ATEX-compliant dust filtering equipment

A report by Herding Filtertechnik GmbH*

The Maastricht Treaty agreed in 1992 obliges all EU states to harmonize their laws within a certain timeframe. § 100a and § 118a deal with “Machines for use in potentially explosive atmospheres” and “Regulations for the safety of workers in potentially explosive atmospheres”. As part of a restructuring process, these two articles were transferred to §95 and §137 and the appropriate regulations were named ATEX 95 and ATEX 137 (ATEX = ATmospheres EXplosibles – potentially explosive atmospheres). Directive 94/9/EC was passed as long ago as 1994 on the basis of § 95, whilst Directive 99/92/EC followed in 1999 on the basis of § 137. The assessment of HERDING filter systems under the ATEX Directive 94/9/EC is shown in the following in schematic form.

ATEX 95 Directive 94/9/EC

This directive is aimed exclusively at manufacturers who are responsible for designing and building products which are governed by the directive. A period of transition was in force until 2003. Since 1 July 2003 electrical and non-electrical equipment which is designed for use in potentially explosive atmospheres may only be sold in the territories of the EU if it complies with this Directive.

The CE mark on the equipment provides the buyer with a guarantee that the equipment complies with the regulations set out in the directive. The user can achieve greater security if he works with competent partners who have not only just started to comply with the directive. For the last ten years Herding GmbH has been looking closely at the topic of fire and explosion protection and the implementation of the ATEX Directive in its products and has played a role in the implementation of the directive in the form of national regulations in Germany.

ATEX 137 Directive 99/92/EC

This Directive supplements ATEX 95 and deals with "Improving the health and safety protection of the workers who may be at risk from potentially explosive atmospheres”. It is therefore important for owners/operators of the products described above but it excludes certain areas which are governed by separate directives (for example medical treatment equipment, gas consumption equipment, explosives handling equipment and transport equipment).

The directive obliges the employer to prevent potentially explosive atmospheres wherever possible. If this is not possible, ignition must be prevented and it must be ensured that in the event of an explosion, its effects must be reduced to a safe level. The main points comprise the assessment of the explosion risks to be conducted by the owner/operator, the production of an explosion protection document, the definition of zones where there is a potential risk of explosion and the production of operating instructions for handling hazardous substances and machines.

* Herding Filtertechnik GmbH
August-Borsig-Straße 3
92224 Amberg
Tel./Fax: 09621-630-0/120
www.Herding.de

Explosion protection under the new directives

Analysis

If a manufacturer wishes to sell a device, he must decide whether it is covered in full or as a component by Directive 94/9/EC (ATEX 95). An analysis must be conducted to find the answers to the following questions:

- Does the device have a potential / active ignition source of its own?
- Is the device located in a potentially explosive atmosphere?
- Does the device contain a potential explosive atmosphere?

The directive defines a potentially explosive atmosphere as a mixture of inflammable substances in the form of gases, vapors, mists or dust and air, in atmospheric conditions to which the combustion process is transferred after ignition to the whole of the non-combusted mixture. The ATEX guideline dated May 2000 defines atmospheric conditions as a temperature range from -20°C to 60°C and a pressure range from 0.8 bar to 1.1 bar.

Zones

Directive 99/92/EC (ATEX 137) states that the owner/operator must define potentially explosive zones in production. A distinction is made between these zones in terms of the inflammable substances and the frequency and duration of the occurrence of a potentially explosive atmosphere. Zones 0, 1 and 2 apply to gaseous substances.

Zone 0: Area in which the potentially explosive atmosphere consisting of a mixture of air and inflammable gases, vapors or mist exists constantly, for long periods or frequently.

Zone 1: Area in which it may be expected that a potentially explosive atmosphere consisting of a mixture of inflammable gases, vapors or mists may occasionally occur.

Zone 2: Area in which it is not expected that a potentially explosive atmosphere consisting of a mixture of inflammable gases, vapors or mists will occur but if such an atmosphere does occur, in all probability it will occur rarely and for a short period of time.

Zones 20, 21 and 22 apply to dust-type substances.

Zone 20: Area in which potentially explosive atmospheres consisting of a mixture of dust and air occur constantly, for long periods or frequently.

Zone 21: Area in which it may be expected that a potentially explosive atmosphere consisting of a mixture of dust and air may occasionally occur.

Zone 22: Area in which it is not expected that a potentially explosive atmosphere caused by whirled up dust will occur but if such an atmosphere does occur, in all probability it will occur rarely and for a short period of time.

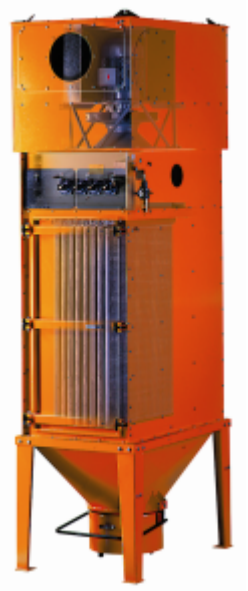

Fig. 1: Filter system, raw gas side

Equipment groups and categories

Equipment designed for use in potentially explosive atmospheres (zones) must be sub-divided into equipment groups and equipment categories. For a consideration of the use of equipment in various operating conditions, this publication will only look closely at Group II (Group I applies to equipment for use in underground operations at mines and their overground facilities). Group II therefore covers all other areas where potentially explosive atmospheres may occur. These are sub-divided into three categories.

Category 1

Equipment in this category is designed in such a way that it can be operated in compliance with the characteristic values specified by the manufacturer whilst providing a high level of safety for use in areas in which a potentially explosive atmosphere occurs constantly, for long periods or frequently.

Category 2

Equipment in this category is designed in such a way that it can be operated in compliance with the characteristic values specified by the manufacturer whilst providing a high level of safety for use in areas in which a potentially explosive atmosphere occurs occasionally.

Category 3

Equipment in this category is designed in such a way that it can be operated in compliance with the characteristic values specified by the manufacturer whilst providing a normal level of safety for use in areas in which it is not expected that a potentially explosive atmosphere occurs but if such an atmosphere does occur, in all probability it will occur rarely and for a short period of time.

In addition the categories which are designed to prevent dust explosions are marked with a D for dust. For preventing gas explosions they are also identified with a G for gas. The appropriate classification is shown in the equipment designation. The following mark

CE Ex II 2 D

stands for a non-electrical device in Group II, Category 2, dust.

The four-figure code of the nominated body or test body is also listed for both electrical and non-electrical equipment in Category 1 and for electrical equipment in Category 2. For example, the following mark

CE 9999 Ex II 2 D

stands for an electrical device in Group II, Category 2, dust which has been tested by a nominated body or test body with the code 9999 (example).

Risk assessment

Compliance with the requirements of the ATEX Directive is mandatory so as to provide protection from explosions. The term proper usage also plays an important role. This must be precisely defined by the manufacturer in the operating and servicing manual. Furthermore, the owner/operator must be provided with full information for operating and servicing the equipment. In addition a risk assessment must be carried out. This means that equipment must be designed using the principle of integrated explosion safety, in other words

- The creation of a potentially explosive atmosphere must be prevented. If this is not possible, then
- Potential or active ignition sources must be avoid.

If this is not possible, then

- An explosion event must be stopped, the range of its effect limited and suitable protective systems used.

Various methods of risk assessment may be used with the following four points requiring attention:

- Risk definition
- Risk estimate
- Risk evaluation
- Analysis of the possibilities to reduce the risk

In this respect profound knowledge on the part of the manufacturer about the physical principles of the processes involved, the characteristic values of the substances and substance mixtures (such as explosion limits, temperature classes and maximum surface temperatures), ignition sources and ignition processes and the protective measures is absolutely essential.

Effects of the ATEX Directives on filter equipment from Herding

Filter equipment from Herding is placed in the following classes:

- Raw gas compartment
- Clean gas compartment
- Surrounding area
- Area surrounding the cleaning system valves

The raw gas compartment (Fig. 1) may contain inflammable dust. Since the fine dust is “concentrated” in filter systems, it is likely that the lower explosion limit may occur in this area so that a potentially explosive atmosphere is created.

For time cycle-controlled cleaning (“predominantly timed”) the cloud of dust is present constantly, for long periods or frequently – Zone 20. For cycle cleaning controlled by differential pressure, the dust cloud only occurs occasionally – Zone 21.

In addition, inflammable gas must be taken into account for the extraction process. In this case the filter device contains a hybrid mixture (mixture of inflammable dust with inflammable gas and air). Once again the raw gas compartment must be classed as Zone 1 or Zone 2.

The dust concentration in the clean gas compartment (Fig. 2) is less than 1 mg/m³ and is therefore well below the lower explosion limit. The HERDING sinter-plate filter is a completely rigid body with a PTFE coating. It is designed for classic surface filtration and has a sealing system which experience has shown ensures that no dust passes through and no filter ruptures occur. This means that zone migration to the clean gas compartment is not possible. This, in turn, means that no explosive atmosphere (n.e.A.) can be created and therefore that the clean gas compartment is not a potentially explosive atmosphere. The appropriate servicing instructions must be followed.

In this case, too, inflammable gas must be taken into account for the extraction process. The clean gas compartment is Zone 1 or Zone 2.

The owner/operator is responsible for the classification of the surrounding area into zones. Installation inside production halls (indoor installation) or outside in the open air (outdoor installation) must be taken into consideration in this respect.

The valves required for the cleaning process may be housed in a separate valve chamber (a), in the clean gas compartment (b) or mounted in an external tank (c). In case a) the valve chamber will be in the same zone as the surrounding area and the valves must be designed in the appropriate category. In case b) standard valves may be used for inflammable dust since the clean gas compartment is not a zone. For inflammable gases the valves must be in the category for the corresponding zone of the clean gas compartment. In case c) the valves must be in the category for the corresponding zone of the surrounding area.

Summary

The two ATEX Directives demand that manufacturers and owners/operators conduct an extensive analysis of the conditions in which equipment is used. Herding's extensive expertise in the field of analysis, integrated explosion safety and risk assessment ensures that the user will be supplied with equipment which complies with the ATEX Directives in every respect. As a result of the great operational safety of the HERDING sinter-plate filter, which is a compact rigid body for classic surface filtration, the clean gas compartment does not constitute a zone. The downstream units such as a fan with a drive motor, etc. therefore do not have to have an explosion-protected design.

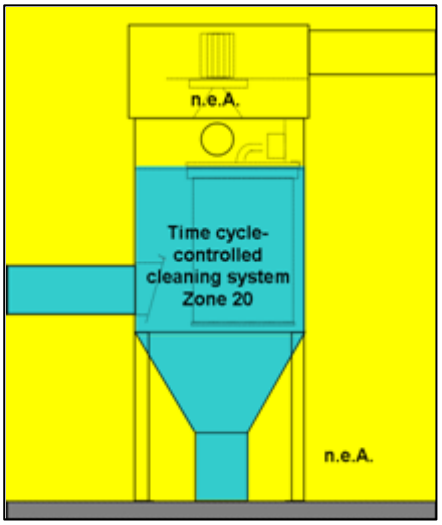

Fig. 2: Filter system, clean gas side

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