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Explosion Risk Assessment of Dust Collectors (Bag filters)

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Sumario

Introduction and regulations

Dust extraction systems represent one of the main installations in industries handling powdery substances, mainly intended to control environmental dust emissions and thus reduce their contamination.

Bag filters are the main component of a dust extraction system and in solid-gas separation systems, and represent one of the main explosion risks in industries handling flammable dusts.

Carrying out a correct risk assessment of extraction systems, and specifically of bag filters, must be one of the main objectives in order to establish an effective strategy for dealing with the risk of explosion in our installations.

In order to carry out a correct assessment of the risk of explosion, we can use as a support some of the most widely used international standards of recognised prestige, among which we can highlight the following:

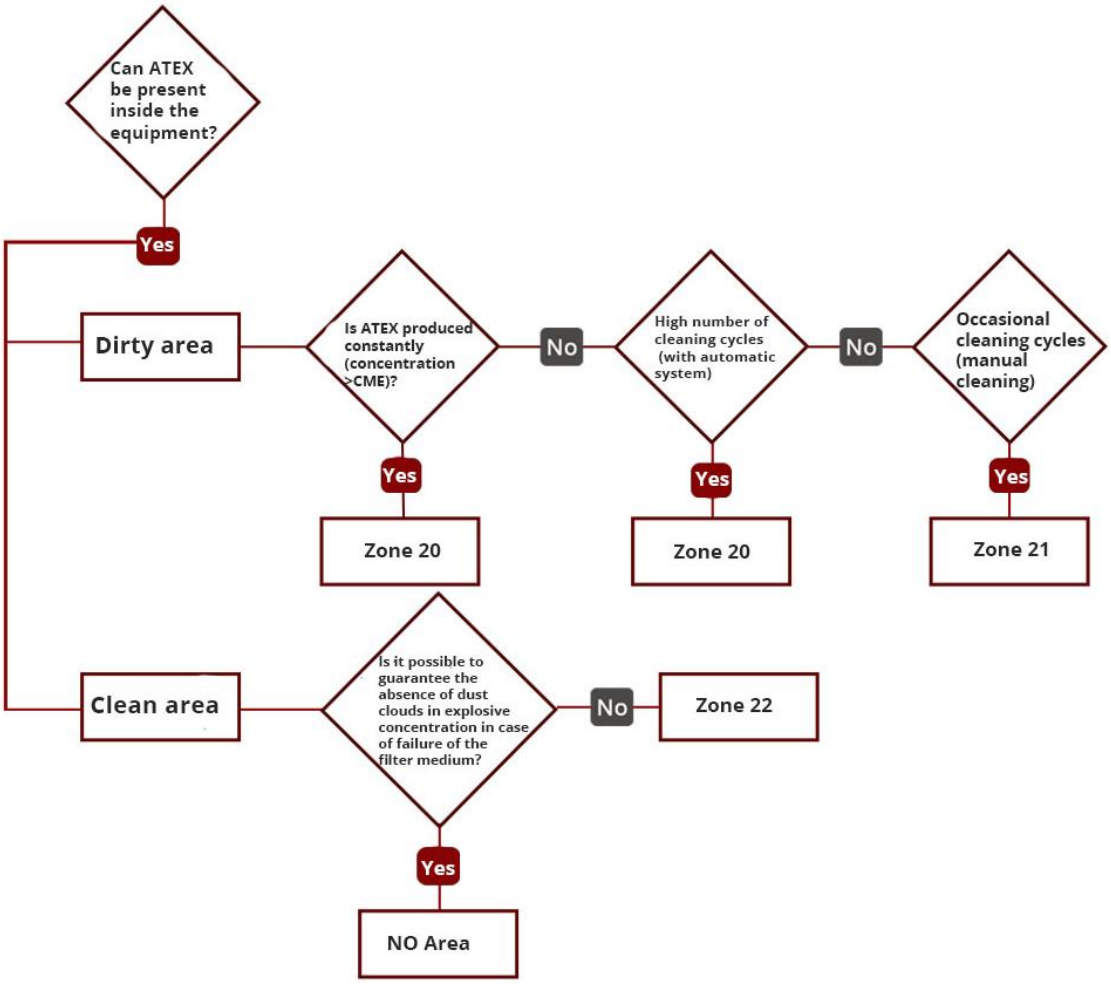
- The German standard VDI-2263, part 6: Dust fires and dust explosions, Risk assessment - protective measures, Protection against dust fires and dust explosions in dust extraction plants, 2017.
- The guide to Directive 2014/34/EU, in the section dedicated to particular cases and more specifically in the point "§ 243 Filter units and ventilated silos".
- The American standards NFPA 61: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, and NFPA 654: Standard for the Prevention of Fires and Dust Explosions from the manufacturing, processing and handling of combustible particulate solids.

Explosion risk assessment:

A proper explosion risk assessment must include at least the following points:

- Classification of explosion hazardous areas.
- Assessment of effective ignition sources.
- Probability of an explosion occurring.
- Consequences of an explosion on equipment and installations.

Classification of potentially explosive areas in bag filters:



Notes:

(1): Due to cleaning cycles or the possibility of accumulation of dust layers inside the filter (including dust layers on the sleeves).

MEC: minimum explosive concentration (g/m3). Examples: Sugar (30 g/m3); Starch (60 g/m3); Wood (30 g/m3). Data obtained from the GESTIS-DUST EX database: https://staubex.ifa.dguv.de/explosuche.aspx?lang=e

(2): An automatic cleaning system is considered to be any system that is carried out by means of pressurised air, either by means of a timer or a differential pressure system, or any system that is carried out by vibration or mechanically or requires activation by means

of an external pushbutton.

Manual cleaning involves stopping and opening the equipment as well as disassembling and cleaning the filter media.

Effective ignition sources:

1. Mechanical sparks from other equipment, when the baghouse draws in from mechanical equipment susceptible to failure (mills, elevators, conveyors, etc.).
2. Hot surfaces, due to friction in mechanical filter discharge equipment (rotary valve, screw conveyor) or in wood processing equipment (saws, dryers, etc.).
3. Electrical equipment, due to:
    - Incorrect or damage equipment
    - Incorrect earthing or lack of continuity
4. Electrostatic discharges, due to the accumulation of static energy due to the friction of the aspirated product with the internal elements of the filter and the lack of equipotential continuity.
5. Sources of ignition introduced from other interconnected equipment, e.g., hot particles, fires or explosions in other equipment.
6. External ignition sources due to maintenance, welding, cutting (hot work), smoking in the installation. Such ignition sources are prevented by organisational measures.
7. Ignition sources caused by the product to be transported itself, e.g., due to self-combustion of dust accumulations inside the filter.

Fig. 2. Common ignition sources (source: INRS and donaldson.com)

Recommended preventive and protective measures:

Considering the possible presence of explosive atmospheres on a virtually continuous basis and the variety of ignition sources that can become effective, the probability of an explosion occurring in a baghouse is high and its consequences can be catastrophic for installations and people.

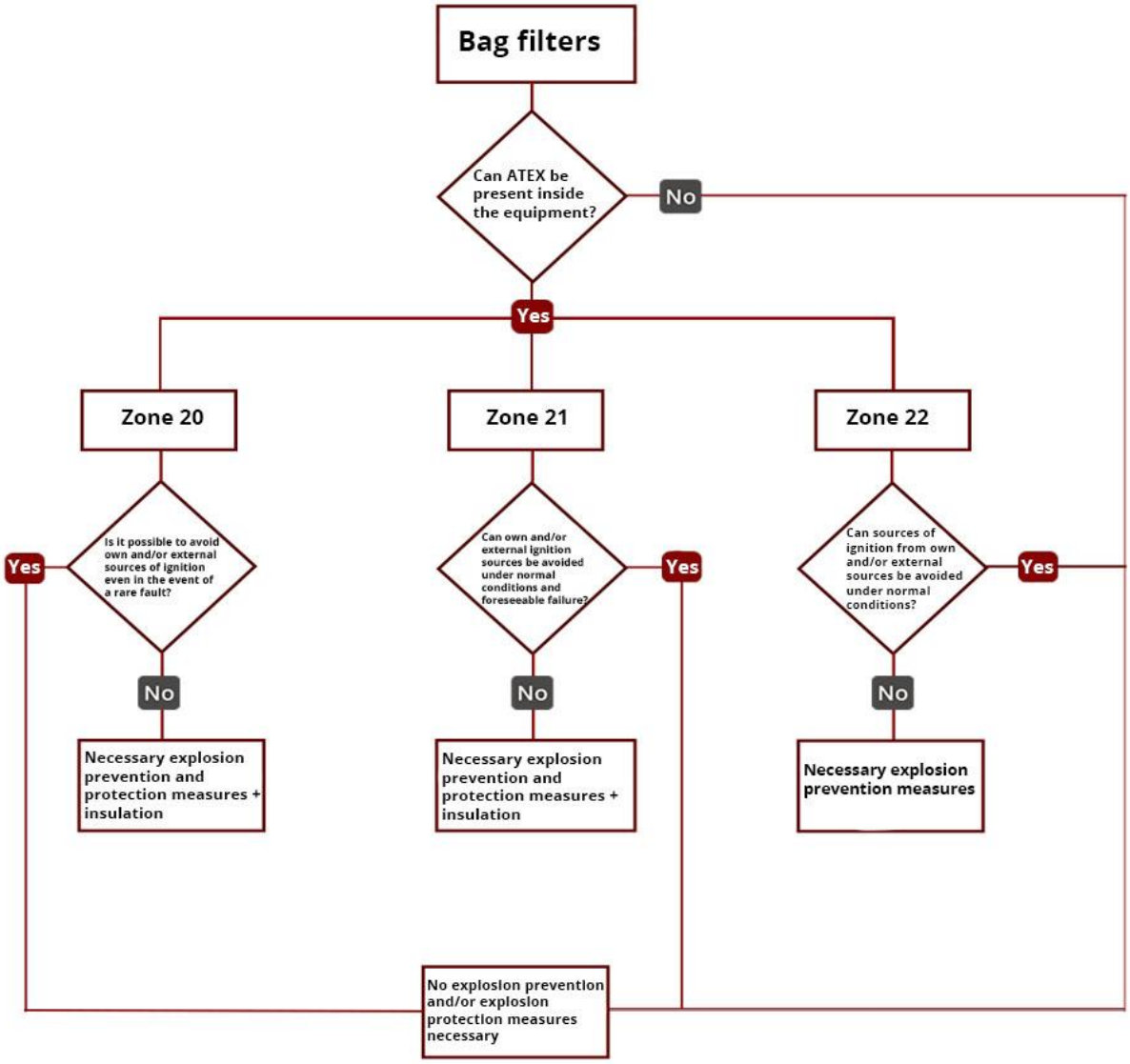


Fig. 3. Esquema de evaluación del tipo de medidas necesarias

Preventive measures

- Prevention of explosive atmospheres:
  - ✓ Reduce cleaning cycles
  - ✓ Periodic cleaning
- Prevention of ignition sources:

- ✓ Installation of a spark detection and extinguishing system in the suction line to prevent the entry of sparks or hot particles from other equipment.
- ✓ Installation of a fire detection system using CO, infrared or temperature detection.
- ✓ Correct earthing and equipotentiality of the sleeve supports, sleeves made of antistatic material.

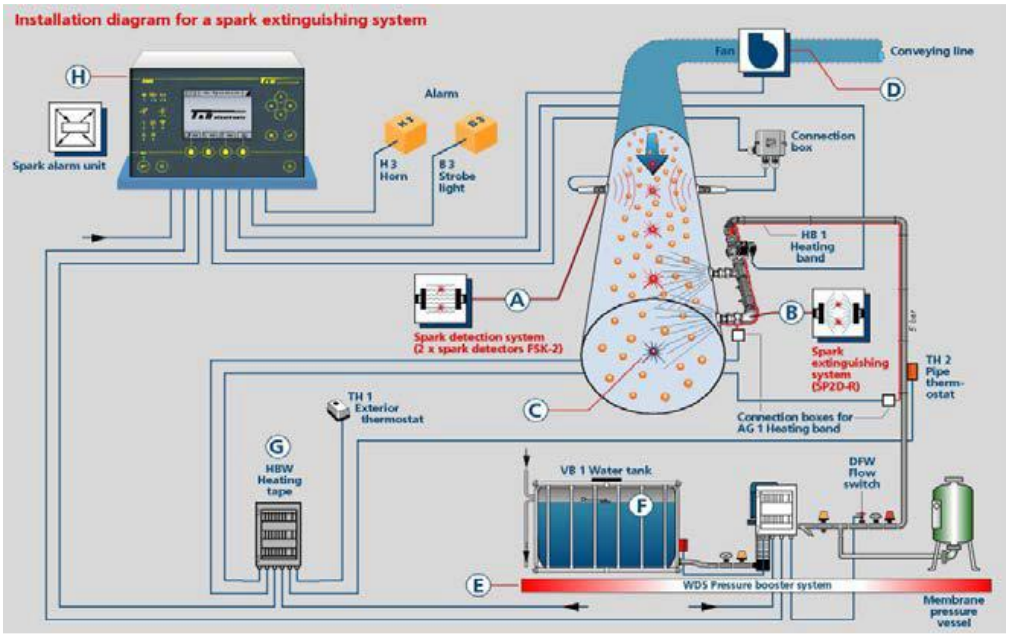


Fig. 3. Scheme for assessing the type of measures needed

Protect measures:

- Explosion vent panels certified according to ATEX Directive 2014/34/EU, with venting area according to some recognised standard (EN 14491:2012 'Dust explosion venting protective systems' or NFPA 68: Standard on explosion protection by deflagration venting). Venteo sin llama en caso de que el equipo se encuentre en el interior de las instalaciones.
- Flameless venting in case the equipment is located inside the premises.
- Explosion suppression (system certified according to ATEX Directive 2014/34/EU).
- Explosion isolation:
  - ✓ Mechanical isolation by means of flap valve (certified as protection system according to ATEX Directive 2014/34/EU or approved by authorised body according to NFPA 69 standard) installed in the dust suction line.
  - ✓ Chemical isolation system (chemical barriers), installed in the dust extraction line.
  - ✓ Rotary valves certified as isolation system (according to ATEX Directive 2014/34/EU or NFPA 69) installed in the product discharge.

Fig. 5. Baghouse protection systems

Note: The implementation of baghouse protection systems should follow a recognised standard or guide (e.g., EN 14491 or NFPA 68

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