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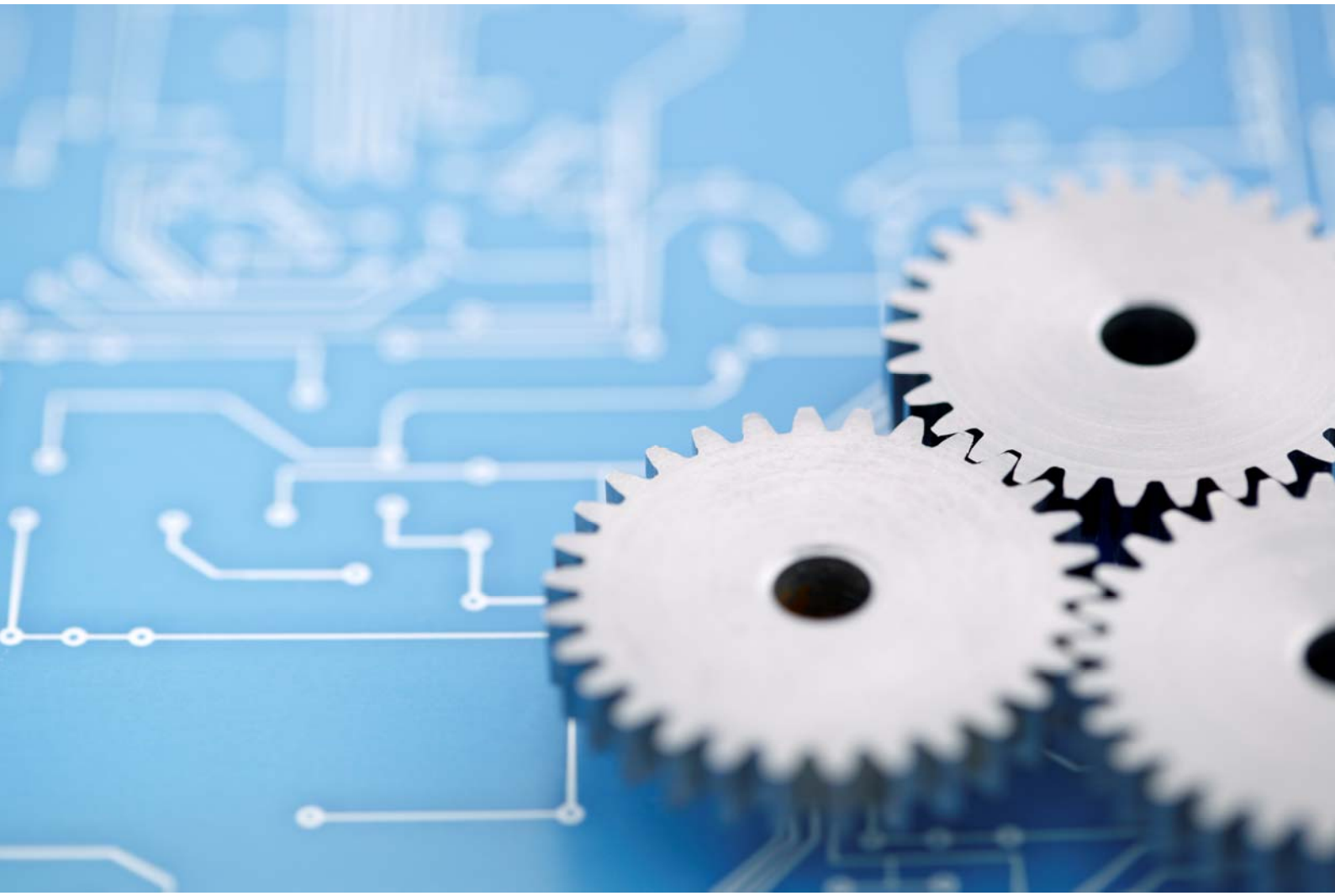
Risk Assessment of Mechanical Equipment:

The new EN 1127-1:2011



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Overview

EN 1127-1 2011 Edition, "Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology," has been released and gives guidance in the area of explosion prevention and protection.

Hazards from explosions are to be considered in accordance with this standard along side EN ISO 12100, which specifies basic terminology, principles and a methodology for achieving safety in the design of machinery. It specifies principles of risk assessment and risk reduction to help designers achieve safety in design.

These principles are based on knowledge and experience of the design, use, incidents, accidents and risks associated with machinery. Procedures are described for identifying hazards and estimating and evaluating risks during relevant phases of the machine life cycle, and for the elimination of hazards or sufficient risk reduction. Guidance is given on the documentation and verification of the risk assessment and risk reduction process.

As indicated in Section 1 of the Standard, understanding the application of EN 1127-1 will help designers and manufacturers in achieving explosion safety in the design of equipment, protective systems and components at all stages of its use. It is applicable to any equipment, protective systems and components intended to be used in potentially explosive atmospheres, under atmospheric conditions.

Changes between EN1127-1:2007 and EN1127-1:2011

The risk assessment now includes reference to EN15198 'Methodology for the risk assessment of non-electrical equipment and components for intended use in potentially explosive atmospheres' in addition to EN ISO 12100.

With this change, the risk assessment aspect has been modified to include the frequency of occurrence of the potential ignition source and the flammable atmosphere. The potential ignition sources are classified according to the likelihood in the following manner:

- Sources of ignition which can occur continuously or frequently;
- Sources of ignition which can occur in rare situations;
- Sources of ignition which can occur in very rare situations.

The inclusion of 'Tightness of Equipment'

The formation of a hazardous explosive atmosphere outside the equipment can be prevented or limited by means of the tightness of the equipment. Here, a differentiation is made between:

- equipment which is durably technically tight;
- technically tight equipment where the escape of flammable materials is due to operation.

Equipment which is durably technically tight:

a) In the case of equipment which is durably technically tight, no release is to be expected.

b) Equipment is regarded as durably technically tight, if:
   1. it is constructed such that it remains technically tight due to its design; or
   2. its technical tightness is permanently ensured by means of maintenance and supervision.

c) Equipment with a durably technically tight construction does not cause any hazardous areas in its surroundings while closed.

Examples of equipment which is durably technically tight are:

1. welded equipment with:
    I. detachable components where the required detachable connections are rarely detached due to operation and are designed like the below-mentioned detachable pipework connections (exception: metallically sealing connections);
    II. detachable connections with pipeworks, fittings or blind covers where the required detachable connections are rarely detached and are designed like the below-mentioned detachable pipework connections;
2. shaft passages with double-acting axial seal ring (e.g. pumps, agitators);
3. canned motor pumps;
4. magnetically coupled seal-less pumps;

Please refer to EN1127-1:2011 Annex B p35.

Preventing Explosions

EN 1127-1 page 5 specifically addresses explosion hazards that can occur from:

a) materials processed or used by the equipment, protective systems and components;

b) materials released by the equipment, protective systems and components;

c) materials in the vicinity of the equipment, protective systems and components;

d) materials of construction of the equipment, protective systems and components.

The standard provides guidance and specifies methods for the identification and assessment of hazardous situations leading to explosion.

By conducting a well defined risk assessment and applying risk reduction techniques as prescribed by the Standard, appropriate measures can be applied to achieve the higher levels of safety and explosion prevention.

Reduce the risk

A significant amount of cost in any product can be removed by ensuring safety and explosion prevention is designed into it right from the start. EN1127-1 provides for a common sense approach to ensure:

a) Appropriate design (without using safeguarding). The prevention approach, which is covered in Clause 6;

b) Safeguarding. The protection approach, which is covered in Clause 6;

c) Information for use. Safe use and operation, which is covered in Clause 7;

d) Any other preventive measures. This approach is not specified in this Standard. You should refer to EN ISO 12100:2010, Clause 6.

It is also very important to note that EN1127-1 1 page5/6 clearly states;

"The preventive and protective measures described in EN 1127-1 will not provide the required level of safety unless the equipment, protective systems and components are operated within their intended use and are installed and maintained according to the relevant codes of practice or requirements.

Since safety depends not only on equipment, protective systems and components but also on the material being handled and its use, this standard also includes aspects related to the intended use and foreseeable misuse, that is, the manufacturer should consider in which way and for which purpose the equipment, protective systems and components will be used and take this into account during their design and construction. This is the only way hazards inherent in equipment, protective systems and components can be reduced."

This reiterates that safety is *everyone's* responsibility from the OEM to the installer and to the end user.

How do we approach the Risk Assessment?

(Source: *EN 1127-1 4.1 p8/9)*

A risk assessment shall be carried out for each individual situation in accordance with EN ISO 12100 and/or EN 15198, unless other standards can be identified as being more appropriate to the situation:

a) Identification of explosion hazards and determination of the likelihood of occurrence of a hazardous explosive atmosphere;

b) Identification of ignition hazards and determination of the likelihood of occurrence of potential ignition sources;

c) Estimation of the possible effects of an explosion in case of ignition;

d) Evaluation of the risk and whether the intended level of protection has been achieved;

e) Consideration of measures to reduce of the risks.

A comprehensive approach should be taken, especially for complicated equipment, protective systems and components, plants comprising individual units and, above all, for extended plants.

The risk assessment shall take into account the ignition and explosion hazard from:

1. The equipment, protective systems and components themselves;
2. The interaction between the equipment, protective systems and components and the substances being handled;
3. The particular industrial process performed in the equipment, protective systems and components;
4. The surroundings of the equipment, protective systems and components and possible interaction with neighbouring processes.

How is the Risk Assessment adopted for ATEX categories?

The ignition hazard assessment will identify sources of ignition; these are then dealt with either through compliance with the EN 13463 series of standards.

Category 3 equipment, Zone 2/22 – Assessment of potential ignition sources under normal operation and under certain operating conditions of the equipment. This is the main task and performed for all categories.

Category 2 equipment, Zone 1/21 – Assessment of potential ignition sources under expected malfunction.

Category 1 equipment Zone0/20 – Assessment of potential ignition sources under rare malfunction.

Routes to compliance with your Non-Electrical equipment (Group II)

Category 3 equipment, Zone 2/22
Internal Control of Production (Manufacturers Declaration)

Category 2 equipment, Zone 1/21
Internal Control of Production & Communicate the Technical Documentation to a Notified Body

Category 1 equipment, Zone0/20
EC Type Examination and Quality Assurance Notification

All of above may be subjected to Unit Verification Certification.

Classification of hazardous places

(Source: Reference Directive 1999/92/EC)

Hazardous places are classified in terms of zones on the basis of the frequency and duration of the occurrence of an explosive atmosphere.

The extent of the measures to be taken in accordance with Annex II, Part A, is determined by this classification.

Zone 0
A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.

Zone 1
A place in which an explosive atmosphere consisting of a mixture with air or flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

Zone 2
A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Zone 20
A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.

Zone 21
A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.

Zone 22
A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Is EN1127-1 applicable to my mechanical equipment?

(Source: Reference ATEX Guidelines 3.7.3)

If non-electrical equipment has a potential ignition source, (in most cases this is due to moving parts able to create a potential ignition risk either from hot surfaces, or friction sparks) then EN1127-1 is applicable. Examples are: gears, fans, pumps, compressors, mixers, brakes.

Mechanical equipment of this type usually has to be connected to a power source, such as an electric motor. Together placed on the market in this form, it might be an assembly (an assembly, formed by combining two or more pieces of equipment, together with components if necessary, has to be considered as a product falling under the scope of Directive 94/9/EC).

Assemblies

(Source: Reference ATEX Guidelines 3.7.5)

An assembly consisting of different compliant pieces of equipment as defined by Directive 94/9/EC (ATEX Certified) which were previously placed on the market by different manufacturers has to conform with the Directive, including being subject to proper conformity assessment, CE-marking, etc.

A manufacturer may choose to supply an assembly - e.g. a pump and motor - with one declaration of conformity for the assembly as a whole. In this case further clarification is required as to the obligation of the assembler where only ATEX CE compliant products are used. Here it is clear that the assembler needs to undertake an ignition risk assessment (EN1127-1:2011) to ensure that the nature of the incorporation and assembly has not altered the explosion characteristics of the products with respect to the Essential Health and Safety Requirements.

If there are additional ignition hazards, a further conformity assessment of the assembly regarding these additional risks is necessary.

This might be the case, for example, if a assembler of mechanical equipment needs to connect different pieces of ATEX electrical equipment together as part of the assembly.

Once the assembler has successfully undertaken such an assessment and no additional ignition risk has been identified, the general agreement is that the assembler produces a technical file for the assembly.

Affixes the CE and Ex marking to the assembly, indicating intended use.

Signs the EC Declaration of Conformity covering the whole of the assembly indicating the technical specifications/ standards applied (for example, for electrical inter-connection) and provide instructions for safe use.

The assembler therefore takes complete responsibility for the assembly.

What ignition sources do we need to consider?

In accordance with the EN1127-1 standard all key ignition sources likely to occur in operation of the equipment are:

- Hot surfaces
- Flames and hot gases (including hot particles)
- Mechanically generated sparks
- Electrical apparatus
- Stray electric currents, cathodic corrosion protection
- Static electricity
- Lightning
- Radio frequency (RF) electromagnetic waves from 104 Hz to 3 x 1011 Hz
- Electromagnetic waves from 3 x 1011 Hz to 3. x 1015 Hz
- Ionizing radiation
- Ultrasonics
- Adiabatic compression and shock waves
- Exothermic reactions, including self-ignition of dusts

How can Intertek help?

Intertek offers market leading services from our knowledgeable team of hazardous locations testing engineers located in facilities around the world. Our experienced, global teams provide comprehensive services required in today's competitive market. Our service levels range from EC Type Examination (required only for Category 1 & M1) to storing your Technical Documentation (minimum requirement for Category 3 equipment). Although in some cases non-electrical equipment does not require Notified Body involvement, Intertek can offer manufacturers of Category 2 and Category 3 non-electrical equipment a service level appropriate to their needs, as a minimum we can provide;

- Ignition Hazard Assessment
- Technical File Storage
- Technical File Gap Analysis
- Testing to applicable standards
- Certification Body Services

To understand our full capabilities and services for ATEX compliance reducing your costs and improving speed to market, please contact us.

For more information on specific testing and certification information, please contact Intertek at 1-800-WORLDLAB, email icenter@intertek.com, or visit our website at www.intertek-hazloc.com.