Dust removal filters for combustible dusts

Information

ATEX-compliant dust removal filters

1. Features

Explosion protection is stipulated for combustible dusts by the 94/9/EC Directive.

Particles are separated and upgraded on the raw gas side of a cleanable dust removal filter. The dust cloud that is frequently produced when the filter cartridges are cleaned will cause an explosion in the presence of a sufficiently large spark. To avoid the risk of explosion when combustible dusts are separated, explosion-proof designs in line with ATEX regulations have been specified for Filtration Group dust removal filters together with an engineering consultant.

A hazard analysis and risk assessment based on DIN EN 13463 provide the starting point for appraising the suitability of a particular application and selecting the device type. The hazard analysis evaluates the possible explosion hazards and the probability of occurrence of potentially explosive atmosphere. The analysis presupposes that the filtration device will be for its "intended purpose" and that it is divided into an installation chamber and a process chamber (zones). The possible explosion hazards to be considered are described in DIN EN 1127-1. Hazard analyses are documented for the various applications of Filtration Group dust removal filters.
2. Selection of the dust removal filter

The dust removal filter is selected according to the minimum ignition energy of the dust and the envisaged application. Filtration Group dust removal filters for installation in Zone 22 are designed with the Ex II 3D c T140 °C type of protection.

<table>
<thead>
<tr>
<th>Dust removal filter</th>
<th>Minimum ignition energy</th>
<th>Type of dust</th>
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<tbody>
<tr>
<td>Type A</td>
<td>&gt; 10 mJ</td>
<td>Normally flammable</td>
</tr>
<tr>
<td>Type A or Type B *</td>
<td>Between 3 and 10 mJ</td>
<td>Highly flammable</td>
</tr>
<tr>
<td>Type B</td>
<td>&lt; 3 mJ</td>
<td>Extremely flammable</td>
</tr>
</tbody>
</table>

* Type B must be selected if the dust removal filter is to be used for one of the following purposes: pneumatic conveying, central aspiration or suction, separation downstream of a drying or grinding process, suction with mechanical conveyors operating at a speed of more than 1 m/s or separation of self-igniting powder.

3. Type A dust removal filter in basic ATEX design with proactive explosion protection

1. Earth conductor or equipotential bonding conductor  
2. Quick-disconnect earth conductor  
3. Filter controller or terminal box, category II 3D

**Characteristics**

- Equipotential bonding conductors on all housing parts, incl. earth connection  
- ATEX-compliant electrical components with the appropriate type of protection, e.g. filter controller, magnetic valve, electric motor, level indicator for Zone 22  
- Terminal strip for connecting more than one magnetic valve to a filter controller or control cabinet  
- Filter cartridges capable of electrostatic discharge (Filtration Group standard, even for a minimum ignition energy > 4 mJ)

**Operating principle**

Static electricity cannot build up in the basic ATEX version, so that sparking and explosion are ruled out. Sparking must be reliably prevented. If this is not possible, a type B dust removal filter must be used instead.
4. Type B dust removal filter in explosion-proof ATEX design

In the case of the explosion-proof design, the dust removal filter must be decoupled from explosions in the raw and clean gas lines. All plant components connected upstream or downstream are then protected against dust explosion propagation. The dust is discharged either in an explosion-proof bucket or by means of a flameproof discharge device.

Explosion protection by decoupling a dust removal filter in explosion-proof design with explosion release.

Example 1: Decoupling with a quick-acting valve and check valve

- Earth conductor or equipotential bonding conductor
- Filter controller or terminal box
- Explosion-tested air release valve with integrated flame absorber
- Rotary valve
- Explosion-tested check valve
- VENTEX quick-closing valve
- Control room or cabinet

Explosion-proof dust removal filter with air release valve

Characteristics

- Equipotential bonding conductors on all housing parts, incl. earth connection
- ATEX-compliant electrical components with the appropriate type of protection, e.g. filter controller, magnetic valve, electric motor, level indicator for Zone 22
- Terminal strip for connecting more than one magnetic valve to a filter controller or control cabinet
- Filter cartridges capable of electrostatic discharge (Filtration Group standard, even for a minimum ignition energy > 4 mJ)
- Max. dust constant (Kst value): 300 bar m/s
- Signal transmitter on the air release valve for recording explosions
- Quick-acting valve and check valve for decoupling explosions
- Pressure burst resistance of the housing: 0.5 bar

Operating principle

At the start of an explosion, the fitted spring contact sends a signal to the control room (7) as soon as the air release valve (3) opens. The transmission of the signal causes all electrical components to be disconnected. The check valve on the raw gas side (5) closes automatically by mechanical means in a fraction of a second when the explosion begins. A quick-acting shut-off device (6) decouples the explosion on the clean gas side (6), e.g. the automatic VENTEX quick-closing valve or an active fire barrier. Alternatively, the air release valve (3) can be replaced by a rupture disc or a quench pipe and the rotary valve (4) by a dust bucket.
Example 2: Decoupling with extinguishing agent

![Diagram of explosion-proof dust removal filter with rupture disc]

**Characteristics**
- Equipotential bonding conductors on all housing parts, incl. earth connection
- ATEX-compliant electrical components with the appropriate type of protection, e.g. filter controller, magnetic valve, electric motor, level indicator for Zone 22
- Terminal strip for connecting more than one magnetic valve to a filter controller or control cabinet
- Filter cartridges capable of electrostatic discharge (Filtration Group standard, even for a minimum ignition energy > 4 mJ)
- Max. dust constant (Kst value): 300 bar m/s
- Rupture disc with breakwire as a signal transmitter
- Extinguishing agent bottles for decoupling explosions
- Pressure burst resistance of the housing: 0.5 bar

**Operating principle**

At the start of an explosion, the rupture disc (3) opens at a defined set pressure and the signal is transmitted to the switch box by the breakwire (7). The transmission of the signal causes the extinguishing agent bottles (6) to be activated. The extinguishing agent expelled via the pipes on the raw and clean gas sides prevents the flame front from propagating. At the same time, the signal disconnects all electrical components. Alternatively, the rupture disc (3) can be replaced by an air release valve or a quench pipe and the dust bucket (4) by a rotary valve.
Explosion protection by suppressing the explosion in a dust removal filter in explosion-proof design

Characteristics

- Equipotential bonding conductors on all housing parts, incl. earth connection
- ATEX-compliant electrical components with the appropriate type of protection, e.g. filter controller, magnetic valve, electric motor, level indicator for Zone 22
- Terminal strip for connecting more than one magnetic valve to a filter controller or control cabinet
- Filter cartridges capable of electrostatic discharge (Filtration Group standard, even for a minimum ignition energy > 4 mJ)
- Max. dust constant (Kst value): 300 bar m/s
- Extinguishing agent bottle(s) on the dust removal filter for suppressing explosions
- Extinguishing agent bottles in the pipes on the raw and clean gas sides for decoupling explosions
- Pressure burst resistance of the housing: 0.5 bar

Operating principle

At the start of an explosion, the pressure increase is recorded by two separate pressure sensors (3) and the extinguishing agent bottles (5) are activated by the high-speed electronics. Inside the dust removal filter, the flame is suppressed by the extinguishing agent, so that the explosion pressure is reduced. The number of explosion agent bottles depends on the volume of the raw gas side, the maximum explosion pressure, the dust constant and the ignition temperature. If this pressure reduction is ensured by optimising the design of the dust removal filter, it is possible to minimise the explosive action such that additional pressure relief can be dispensed with. The extinguishing agent expelled via the pipes on the raw and clean gas sides prevents the flame front from propagating. At the same time, the signal from the switch box (8) disconnects all electrical components. Alternatively, the dust bucket (6) can be replaced by a rotary valve.
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Explosion protection with dust removal filter in explosion-proof design

1. Earth conductor or equipotential bonding conductor
2. Filter controller or terminal box
3. Manhole
4. Swinging gallows

Characteristics
- Equipotential bonding conductors on all housing parts, incl. earth connection
- ATEX-compliant electrical components with the appropriate type of protection, e.g. filter controller, magnetic valve, electric motor, level indicator for Zone 22
- Terminal strip for connecting more than one magnetic valve to a filter controller or control cabinet
- Filter cartridges capable of electrostatic discharge (Filtration Group standard, even for a minimum ignition energy > 4 mJ)
- Dust constant (Kst value) corresponding to the approval for the decoupling elements
- Explosion decoupling must be provided for the dust removal filter in the raw and clean gas lines
- Dust removal filter design optimised for the maximum explosion pressure

Operating principle
In the event of an explosion, the maximum explosion pressure is absorbed by the robust housing. The steel is not stressed beyond the yield point in accordance with the design. All electronic components can be disconnected by tripping an optional pressure switch. Cabinet optional.

5. Type examination with explosion test

The stable design of our apparatus is confirmed by an FSA test certificate. A pressure burst resistance of 0.5 bar was demonstrated in a test series with selectively induced explosions. The devices thus comply with the test requirements of EN 14460 "Explosion resistant equipment".

6. Design

Please contact us for detailed technical information, any open questions and for general expert advice. Completion of the relevant questionnaire would facilitate in the coordination of all important parameters. Comprehensive documentation on our product range, cleaning units and elements can be provided. For more information about installation and operation, please refer to our Instruction Manual.

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