ISO 80079-37

Edition 1.0 2016-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety "c", control of ignition source "b", liquid immersion "k"

Atmosphères explosives –
Partie 37: Appareils non électriques destinés à être utilisés en atmosphères explosives – Mode de protection non électrique par sécurité de construction "c", par contrôle de la source d'inflammation "b", par immersion dans un liquide "k"

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety "c", control of ignition source "b", liquid immersion "k"

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International Standard ISO 80079-37 has been prepared by IEC sub-committee 31M: Non-electrical equipment and protective systems for explosive atmospheres, of IEC 31: Equipment for explosive atmospheres.

The text of this standard is based on the following documents of the IEC:

FDIS	Report on voting
31M/104/FDIS	31M/110/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 15 P members out of 20 having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

"A list of all parts in the IEC 60079 series, under the general title *Explosive atmospheres*, as well as the International Standard 80079 series, can be found on the IEC website."

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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EXPLOSIVE ATMOSPHERES –

Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety “c”, control of ignition source “b”, liquid immersion “k”

1 Scope

This part of ISO/IEC 80079 specifies the requirements for the design and construction of non-electrical equipment, intended for use in explosive atmospheres, protected by the types of protection constructional safety “c”, control of ignition source “b” and liquid immersion “k”.

This part of ISO/IEC 80079 supplements and modifies the requirements in ISO 80079-36. Where a requirement of this standard conflicts with the requirement of ISO 80079-36 the requirement of this standard takes precedence.

Types of Protection “c”, “k” and “b” are not applicable for Group I, EPL Ma without additional protective precautions.

The types of ignition protection described in the standard can be used either on their own or in combination with each other to meet the requirements for equipment of Group I, Group II, and Group III depending on the ignition hazard assessment in ISO 80079-36.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC TS 60079-32-1, *Explosive atmospheres – Part 32-1: Electrostatic hazards, Guidance*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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

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*

ISO 9563, *Belt drives – Electrical conductivity of antistatic endless synchronous belts – Characteristics and test method*

ISO 4413, *Hydraulic fluid power – General rules and safety requirements for systems and their components*

ISO 4414, *Pneumatic fluid power – General rules and safety requirements for systems and their components*

ISO 19353, *Safety of machinery – Fire prevention and protection*

ISO 80079-36: 2016, *Explosive atmospheres – Non-electrical equipment for explosive atmospheres – Part 1: Basic method and requirements*[1]

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

EN 13501-1, *Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 80079-36, IEC 60079-0 and the following apply.

3.1
constructional safety "c"
ignition protection where 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 produced by mechanical impact or friction burning particles, as well as showers of particles, produced by impact or friction between two solid materials

3.3
control of ignition source "b"
ignition protection where mechanical or electrical devices are used in conjunction with non-electrical equipment to manually or automatically reduce the likelihood of a potential ignition source from becoming an effective ignition source

Note 1 to entry: This might for example be a level sensor used to indicate loss of oil, a temperature sensor to indicate a hot bearing or a speed sensor to indicate over-speed.

3.3.1
automatic control measure
action taken without manual intervention, to reduce the likelihood of a potential ignition source from becoming an effective ignition source

3.3.2
manual control measure
action taken by a person as a result of a warning, indication, or alarm, to reduce the likelihood of a potential ignition source from becoming an effective ignition source

3.3.3
ignition prevention devices/systems
arrangement that converts signals from one or more sensors into an action, or indication, to reduce the likelihood of a potential ignition source from becoming an effective ignition source

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1 To be published.

3.3.4
safety devices
devices intended for use inside or outside explosive atmospheres but required for or contributing to the safe functioning of equipment and protective systems with respect to the risks of explosion

3.4
liquid immersion "k"
type of protection where potential ignition sources are made ineffective or separated from the explosive atmosphere by either totally immersing them in a protective liquid, or by partially immersing and continuously coating their active surfaces with a protective liquid in such a way that an explosive atmosphere which may be above the liquid, or outside the equipment enclosure, cannot be ignited

3.4.1
protective liquid
a liquid which prevents the explosive atmosphere from making direct contact with potential ignition sources and thereby ensures the explosive atmosphere cannot be ignited

3.4.2
equipment with a sealed enclosure
totally enclosed equipment that limits the ingress of an external atmosphere during the expansion and contraction of the internally contained protective liquid during use in service

Note 1 to entry: Such equipment includes any pipework associated with it and often contains an overpressure relief device.

3.4.3
equipment with a vented enclosure
enclosed equipment that allows the ingress and egress of an external atmosphere through a breathing device or constricted opening during the expansion and contraction of the internally contained protective fluid during normal operation

Note 1 to entry: Such equipment includes any pipework associated with it.

3.4.4
open equipment
equipment that is immersed, or has its components immersed, in a protective liquid that is open to the external atmosphere

Note 1 to entry: For example, an open top vessel with immersed moving components. Such equipment includes any pipework associated with it.

4 Determination of suitability

Before a decision is made to protect equipment or parts 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 ISO 80079-36.

5 Requirements for equipment with Type of Protection constructional safety "c"

5.1 General requirements

Equipment designed and constructed according to the applicable safety requirements of the relevant industrial standards is intended to be capable of functioning in conformity with the operational parameters established by the manufacturer, including any mechanical and thermal stresses that they are intended to be subjected to.

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

NOTE This is accomplished by using one or more of the following documents:

- International standards or Technical Specifications
- FDIS of International standards or Technical Specifications
- National Standards or Technical Specifications
- Technical specifications or Test Reports issued by an Ex accredited Test Laboratory
- Technical specifications of industrial associations.

5.2 Ingress protection

5.2.1 General

The degree of ingress protection (IP) as specified in IEC 60529 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 shall be determined as part of the ignition hazard assessment (see Clause 4) and, if relevant for ignition protection, shall be able to provide that degree of protection.

NOTE IP degrees of protection according to IEC 60529 are not intended to provide protection against the ingress of an explosive gas atmosphere.

5.2.2 Ingress protection in special cases

The following points specify the minimum IP rating for enclosures used in the circumstances described.

a) In the case of equipment intended for use in explosive gas atmospheres, where entry of foreign objects can cause ignition, but entry of dust is harmless, the required degree of protection against the entry of foreign objects shall be determined in the ignition hazard assessment and shall be at least IP20.

b) In the case of equipment intended for use in explosive gas atmospheres, where the entry of dusts or liquids could cause a malfunction leading to an ignition source, the degree of protection shall be at least IP5X for dust and IPX4 for liquids.

c) In the case of equipment intended for use in explosive dust atmospheres, where ingress of dust can result in an ignition source or fire, the degree of protection shall be IP6X.

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

NOTE An enclosure is often employed for other safety reasons, e.g. IP2X to prevent parts of the body coming into contact with rotating parts.

5.3 Seals for moving parts

5.3.1 Unlubricated gaskets, seals, sleeves, bellows and diaphragms

Un-lubricated gaskets, seals, sleeves, bellows and diaphragms shall not become an effective ignition source, e.g. if there is a risk of mechanically generated sparks and hot surfaces which can become an effective ignition source. Light metals shall not be used for these parts in this case (see ISO 80079-36).

Non-metallic materials shall be resistant to distortion and degradation which would reduce the effectiveness of explosion protection within the specified lifetime of operation.

5.3.2 Stuffing box seals (packed glands)

Stuffing box seals (packed glands) shall only be used when instructions are provided by the manufacturer to limit the maximum surface temperature during operation of the gland; alternatively an automatic means shall be provided.

5.3.3 Lubricated seals

Seals which normally require the presence of a lubricant which can be replenished to reduce the likelihood of hot surfaces occurring at their interface with equipment parts shall be designed to ensure the sufficient presence of lubricant or shall be protected by one of the following means:

- provision of an effective means to monitor the continued presence of the lubricant; or
- provision of a temperature detection device to warn of increasing temperatures; or
- design of the equipment to be capable of completing the 'dry run' type test, as described in Annex B, without exceeding the maximum surface temperature of the equipment and without suffering damage which would reduce the effectiveness of its ignition protection.

Monitoring shall be either continuous or by required appropriate inspection and examination. Where the level of lubricant cannot be easily monitored (e.g. seal containing grease) the relevant information shall be given in the instructions.

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

5.4 Equipment lubricants, coolants and fluids

Lubricants and coolants, which are required for the protection against incendive hot surfaces or mechanically generated sparks (see Clause 7) shall have an auto-ignition temperature (see IEC 60079-20-1) at least 50 K above the maximum surface temperature of the equipment where the liquid is being used.

NOTE IEC 60079-20-1 is under revision and is expected to be published as ISO/IEC 80079-20-1.

Any fluid which can be released shall not result in an effective ignition source, e.g. due to high temperature or electrostatic charging.

5.5 Vibration

Effective ignition sources, 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 prepare any necessary installation, operation and maintenance instructions. In particular, the instructions shall specify the correct operating speed range of the equipment in order to avoid excessive vibration.

5.6 Requirements for moving parts

5.6.1 General

The ignition hazard assessment (see ISO 80079-36) 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 are unlikely to become an effective ignition source during the specified lifetime of operation of the equipment, taking the EPL into consideration in combination with the instructions.

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 incendive hot

surfaces or mechanical sparks, additional protective measures are not normally necessary (e.g. the provision of a low melting point sacrificial wear plate; the use of a plastic fan inside a metal housing, or a metallic fan with sacrificial non-sparking low melting point fan blade-tips).

5.6.2 Clearance

Clearances between un-lubricated moving parts and fixed parts shall be designed such that likelihood of frictional contact, able to produce an effective ignition source in the form of hot surfaces or mechanically generated sparks, is appropriate to the intended EPL.

5.6.3 Lubrication

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

- an oil splash lubricator, or
- a constant oil feed by means of a reservoir, pump and perhaps an oil cooler, or
- an automatic greasing system, or
- an adequate maintenance procedure to provide for routine greasing or oil level verification by manual or visual means.

If the above measures do not achieve the required EPL of the equipment additional measures to monitor adequate lubrication shall be applied, e.g. level, flow, pressure or temperature sensors which operates an alarm or switch function before a critical lubricant condition is reached, see Clause 6.

Where equipment is designed to process liquids and the presence of the process liquid is essential for the purpose of lubrication, cooling, quenching, or ignition protection, or when the safe operation of the equipment (e.g. of a pump) requires special priming considerations, this shall be stated in the instructions.

5.7 Requirements for bearings

5.7.1 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 ISO 80079-36, at least the following shall be taken into account:

a) the bearing's suitability for the equipment's intended duty e.g. speed, temperature, loading and variations of speed and loading;

b) the bearing's basic rated life as described in ISO 281 for rolling element bearings (see also Note 1);

c) 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;

d) the correct alignment of the bearings;

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

f) protection of the bearing from ingress of water and solids, if necessary to avoid premature failure;

g) 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);

h) 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);

i) Maintenance checks at recommended intervals (e.g. vibration, temperature);

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

k) protection of the bearing from vibration, especially at standstill;

l) the use of low reliability non-metallic bearing cages in industrial applications.

m) Where a special initial running in period is necessary that could lead to an effective ignition source, information shall be given in the instructions.

NOTE 1 At the present time, no suitable experimental test exists to demonstrate that a given type of bearing has a low risk of becoming an ignition source in service. Ball and roller bearing manufacturers do, however, quote a basic rated life corresponding to a probability of mechanical failure occurring during operation (e.g. failure by deformation of an element, or fatigue flaking or spalling occurring on one of its elements). This basic rating can be used in the ignition hazard assessment in an attempt to determine the risk of bearing malfunction that might lead to the production of an incendive hot surface or sparks. The basic rated life of a ball/roller bearing is based on the amount of radial and axial loading that a ball/roller bearing can theoretically endure for one million revolutions. It is usually expressed as an “L” value in terms of foreseeable lifetime operating revolutions, or foreseeable lifetime hours of service. In an attempt to reduce the risk of malfunction in service to a minimum, it is paramount that the equipment manufacturer pays attention to good design, the ratio of the axial and radial loadings, construction, lubrication, cooling, and maintenance procedures. Regular examination is also recommended during operation, in an attempt to detect impending malfunction. If bearings act as an insulator, constructive measures are taken, so that the isolation of parts of the equipment is avoided (see ISO 80079-36).

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

NOTE 3 Bearings without rolling elements are not affected, because it is not possible to calculate their service life. Lubrication is specified in 5.7.2.

5.7.2 Lubrication

Bearings which depend on the presence of a lubricating medium to protect 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.

If the above measures do not achieve the required EPL of the equipment additional measures to monitor adequate lubrication shall be applied, e.g. level, flow, pressure or temperature sensors which operates an alarm or switch function before a critical lubricant condition is reached, see Clause 6.

Where equipment is designed to process liquids and the presence of the process liquid is essential for the purpose of lubrication, cooling, quenching, or ignition protection, or when the safe operation of the equipment (e.g. of a pump) requires special priming considerations, this shall be stated in the instructions.

5.7.3 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 they are intended to come into contact with. 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.

NOTE It is not a requirement of this standard that the manufacturer confirm suitability by tests for each combination of fluid and bearing materials.