Aspects regarding the applicability of ATEX directives for the evaluation of products regarding the risk of explosion

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Abstract. Current legislation regulates the obligations and responsibilities of persons who perform design, manufacture and use of equipment and installations in potentially explosive atmospheres with regard to compliance with explosion prevention requirements. There are two European Directives, so-called ATEX Directives, which regulate the placing on the European market of products intended for use in potentially explosive atmospheres and their safe use: Directive 2014/34/EU and Directive 1999/92/EC. The paper presents some aspects regarding the border situations where the two directives apply, in the case of assemblies of equipment to be assessed by a manufacturer in accordance with the Directive 2014/34/EU for putting on the market and the installations that are equipment assembled by the user under his responsibility and have to be assessed by users toward with the Directive 1999/92/EC requirements.

1. Introduction

The ATEX Directive 2014/34/EU [1,2], so-called "product" Directive, carries obligations and responsibilities for the person who put products on the market and/or commissioning of the product (the manufacturer, the authorized representative of the manufacturer or the somebody else responsible person). In order to apply the CE marking, they must follow the procedures applicable to the respective product for conformity assessment. The manufacturer must elaborate a technical documentation. The documentation have to include an adequate analysis (ATEX analysis) and an risk assessment (the manufacturer could apply the harmonized standard EN 1127-1).

The use of products in an atmosphere which can be explosive is not covered by the ATEX Directive 2014/34/EU, it is included in "workplace" Directive 1999/92/EC or in other national legislation [3], [4].

The Directive ATEX 2014/34/EU shall apply to the following, usual referred to as "products" or just „equipment”:

a) equipment and protective systems; (b) safety devices, controlling devices and regulating devices; (c) components intended to be incorporated into equipment and protective systems referred to in point (a). [1]

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Fig. 1. Application of Directive 2014/34/EU

First of all, the manufacturer or another responsible person has to make an **ATEX analysis** to verify whether the product is within the domain of the Directive and what requirements apply.

For some products it is difficult to decide whether they are within the domain of the Directive 2014/34/EU or not. ATEX analysis for a lot of such products are presented in *The ATEX 2014/34/EU GUIDELINE*: inerting systems, paint spray booths, vented silo bins, gas turbines (*see section*, steam turbines, petrol pumps, cables, rotating mechanical seals, bucket elevators, fork lift trucks, transportable-pressurized cabins ("modules"), automatically lubricating systems, electrical trace heating systems, category 3 motors, Wi-Fi access points, cabinets for volatile substances.

The guide also includes a "border list - ATEX products" that clarifies the situation of a number of products regarding the applicability of ATEX Directive 2014/34 / EU.

ATEX analysis starts from the definition of the product/equipment. Must be done a difference between a installation that is an item which is made from parts already evaluated but which are only assembled together at the point of application and assemblies which comprise parts already evaluated or not, interconnected to create a product (assembly), ready to be put on market as a single functional unit.

The responsibilities for assessment of assemblies and installations will either fall on the person who places the assembly on the market, or the end-user. Any one of them must elaborate a technical file. Each technical file must include a risk assessment. The technical content of the file will be largely the same.

2 Methods and/or techniques for risk assessment (explosion risk assessment)

There are many possible methods and/or techniques for risk assessment, especially for hazard identification. In principle the risk assessment comprises of four steps: hazard identification, risk estimation, risk evaluation and risk reduction option analysis [5, 6].

2.1 Assessment by manufacturer of explosion risk

To meet the requirements of Directive 2014/34/EU the manufacturer have to dealing a risk assessment process.

Risk in the explosion safety consists of two elements: probability of occurrence the harm and the severity of the possible harm.

$$Risk = Likelihood \times Severity \quad (1)$$

The severity or consequence of an explosion can often be adequately characterized however the probability of its occurrence is usually very difficult to quantify. The analysis of the consequences (the magnitude of the foreseeable consequences) is not very important because it is known that the explosions always involve considerable damages, starting from important material damages and to human damages that could lead to death.

Likelihood of an explosion is determined of the likelihood of an explosive atmosphere occurrence, together with the occurrence of an efficient ignition source.

Likelihood of an explosion is determined by the probability of the occurrence of an explosive atmosphere, at the same time and at the same place with the appearance of an efficient source of ignition.

Figure 2 shows the elements of the explosion risk assessment.

Fig. 2. The elements of the explosion risk assessment.

According to Annex II, 1.0.1 of Directive 2014/34/EU manufacturers are under an obligation to design equipment and protective systems from the point of view of integrated explosion safety. Integrated explosion safety is conceived to prevent the formation of explosive atmospheres as well as sources of ignition and, should an explosion nevertheless occur, to halt it immediately and / or to limit its effects. However, in most cases he will not be in the position to understand the possible extent of the adverse consequences of an explosion (as part of the overall explosion risk) since this is solely dependent on the particular circumstances at the users' premises. So the manufacturer's risk assessment will be focused on the assessment of the ignition hazard (part of the explosion risk) [7].

The principles and guidelines for risk management defined in the ISO SR 31000:2010 can be applied to *ignition risk assessment* for design of equipment or component according to methodology from SR EN 15198:2008.

Fig. 3. Ignition risk assessment for design of equipment or component.

The intended safety level means equipment protection level for the intended use. *"Intended use"* means the use of a product prescribed by the manufacturer by assigning the equipment to a particular equipment-group and category or by providing all the information which is required for the safe functioning of a protective system, device or component [Directive 2014/34/UE].

The risk assessment that is limited to the ignition risk assessment is part of the conformity of the product with the essential health and safety requirements (EHSRs) of the Directive ATEX 2014/34/UE. Technical requirements for complying with these EHSRs are given in European harmonized standards. Application of harmonized standards confers a presumption of conformity with the essential requirements. Risk / safety level assessment shall relate to the safety requirements provided in the norms and standards in the field, whilst there is a presumption of ensuring a low, acceptable level of risk level, by conforming to norms [8].

The Directive ATEX 2014/34/EU divides equipment into two groups and three categories. In order to choose the adequate conformity assessment procedure, the manufacturer must first establish the product group and category.

The ATEX "workplace" Directive 1999/92/EC defined the zones as a physical area and the probability of an explosive atmosphere being present and establishes the relationship between the area and the category of equipment that can be installed in the area (table 1)

Table 1 Level of protection required, in function of the explosive atmosphere.

ZONE	Presence of an explosive atmosphere	Ignition sources avoidance	Level of protection required	Group II category	EPL
2	Infrequent or only on a short period of time	during normal operation	NORMAL	3G	Gc
1	Likely to occur	also during foreseeable malfunctions (one defect)	HIGH	2G	Gb
0	Continuously, for long periods of time or frequently	also during rare malfunctions (two defects independent)	VERY HIGH	1G	Ga
USERS Directive 1999/92/EC (HG 1058/2006)		MANUFACTURERS European Directive 2014/34/UE (HG 245/2016)			

2.2 Assessment by end user of explosion risk

In order to fulfil the obligations provided by the European Directive 1999/92/EC, the employer (end user) has to ensure drawing up and update of a document called *Explosion Protection Document (EPD)*. The key element of EPD is evaluation of the explosion risk.

The principles and guidelines for risk management defined in the ISO SR 31000:2010 can be applied to *ignition* explosion risk assessment for installation.

Methods applicable for assessment must take in consideration: sensitivity of explosive atmosphere (the characteristics of the substances) and the probability of its occurrence, the probability of sources ignition [9].

The purpose of the explosion risk assessment is the set of appropriate measures to reduce it, in accordance with the requirements of the norms and standards. We can say that, through abiding by the norms, the presumption of providing an acceptable risk level is ensured.

The minimum level of risk accepted by the rules corresponds to the minimum probability that the ignition source will appear in the same place and at the same time as the explosive atmosphere. The application of this principle is based on the classification of the hazardous area into zones according to the frequency and duration of the explosive atmosphere and the classification of the equipment into categories according to the level of protection provided, and the acceptance criterion is given in the table 1.

The users have only to classify their dangerous areas and then adequately choose the equipment. Following, the installation as a whole shall be assessed in regard to possible ignition sources. All electric and non-electric equipment, the associated connected devices have to be taken into consideration.

Each ignition source according to EN 1127-1:2011 must be analyzed [10]. If is not possible to avoid explosive atmospheres and sources of ignition to the required level, protective systems should be used to limit the effects of explosion.

Fig. 4. Explosion risk assessment for installation.

3 Conclusions

To meet the requirements of Directive 2014/34/EU the manufacturer have to dealing a risk assessment process. The manufacturer's risk evaluation will be focused on the evaluation of the ignition hazard or the explosion control function for a protective system and safety devices.

In order to fulfil the obligations provided by the European Directive 1999/92/EC, the employer (end user) has to ensure drawing up and update of a document called *Explosion Protection Document (EPD)*. The key element of EPD is evaluation of the explosion risk.

A distinction needs to be made between the duty of manufacturers as regulate by Directive 2014/34/EU and the duty of an end user, as regulate by Directive 1999/92 / EC and other legal requirements of the Member Statesand other legal requirements of the Member States.

The result, this is to say, the responsibilities for assessment of assemblies and installations will either fall on the person who places the assembly on the market, or the end-user. Any one of them must elaborate a technical file. Each technical file must include a risk assessment. The technical content of the file will be largely the same.

References

1. Directive **2014/34/EU** (2014)
2. Guidelines **ATEX 2014/34/EU**, 2nd EDITION (2017)

3. Directive **1999/92/EC** (1999)
4. Non-binding Guide of Good Practice for implementing of Directive **1999/92/EC** (2017)
5. Standard, SR ISO **31000** (2018)
6. Standard, SR EN **15198** (2008)
7. M. Părăian, et al., Code of practice for the preparation of the explosion protection document, INSEMEX publishing house, (2018)
8. M. Părăian, G.A. Găman, A. Jurca, S. Burian, F. Paun, BIP Iași, Tomul LV (LIX), Fasc. **1**, pag. 138-144 (2009)
9. M. Părăian, F.A. Păun, A.M. Jurca, M. Popa, Proceedings of the 18th International Multidisciplinary Scientific Geoconference SGEM 2018 (to be published)
10. Standard, SR EN **1127-1** (2011)