

In accordance with Directive 2014/34/EU, the equipment is classified into groups and categories:

- Group I: Mining and surface mining plants in the mining industry with a hazard due to mine gas/dust
- Group II: Other hazardous area with the following categories
  - Category 1: Very high degree of safety; safe even in the event of 2 independent faults
  - Category 2: High degree of safety; safe even in the event of a fault
  - Category 3: Normal degree of safety; safe in normal operation

The measures for the explosion protection of non-electrical devices differ significantly from those for electrical devices because they also often constitute effective ignition sources in normal operation. For most non-electrical, usually mechanical devices, this is not the case. The prerequisite is that they fulfill their intended constructional task without fault and with proper maintenance. "Normal operation" of a device refers to the condition in which intended functions are fulfilled within their design parameters. Faults that require overhaul or shutdown are not included.

No ignition sources are therefore to be expected in the normal operation of non-electrical devices and, as a rule, ignition of a potentially explosive atmosphere will not occur. There is thus no requirement for additional protective measures that are typical for explosion-protected electrical devices, e.g., an enclosure. Even when taking into account faults that increase the risk of an ignition source, the requirements for devices with proven constructional measures under category 2 can be fulfilled. The basis for a decision is the ignition hazard assessment. It is used to estimate potential ignition sources of non-electrical devices and the conditions under which these can become effective.

The ignition hazard must be assessed for explosion-protected, non-electrical devices that are used in hazardous areas. The assessment is essential for safety-related measures necessary for the prevention of ignition hazards caused by potential faulty conditions and incorrect use.

Standard DIN EN ISO 80079-36 is the basis for fulfilling the health and safety requirements demanded by Directive 2014/34/EU. Standard and Directive together provide precisely defined requirements for the result of an ignition hazard assessment.

Non-electrical devices for use in Zones 1 and 2 must be subjected to a formal analysis to identify all conceivable ignition sources.

The following classification applies for gases:

- Zone 1: Area in which it is expected that in normal operation a potentially explosive atmosphere consisting of a mixture of air and flammable chemical substances in the form of gas, vapor, or mist will occasionally occur.
- Zone 2: Area in which it is not expected that in normal operation a potentially explosive atmosphere consisting of a mixture of air and flammable chemical substances in the form of gas, vapor, or mist will occur, and if so only rarely and for a short time.

The corresponding documents from the manufacturer are recorded in coordination with a "notified body." An example of such a "notified body" is the National Metrology Institute of Germany. Non-electrical devices may only be placed on the market with a declaration of conformity when they are deemed to be sufficiently safe following the ignition source assessment. To use the devices in Zone 0, a type examination is mandatory. The notified body then provides an EU-type examination certificate.

# Requirements of Relevant Standards

Standards DIN EN 1127–1 and DIN EN ISO 80079-36 set out the following requirements:

- Non-electrical devices must satisfy the operational conditions stipulated by the manufacturer, which must be included in the instruction manual; this includes improper handling, rough handling, exposure to humidity, ambient temperature and pressure variations, influence of chemicals, corrosion, oscillations.
- The ignition hazard must be determined and assessed.
- The ignition hazard assessment must be documented.
  - The maximum temperatures must be determined for outer and inner surfaces for category 1 with a maximum of 80 % of T1 ... T6. The classification into 6 temperature classes for the maximum surface temperature is in accordance with European Standard EN 60079-0:2014.
- The production of mechanical sparks from friction, impact, and erosion processes must be avoided. The proportions of aluminum, magnesium, titanium, and zirconium in alloys and coatings are limited according to the respective category.
- All conductive parts must be connected and grounded to protect against sparks due to static electricity.
- Surface resistance must be less than $10^9$ Ω.
- Further detailed requirements must be met depending on the equipment category and potential ignition source.
- If the ignition hazard assessment indicates that there is an ignition risk due to friction, impact effect, or friction sparks, then depending on the category assignment the following maximum permissible mass fractions are stipulated for external materials:
  - Category 1: A total of no more than 10 % aluminum, magnesium, titanium, and zirconium as well as a total of not more than 7.5 % magnesium, titanium, and zirconium
  - Category 2: No more than 7.5 % magnesium
  - Category 3: No special requirements

The ignition hazard assessment in accordance with DIN EN ISO 80079-36 requires the risks in terms of potential ignition sources to be assessed and cited not only for the complete device but for all components. The measures that have been taken to prevent ignition and explosion must be given. Necessary protective measures must be taken in the following order:

1. Ensure that no ignition sources can occur
2. Ensure that no ignition sources can become effective
3. Prevent a potentially explosive atmosphere from reaching the ignition source
4. Suppress explosion and prevent flame propagation

# Ignition Hazard Assessment

The required ignition hazard assessment encompasses the following necessary basic information, which must exist for each non-electrical device:

- Description of the device
- Intended use of the device
- Materials used and their properties
- Design drawings and regulations
- Results of studies undertaken
- Requirements for installation, operation, and servicing

The result of the ignition hazard assessment must be fully documented. A report with the following contents must be created and incorporated in the technical documentation for the device:

- Basic information for the ignition hazard assessment
- Ignition hazards identified and their causes
- The implemented measures to prevent or reduce the detected ignition hazards
- Result of the definitive ignition hazard assessment
- Category classification resulting from the evaluation and necessary safety restrictions for the intended use

The instruction manual for the device must contain a summary of the identified hazards, the preventive measures, and/or the protective measures. It is useful to give the results of the ignition hazard assessment in the form of a reporting scheme. Standard DIN EN ISO 80079-36, Annex D, lists examples of reporting schemes for ignition hazard assessment.

## Typical Sequence for the Assessment of Potential Ignition Hazard

In the following text, we outline the typical sequence for the classification of potential ignition hazards due to mechanically generated sparks. This scheme is now used by many "notified bodies" that perform a type examination for category 1 devices.

1. The potential ignition sources in question are listed.
   Example: mechanically generated sparks.
2. The ignition sources are then assigned to the components present.
   Components may include ball bearings or fans.
3. An examination of the circumstances under which the ignition source can become effective is undertaken.
   For example, can this occur in normal operation or only if there is a fault?
4. Depending on point 3, clarify which possible countermeasures are required.
   These could include: oversizing of ball bearings and specification of servicing information.
5. The result of point 3 and point 4 determines the equipment category, the group, and the temperature class that can be achieved for the assessed device.

# Ignition Sources

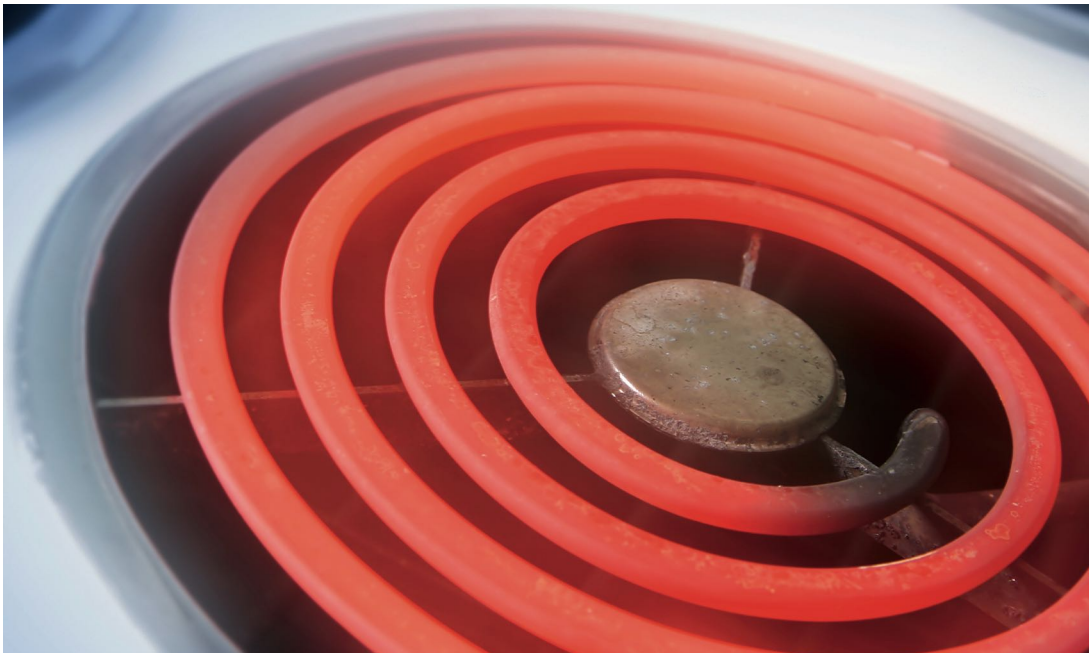
Non-electrical devices can have various potential ignition sources.
The following text gives an overview of the most common potential sources.

**Possible Causes for the Ignition of a Surrounding Potentially Explosive Atmosphere**

| Cause | Example |
|---|---|
| Substances that are processed in devices, protective systems, and components | Content in agitated vessels |
| Substances that are released by the devices, protective systems, and components | Leakage from a pump |
| Substances in the vicinity of devices, protective systems, and components | Pump in the hazardous area near a leaking flange joint |
| The materials comprising the devices, protective systems, and components | Exothermic welding caused by a rusty screw falling on the aluminum housing of a device |

Just the combustion reaction with the air releases considerable amounts of heat, which can be accompanied by an explosion pressure rise and a release of hazardous substances.

**Hot Surfaces as Ignition Source**



**Potential Ignition Sources of Mechanical Devices for the Ignition of a Surrounding Potentially Explosive Atmosphere**

| Ignition source | Cause, example |
|---|---|
| Hot surfaces | Heaters, drying cabinets, heating coils |
| Mechanical processes and machining operations | |
| Devices, protective systems, and components that convert mechanical energy into heat | Friction couplings, mechanically activated brakes on vehicles, centrifuges |
| Rotating parts | Bearings, shaft bushings, stuffing glands, etc. with insufficient lubrication |
| Friction processes | Ingress of foreign matter in narrow enclosure with moving parts and relocation of axes |
| Temperature rise | Chemical reactions of lubricants and cleaning agents |
| Flames and hot gases | |
| Mechanically generated sparks | ■ Friction, impact, and erosion processes such as grinding<br>■ Ingress of foreign materials in devices, protective systems, and components<br>■ Friction between similar iron and ceramic materials<br>■ Impact processes involving rust and light metals |
| Electrical equalization currents | ■ Reverse currents to power generation plants<br>■ Short circuit to frame or ground when faults occur in electrical installations<br>■ Magnetic induction<br>■ Lightning |
| Static electricity | ■ Discharge of charged and insulated conductive parts<br>■ Brush discharges on charged parts made of non-conductive materials<br>■ Separation processes, e.g., passing of foils over rollers and drive belts<br>■ Bulk cone discharges with bulk materials<br>■ Lightning |
| Electromagnetic waves | ■ High-frequency plants, e.g., wireless transmitter stations<br>■ High-frequency generators for heating, drying, hardening, and welding<br>■ Radiation in the spectral range through concentrated sunlight (lens)<br>■ Radiation of strong light sources, e.g., flash light<br>■ Laser beams meeting a surface of solids |
| Ionizing radiation | |
| X-rays and radioactive substances | Energy absorption |
| Ultrasound | |
| Adiabatic compression and shock waves | |
| Exothermic chemical reactions | |
| Spontaneous ignition of dust | |

# Protective Systems

Protective systems are non-electrical appliances that stop initiating explosions immediately and limit the area affected by an explosion. These include bursting disks, detonation flame arresters, flame arresters, explosion suppression systems, quick closing slide valves, extinguishing barriers, rotary feeders, and stuffing augers.

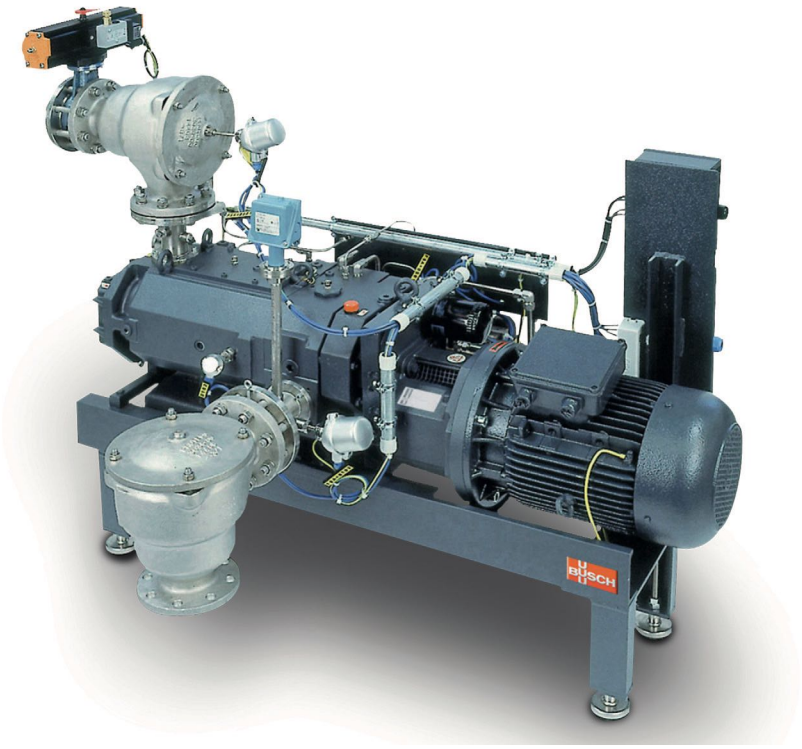
For protective systems to function in an emergency, situations that can lead to explosions must be reliably recognized as such. The following measures must therefore be taken in advance:

- Identify hazards
- Assess risks
- Reduce or eliminate risks
- Provide information for users

The safety of non-electrical devices, protective systems, and components can be achieved by eliminating hazards or limiting the risk. This includes the following measures:

- Constructional measures
- Technical protective measures
- Communication elements for passing on information to the user
- Other precautionary measures

**Vacuum Pump with Flame Arrester (Busch)**



# Types of Protection for Non-Electrical Equipment

Standard EN 13463 describes different types of protection to safeguard non-electrical devices, protective systems, and components against explosion hazards in accordance with the environmental requirements. The following text outlines the main types of protection for non-electrical systems.

All types of protection for non-electrical equipment include an "h" in their marking in accordance with DIN EN ISO 80079-37. The previous markings "c," "d," "b," and "k" are no longer used.

## Constructional Safety

**Type of Protection: "Constructional Safety"**

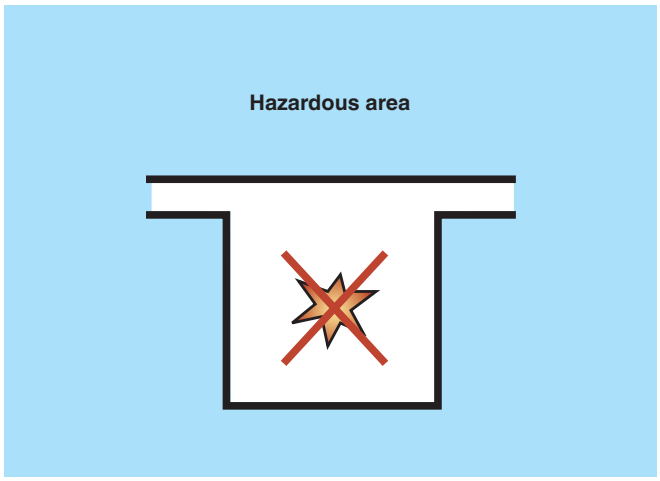



Figure 1.1 Schematic representation of constructional safety for non-electrical devices EN 13463-5

"Constructional safety" is a type of protection that includes structural measures to protect against potential ignition due to moving parts, hot surfaces, as well as sparks and adiabatic compressions.

### Function

The devices must be constructed such that they are protected against the ingress of foreign matter. All device parts and connections used must be sufficiently tough and durable throughout their foreseeable lifetime to withstand mechanical and thermal stresses. All distances between components must be factored in.

### Range of Application

Components that work with this type of protection include:

- Pumps
- Gears
- Ball bearings
- Agitators
- Ventilators

Constructional safety "c" can be used as category 1 and category 2 equipment in the gas and dust hazardous area in Zone 1, 2 or 21, 22.

This type of protection can be combined with other degrees of protection.

Current marking according to DIN EN ISO 80079-37:

II 2 G Ex h IIB T4 Gb

## Flameproof Enclosure

This type of protection has not been included in DIN EN ISO 80079-37. "Electrical" standard DIN EN 60079-1 is also applicable for non-electrical devices.

### Type of Protection "Flameproof Enclosure"

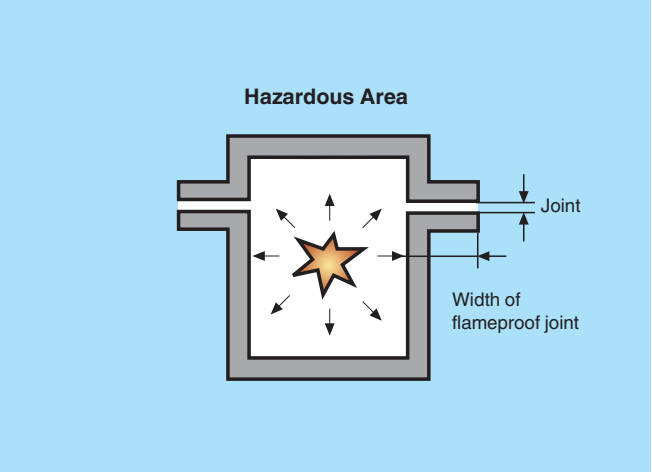



Figure 1.2 Schematic representation of a flameproof enclosure (IEC 60079-1, EN 60079-1, FM 3615, UL 2279.P1, EN 13463-3)

"Flameproof enclosure" is a type of protection that uses the possibility of arranging equipment or devices that can ignite a potentially explosive atmosphere within an enclosure.

## Function

"Flameproof enclosure" is a type of protection that operates only on the principle of prevented explosion propagation. In this type of protection, the energy source may come into contact with the hazardous gas/air mixture and an explosion can occur. In the event of an explosion of an explosive mixture inside, the enclosure withstands the explosion pressure and prevents the propagation of the explosion to the potentially explosive atmosphere surrounding the enclosure.

The enclosure contains a flameproof joint that serves as a pressure relief vent. Technically speaking, the type of protection utilizes the width of flameproof joint and interstice of the enclosure in relation to the specific ambient conditions. The interstice regulates the gas jet that escapes from the enclosure. Escaping hot gases are diluted and cooled down so much that they cannot ignite a colder surrounding potentially explosive atmosphere. The minimum ignition temperature and the minimum ignition energy of the surrounding potentially explosive atmosphere cannot therefore be reached and ignition is prevented.

The nature of the gas and the design of the enclosure joint are decisive in determining the minimum width of joints and the maximum gaps that equipment or devices of this type of protection are allowed. The classification of a flameproof enclosure therefore results from the gas group and the maximum surface temperature, which must be lower than the ignition temperature of the gas present.

## Range of Application for Non-Electrical Devices

### Examples

Examples of non-electrical devices for which flameproof enclosure is used in hazardous areas include:

- Friction clutches
- Brake pads
- Devices that generate flammable friction sparks during normal operation

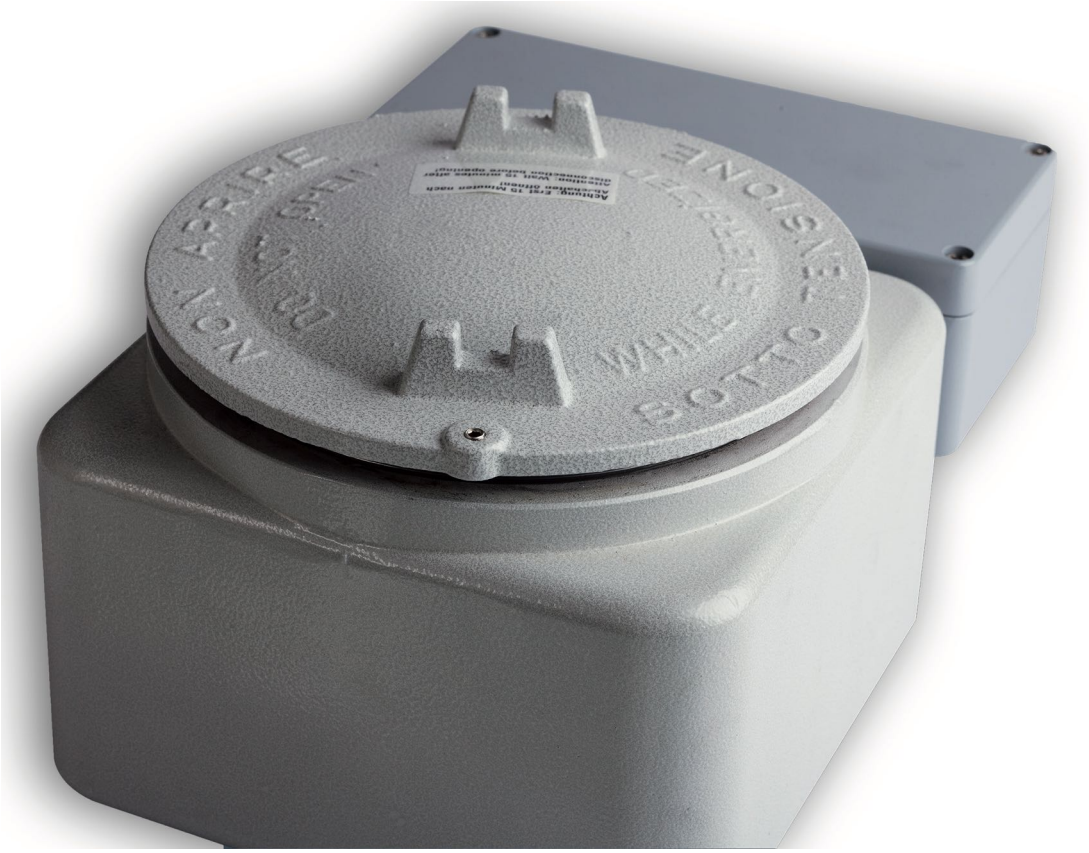
### Possible Applications

Devices with this type of protection can be used as category 2 equipment in the gas and dust hazardous area. This type of protection can be combined with other degrees of protection.

Current marking according to EN 13463-3:


II 2 G d T4

### Example of a Flameproof Enclosure



## Ignition Source Monitoring

### Type of Protection: "Ignition Source Monitoring"

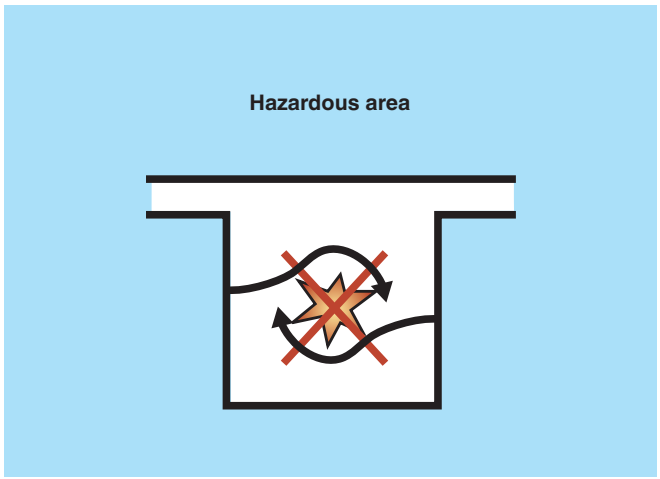



Figure 1.3 Schematic representation of the ignition source monitoring of non-electrical devices, EN 13463-6

This type of protection uses sensors to monitor negative changes in the operating state in a non-electrical device that could cause ignition of the surrounding atmosphere.

## Function

The ignition monitoring can be done either automatically or manually. The manufacturer of non-electrical devices distinguishes between ignition protection systems type b1 and type b2. This ensures that the sensors or ignition protection systems function upon a corresponding demand and that the ignition risk remains within acceptable limits. The ignition protection level indicates the reliability of an ignition protection system.

## Range of Application

Mechanical sensors or actuators that use this type of protection include:

- Fusible inserts in fluid couplings
- Centrifugal governors
- Thermostatic valves

Electromechanical sensors or actuator systems that use this type of protection include:

- Equipment to record temperature, throughflow, and fill level
- Optical pulse counters
- Vibration sensors
- Appliances for orientation on conveyor belts
- Components for monitoring the tension of drive belts
- Wear sensors on couplings

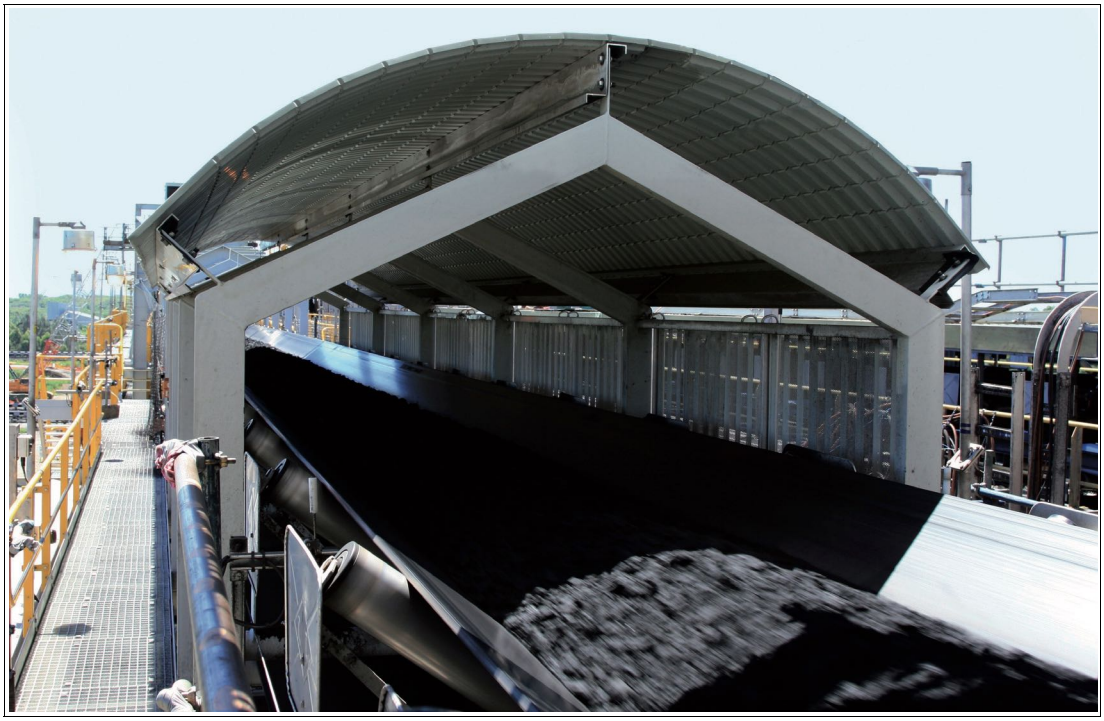
Devices with this type of protection can be used as category 1, category 2, and category 3 equipment in the gas and dust hazardous area.

This type of protection can be combined with other types of protection.

Current marking according to DIN EN ISO 80079-37:

II 2 G Ex h IIC T4 Gb

**Bearing Monitoring on a Conveyor Belt**



## Liquid Immersion

### Type of Protection: "Liquid Immersion"

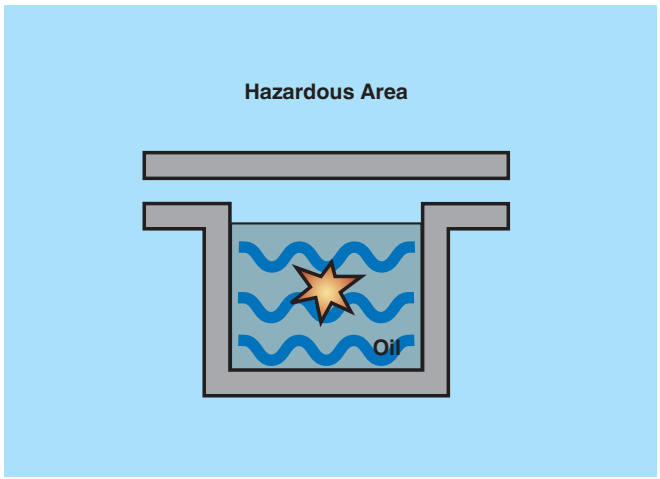



Figure 1.4 Schematic representation of liquid immersion (EN 13463-8)

"Liquid immersion" is a type of protection where potential ignition sources cannot become active or are separated from potentially explosive atmospheres by a protective liquid.

## Function

For this purpose, the device is fully or partially submerged in a protective liquid and its active surfaces are constantly coated with a protective liquid. A potentially explosive atmosphere located above the liquid or outside the device enclosure cannot therefore ignite.

## Range of Application

Devices that use this type of protection include:

- Membrane and immersion pumps
- Oil-filled gearboxes
- Fluid couplings
- Torque converters

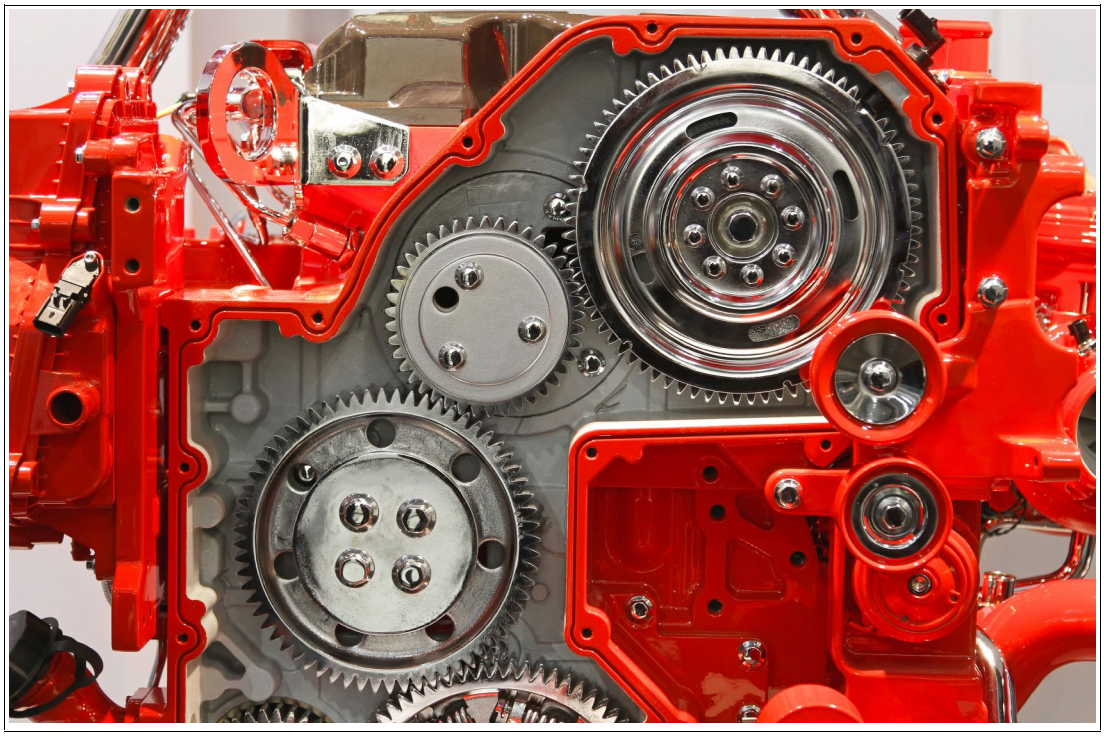
Devices with this type of protection can be used as category 1, category 2, and category 3 equipment in the gas and dust hazardous area.

This type of protection can be combined with other types of protection.

Current marking in accordance with DIN EN ISO 80079-37:

II 2 G Ex h IIC T4 Gb

### Liquid-Immersed Gearbox



## Flow Restricting Enclosure (withdrawn)

This type of protection was defined in the now withdrawn standard DIN EN 13463-2. However, this type of protection was not carried over to DIN EN ISO 80079-37.

**Type of Protection: "Flow Restricting Enclosure"**

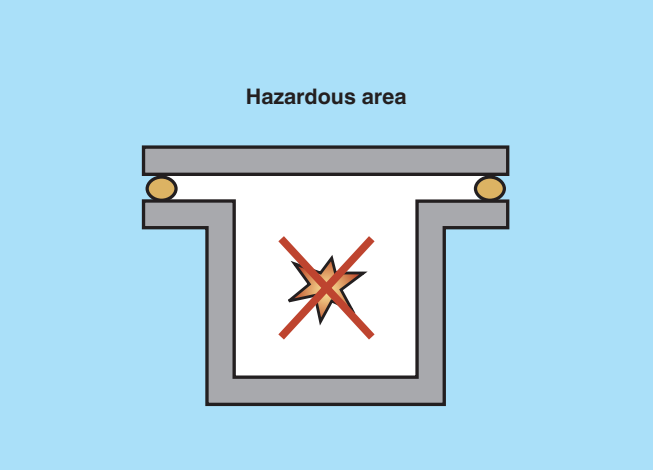



Figure 1.5 Schematic representation of a flow restricting enclosure for non-electrical devices EN 13463-2,

"Flow restricting enclosure" is a type of protection where an enclosure reduces the ingress of a surrounding potentially explosive atmosphere to the degree that the concentration inside lies below the lower explosive limit (LEL).

### Function

The device design prevents the presence of a potentially explosive atmosphere inside the enclosure and coming into contact with the ignition source.

### Range of Application

This type of protection can be used as category 3 equipment in the gas and dust hazardous area in Zone 2 or 22.

This type of protection cannot be combined with other degrees of protection.

Marking, e.g., in accordance with EN 13463-2:

Ex II 3 G fr T6

# Sources and References

European Commission ed.: ATEX Guidelines, Guidelines on the application of Directive 2014/34/EU of the European Parliament and the council of February 26, 2014 on the harmonisation of the law of the member states relating to equipment and protective systems intended for use in potentially explosive atmospheres. (New edition) April 2016.

Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

DIN EN ISO 80079-36:2016-12 - Non-electrical equipment for explosive atmospheres - Basic method and requirements

ISO/EN 80079-37:2016-12 - Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"

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

DIN EN 13463–2:2005 -- Non-electrical equipment for use in potentially explosive atmospheres - Part 2 : protection by flow restricting enclosures 'fr'

DIN EN 13463–3:2005 -- Non-electrical equipment for use in potentially explosive atmospheres - Part 3: Protection by flameproof enclosure 'd'

DIN EN 13463–5:2011 -- Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'

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

DIN EN 13463–8:2004 -- Non-electrical equipment for potentially explosive atmospheres - Part 8: Protection by liquid immersion 'k'

DIN EN 1127-1: Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology

# Basic Brochures from Pepperl+Fuchs

Pepperl+Fuchs, ed., Physical-technical principles—Terminology definitions, explosions, examples, prerequisites, combustible substances and characteristic values, ignition sources.

Pepperl+Fuchs, ed., Types of protection for electrical apparatus—Types of protection for gas hazardous areas, functional principle, identification, specifics for use.

Pepperl+Fuchs editor, Nonelectrical explosion protection: Specifics of nonelectric devices, ignition hazard assessment, types of protection, marking.

Pepperl+Fuchs editor, Type of protection: intrinsic safety.

Pepperl+Fuchs, ed., Dust explosion protection—Types of protection for dust hazardous areas, specifics of combustible dust, functional principle, identification, specifics for use.

Pepperl+Fuchs editor, IEC/EN 60079-14 - Explosive atmospheres - Part 14: Electrical installations design, selection and erection.

Pepperl+Fuchs editor, Global specifications and directives—Laws and regulations of regions or countries for the placing on the market of explosion-protected equipment.

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