Theory and Practice

Basic Guidelines to achieve reliable Explosion Protection

Apart from using approved system components, operators have to fulfill a number of obligations to meet the strict requirements of today's explosion protection directives. If this is not sufficient, there is a number of constructive measures available to reach this goal.

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An explosion risk exists not only at the treatment of chemicals, varnish or oil. But also dusts are able to explode. The Atex-guidelines 94/9/EC (Atex95) and 99/92/EC (Atex137) prescribe Europe-wide standard requirements for safety at work and unit safety in such a surrounding. Via the German VDI 2263-6, requirements at the fire prevention and explosion protection at de-dusting systems are specified.

General Guidelines

Guideline 99/92/EC deals with the operator's explosion protection and imposes the employer the following obligations:

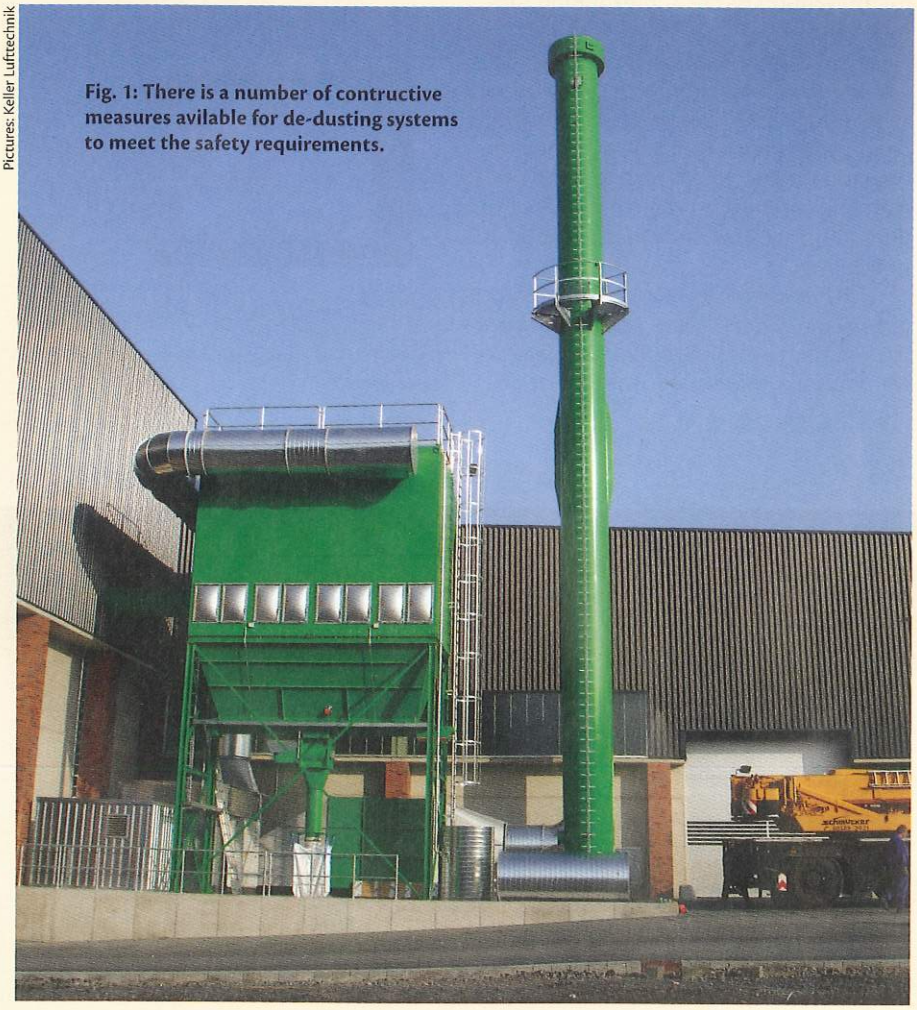
- Identification of the explosion based on the technological dust characteristics (ignition point, glow temperature, minimum ignition energy, self-ignition behaviour, electrostatical behaviour, etc.).
- Division of the company into Ex-zones according to the explosion risk. Marking of the zones of explosion risk.
- Determination of protection measures.
- Operating instruction for employees.
- Creation of an explosion protection document which contains all acquired data and accomplished measurements.

The manufacturer guideline affects all devices, protective systems and components which are located in an explosive atmosphere. Besides, non-electrical devices with an own source of ignition also belong to this guideline.

The guideline comprises safety, control and regulation devices which are positioned outside the danger area if they are necessary regarding the explosion risk and the safe operation of devices and protective systems.

The manufacturer has the following obligations with the Atex 95:

- Performance of a hazard analysis for the product.
- Determination of the conventional utilization and the service conditions.



Pictures: Keller Lufttechnik

Fig. 1: There is a number of contructive measures avilable for de-dusting systems to meet the safety requirements.

Changes by the VDI 2263-6

The VDI 2263-6 'Ignition and explosion protection at dedusting systems' was published in September 2007. Some aspects of explosion protection at de-dusting systems which often lead to insecurities and different interpretations are now more precisely.

This includes, for example, the division into different areas within the crude gas piping and within the clean gas zone of filtering separators, the definition of hybrid mixtures and protective measures that result from this definition, as well as the geometric design of filtering separa-

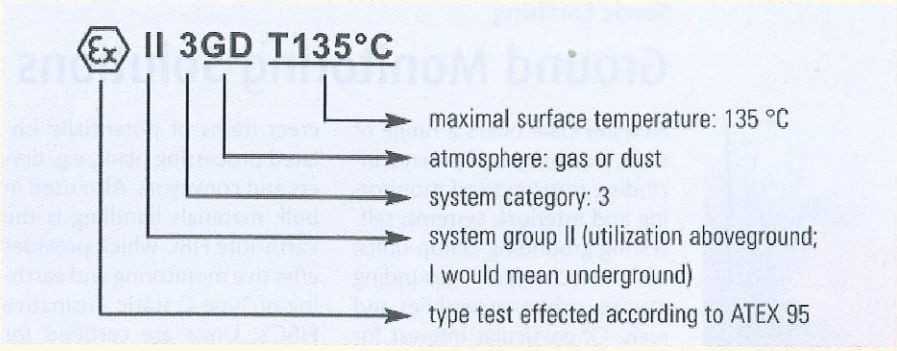


Fig. 2: Example of an explosion protection marking on a product label.

tors regarding the optimal ignition and explosion protection.

Practical Experience

Based on characteristics given by the operator and the division into zones, a hazard analysis has to be conducted and corresponding protective measures for each dedusting system have to be taken. The basis for each explosion protection concept is the avoidance of ignition sources within the de-dusting system. This includes the following measures:

- Grounding of conductive components which are located in zones.
- Conductive filter material for extremely explosive dusts (minimum ignition energy < 10 mJ).
- Utilization of ATEX-approved devices (solenoid valves, motors, etc.) according to the zone division.

Important for the determination of further protective measures is the evaluation if there exists the danger of collection and extraction of effective ignition sources. The operator has to valuate the process possibly in coordination with the machine fabricator taking into consideration the dust's minimum ignition energy.

The following conditions have to be fulfilled for the determination of the avoidance of ignition sources as exclusive protection concept:

- Development resp. collection of efficient ignition sources at the separated process has to be excluded.
- It has do be 'normal flammable dust', i.e. the minimum ignition energy has to be > 10 mJ.
- There must not be any hybrid mixture (composite consisting of explosive dusts and gases).

The danger of an ignition (according to the first point) can be reduced by a spark detection and extinguishing system in the piping or a spark eliminator in front of the filter.

Constructive Measures

If the above described measurements are not sufficient it is necessary to include constructive explosion protection measures. The predominantly used constructive measure are explosion relief by bursting panels, flameless explosion relief and explosion supression.

Explosion relief by bursting panels is the most cost-efficient constructive explosion protection measure. If the excess pressure of p_{stat} of 0.1 bar is reached, the burst panels open and the explosion pressure and the flames are discharged into the open. The pressure in the filter housing increases up to the maximum explosion (over) pressure $p_{red,max}$, which is 0.2 bar for the standard version.

The disadvantage of this protective measurement is the effect of the explosion in front of the burst panels. Therefore only a relief to the outside is allowed. A safety area in front of the burst panels is specified in which no one is permitted to stay during system operation.

It is advantageous if the discharge takes place in an upward direction. This is possible, for example, with the PT-filter systems manufactured by Keller Lufttechnik, which have been especially designed for this type of application.

Fig. 3: Operators are lucky if dust explosions cause only damage to equipment.

At an installation in a room or if the safety distances cannot be adhered to, it is necessary to use flameless de-pressurising units. There are systems in which the flames can be put out by an integrated flame filter. On the crude gas side, explosion-technical decoupling happens e.g. via a back pressure flap.

Explosion suppression offers another way to enable the installation in a workhall and in applications where toxic dusts can occur. With this solution, the explosion is prevented from happening at all by an early detection and quick addition of a dry powder, while the affected system is put to a halt.

If this solution is used, only a maximal reduced explosion overpressure of $p_{red,max}$ of 0.3 to 0.5 bar occurs, while the decoupling of the different system sections is done by a chemical barrier in the suction ductwork.

The protective systems described in this article provide examples of how de-dusting systems can be equipped with an explosion protection.

There are of course also other protection concepts, including, for example, designing a system in such a way that it is able to withstand the maximal explosion pressure. All of this concepts have been used successfully in various applications by Keller Lufttechnik, who dispose of the necessary know-how and experience. ■

EVENT INFORMATION

Safety Congress at Powtech

Keller Lufttechnik is a member of Index, the international association of experts for industrial explosion protection. In parallel with the 2011 Powtech Exhibition in Nürnberg, Germany, the Index Safety Congress 2011 will take place on October 11 and 12 at the Nürnberg Congress Centre.