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Protection systems for baghouse

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Protection systems in raw material reception facilities

In the industry, there are facilities with raw material reception systems, such as grain handling facilities, breweries, feed mills or the food industry, among others.

In this part of the facility, the reception, cleaning, conveying and storage of the raw material, which will later be used in the corresponding production process, takes place.

Generally, a raw material reception system consists of the following elements:

- Raw material unloading system, either through a receiving hopper (usually including a dust collection system) or through a pneumatic conveying system.
- A system for conveying raw material to its storage location, consisting of a series of conveyors such as auger, chain or paddle conveyors and bucket elevators or pneumatic conveying systems.
- Raw material cleaning or drying system, including equipment such as screens, destoners and/or dryers.
- Raw material storage system, usually consisting of storage silos.



The goal of this article is to assess the two types of equipment with the highest risk of explosion, which are also considered to be the most hazardous in terms of serious consequences, namely baghouses and bucket elevators.

Explosion risk assessment

A proper explosion risk assessment must cover both the likelihood of explosive atmospheres occurring (ATEX zone classification), as well as any ignition sources which may arise in the equipment and which may ignite such explosive atmospheres.

The implementation of reputable international standards is always advisable in order to properly assess the risk of explosion and therefore justify the necessary measures to mitigate such risk. These standards include the European standards EN 60079-10-2 (for the classification of areas in explosive dust atmospheres), and EN 1127-1 (explosion prevention and protection); the German standard VDI 2263 for the assessment of explosion risks in bucket elevators or baghouses; the technical report CEN/TR 16829 on prevention and protection in bucket elevators; as well as the NFPA standards.

As the design of a proper assessment plan regarding explosion risks in the abovementioned equipment is dealt with in other articles written on the subject (see <https://adixatex.com/recursos/>), it can be summarised as follows:

- Regarding baghouses, it is common to consider the inside of suction lines and the dirty area as zone 20; and the inside of the clean area, exhaust lines and fan as zone 22. Besides, it is common to consider potential ignition sources resulting from, for example, the self-combustion of the product accumulated inside, mechanical sparks from other equipment, sparks or hot surfaces from hot work, or electrical sparks and hot surfaces caused by electrical equipment resulting in a high risk of explosion. Furthermore, it must be taken into account that an explosion within a baghouse could have serious consequences, including the destruction of part of the facility and personal injury to workers.
- Regarding bucket elevators, there is a high probability of an explosive atmosphere forming inside, thus it is considered as Zone 20. Furthermore, it is highly likely that there are ignition sources present such as mechanical sparks or hot surfaces caused by belt movement or misalignment or bearing failures, hot particles or flames from other equipment, self-combustion of the product accumulated inside, and sparks or hot surfaces from hot work.

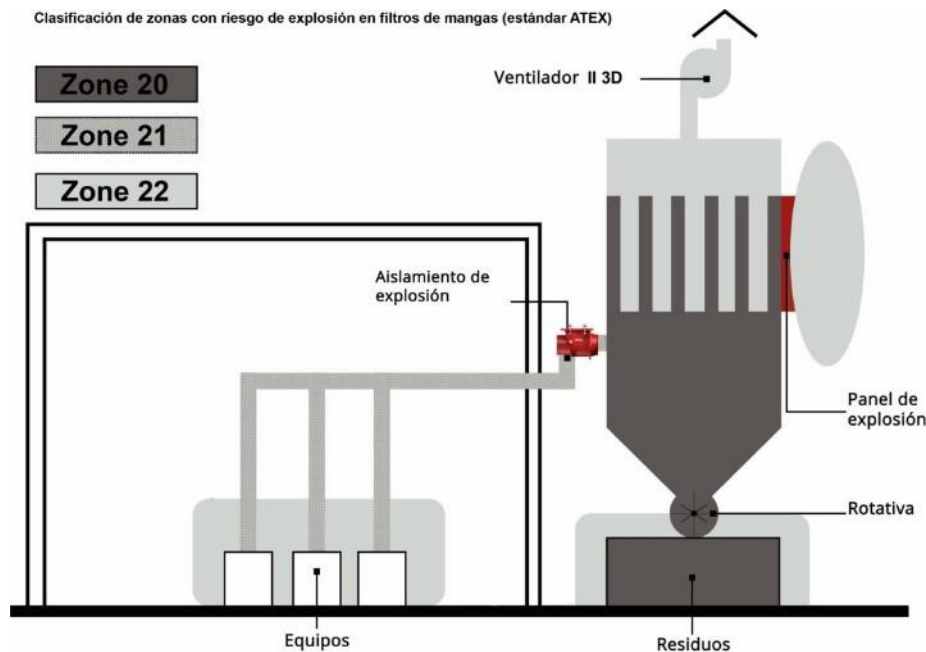


Fig. 1 Example of ATEX zone classification in raw material reception system

Recommended preventive and protective measures

Adix, along its suppliers, has designed and developed a series of explosion prevention and protection systems in accordance with the specific requirements of the ATEX Directive 2014/34/EU and the corresponding harmonised standards, intended for their installation in equipment such as those analysed in this article and which represent an added value to systems, as prevention and protection against the risk of explosion must be considered an investment in safety. Adix can provide the following solutions to address the risk of explosion in this type of equipment:

1. Prevention measures:

As stated in Directive 1999/92/EC, the priority of an efficient strategy to avoid the risk of explosion is to prevent an explosion from occurring, either by preventing the formation of a possible explosive atmosphere or by preventing the formation of an ignition source if the former cannot be achieved. There are a number of preventive measures that can be implemented in baghouses and bucket elevators:

- Prevention of ignition sources:

- ✓ If there is a risk of mechanical sparks in the suction line of a baghouse, the installation of a spark detection and extinguishing system is recommended.

The main advantage of this type of system is how easy it is to install and implement in the equipment (as it is minimally invasive), as well as to maintain, although it is necessary to dispose of water supply with minimum pressure conditions for extinguishing.

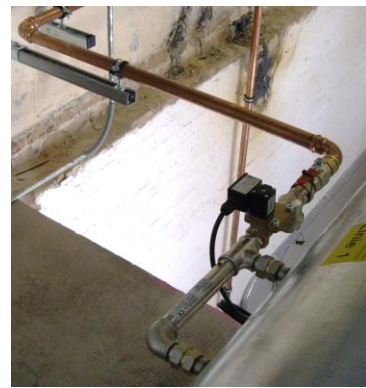


Fig. 2 Spark detection and extinguishing system (source: T&B Electronic GmbH).

- ✓ The ignition source control system for bucket elevators is designed to control the operating variables of the equipment (bearing temperature, belt movement, rotation speed), as well as to detect malfunctions, trigger an alarm and even shut down the equipment. It consists of a series of sensors or detectors and a signal switchboard. Sensors include:

- Belt misalignment detectors.
- Control of the foot's drive axle rotation.
- Jam detector at the product unloading point.
- Bearing temperature detection.

It is a flexible system that facilitates the proper and simple control of an elevator.

It is also fully configurable, but it requires proper maintenance for smooth operation.



Fig. 3 Elevator ignition source control system (Spyline ADIX)

2. Protective measures:

If the risk assessment determines that the risk of explosion cannot be eliminated by implementing preventive measures alone, explosion protective measures should also be implemented to protect both facilities and workers against the consequences of an explosion. For baghouses and bucket elevators there are a number of protective measures that can be implemented:

- Explosion vent panels certified according to ATEX Directive 2014/34/EU, with venting area according to a recognised standard (EN 14491:2012 'Dust explosion venting protective systems' or NFPA 68: Standard on explosion protection by deflagration venting) or flameless venting in case the equipment is located inside the facilities.

The installation of vent panels on baghouses and bucket elevators is one of the easiest protective measures to implement, as it is easy to install and adapts well to equipment. Besides, it also requires low maintenance. However, it is not always possible to implement this type of protection, in which cases another type of protection system should be taken into account.

- Explosion suppression by means of a system certified according to ATEX Directive 2014/34/EU. This type of system should only be considered if it is not easy or it is technically unfeasible to install vent panels.

The installation of a suppression system is an effective measure that is easy to use by

means of its built-in control system. However, its performance depends on the correct periodic maintenance indicated by the manufacturer.

- Apart from the abovementioned measures, and in accordance with Directive 1999/92/EC, measures must also be taken to ensure that the explosion is isolated, i.e. that the explosion cannot spread to other equipment. For this purpose, and focusing on baghouses and bucket elevators, the following measures can be implemented:

- ✓ To prevent a potential explosion from spreading along the suction line of a baghouse, it is recommended to install mechanical isolation by means of the NOVEx check valve (certified as a protection system according to ATEX Directive 2014/34/EU).

Check valves are easy to install and maintain and, additionally, they are a proven solution against explosion propagation. However, they have process requirements derived from certification tests on maximum air velocity in the line (20 m/s) and dust concentration (<500 g/m³), and must always be used together with a protection system (explosion vent).

- ✓ In order to prevent the propagation of a potential explosion along dust collectors in a bucket elevator or its product inlet and outlet, it is possible to install a chemical isolation system (chemical barriers). Installation in the suction line of a baghouse is also possible when process conditions make it difficult to install a check valve.

The installation of a chemical isolation system, as in the case of suppression systems, is an effective measure that is easy to use by means of its built-in control system. However, its performance depends on the correct periodic maintenance indicated by the manufacturer.

Note: The implementation of protection systems should follow a reputable standard or guideline (e.g. EN 14491, CEN/TR 16829 or NFPA 68).



Fig. 4. Protection systems in baghouses



Fig. 5. Flameless vent on elevator



Fig. 6. Chemical isolation system in elevator