LET®meschede

Luftfilter- und Entstaubungstechnologie

Fire and explosion protection

LETmeschede

Content

Requirements for companies

Duties of plant operators

- No "polluting environmental impacts" may emanate from the production plant.
- All measures to limit emissions that are possible according to the "state of the art" must be taken.
- Protection duty Article 5 para. 1 no.1 BImSchG
- Due care duty Article 5 para. 1 no.2 BImSchG
- Federal Immission Control Act (BImSchG)
- EN 14034 Determination of explosion characteristics of dust clouds. Hazards. Assessment. Protective measures)

ZH 1/10 (Guidelines for the prevention of hazards caused by explosive atmospheres, explosion protection - guidelines, EX-RL– NEW: BGR 104 Explosion protection regulations)

Technical instructions for air pollution control (TA-Luft)

Technical instructions for protection against noise (TA-Lärm)

2014/34/EU (Directive on the approximation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres [ATEX 100 a])

DIN VDE 0165 (Construction of electrical systems in potentially explosive atmospheres)

ZH 1/140 (Rules for health and safety at workplaces with workplace ventilation - NEW: BGR 121 Workplaces with workplace ventilation)

Fire protection

Initial situation

It happens more often than you might think.
According to statements from manufacturers in the fire protection industry, at least one extraction or dedusting system burns in Germany every day.

For all combustible types of dust, an investment in filter systems with structural fire protection measures is recommended in consideration of occupational health and safety as well as production safety.

When procuring a filter system, it is important to consider how the dust/smoke to be extracted creates a combustible mixture in conjunction with the air. If this is the case and structural fire protection measures are not installed, then large-scale damage and the resulting high consequential costs in the event of a fire are to be expected.

Arguments

Again and again, we hear from our customers:

"Our plants won't burn!"
or
"Nothing has ever happened here!"
or
"We don't have any money for that!"

We would like to quote the following verdict:
"Experience shows that the development of a fire is to be expected at any time. The circumstance that no fire has broken out in many buildings for decades does not mean that there is no danger, but represents luck on the part of those concerned, the end of which is to be expected at any time!"

Gelsenkirchen Administrative Court
5 K 1012/8 5 of 14/11/198 5

Münster Senior Administrative Court
10 A 363/8 6 of 11/12/1994

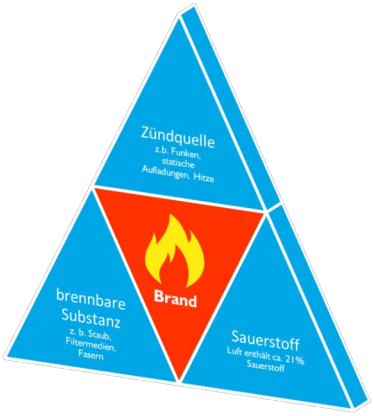
Fires in dedusting systems can always break out where combustible dusts or smoke are present. Fires are caused by burning or smouldering parts with sufficient energy.
We have developed appropriate plant protective measures on the basis of our many years of experience in the field of ventilation and dedusting technology and can be installed as additional equipment if required.

Requirements for a fire

Fire triangle

The requirements for the possible break out of a fire:

- A flammable substance
- An adequate oxygen concentration
- We have numerous empirical values for all 3 points.



We have numerous empirical values for all 3 points. We can send you detailed material on this subject on request.

Selection of combustible types of dust / ignition sources

Combustible types of dust include:

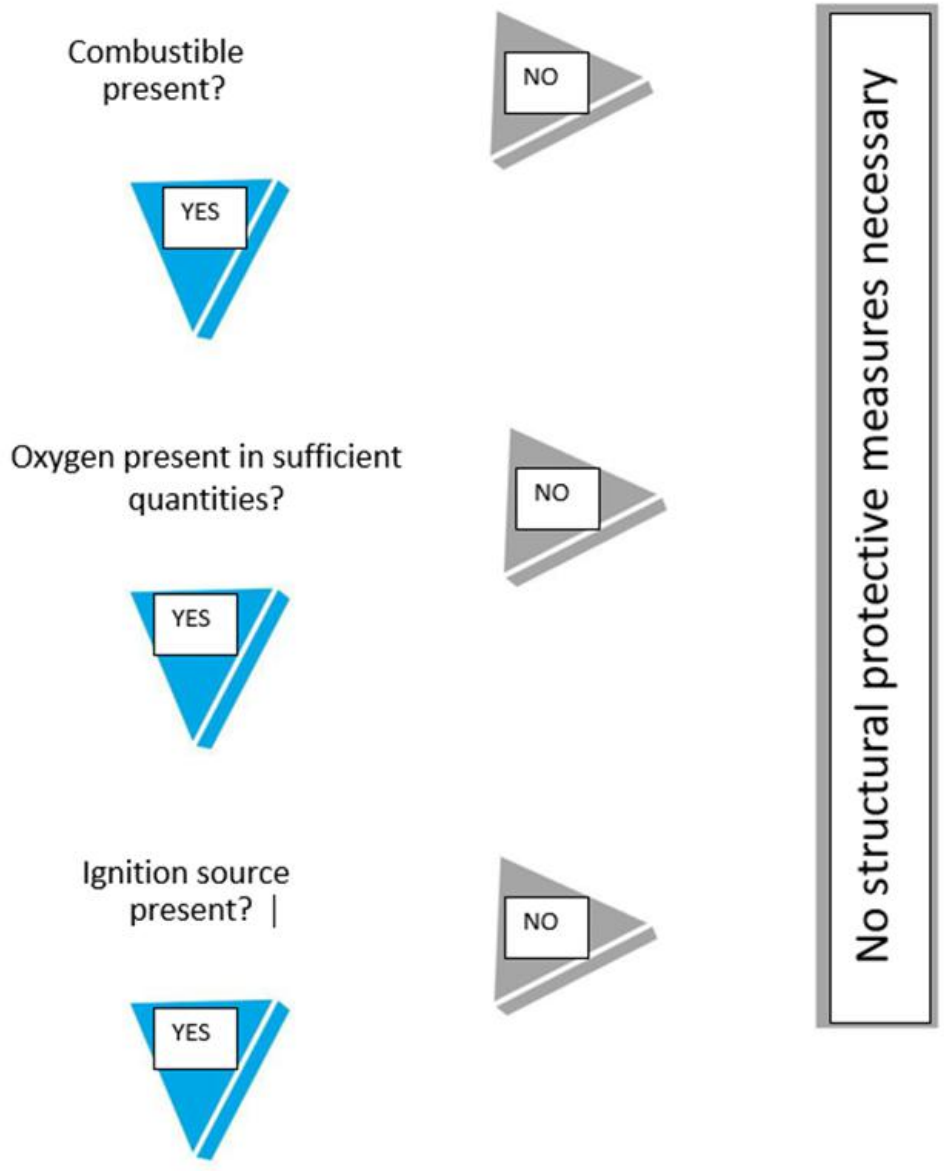
- Natural products:
  Wood, wood products, fibrous materials, food/beverages/tobacco and animal feeds, coal, coal products, etc.
- Technical/chemical products:
  Plastics, resins, rubber, pharmaceuticals, cosmetics, etc.
- Inorganic products:
  Aluminium, stainless steel and other metals.

Burning or smouldering parts introduced with the extracted air can act as ignition sources and thus cause a fire. These include:

- Smouldering cigarette butts
- Sparks from welding/grinding

The introduction of these ignition sources cannot be fully monitored and therefore represents a permanent hazard.

Hazard analysis



Structural protective measures necessary!

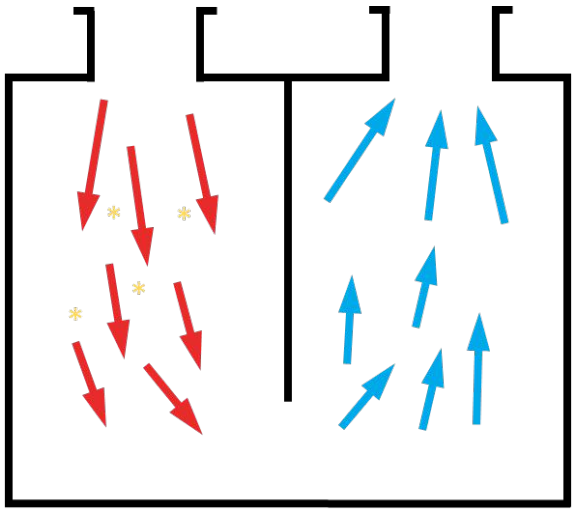
Fire protection

Structural fire protection

With the installation of structural fire protection measures on filter systems, the following hazard points and their consequential costs can be reduced:

- Priority should be given to possible personal injuries in the case of damage.
- Damage to buildings and machinery – these costs are partly covered by the insurance, but increasing premiums after a claim must be taken into account.
- Production losses in the event of damage can have significant business consequences. Customers may defect to competitors due to delivery delays.

If you take these 3 points into account when deciding to invest, you will come to the conclusion that the higher plant price quickly pays for itself in the event of damage. The investment in structural fire protection measures makes a decisive contribution to the production and supply reliability of your company.



Fire protection conceptse

Structural fire protection is divided into the following concepts.

Preventive fire protection

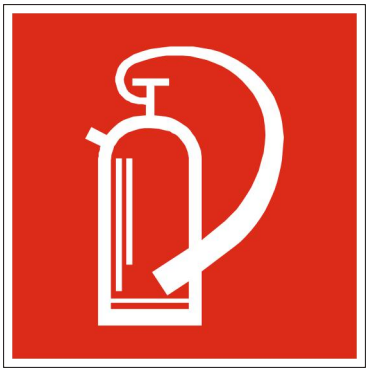
Measures to minimise or prevent fire damage:

- Fire protection organisation
- Structural installations
- Fire brigade access roads
- Fire detection and alarms
- Avoidance of sparks

Defensive fire protection

Measures to reduce or fight fires:

- Extinguishing water supply
- Special fire extinguishing agents
- Fire brigade access roads
- Firefighting measures



Preventive fire protection

Extinguishing of sparks

A spark extinguishing system installed in the pipeline largely avoids the transfer of the ignition sources into the filter system.

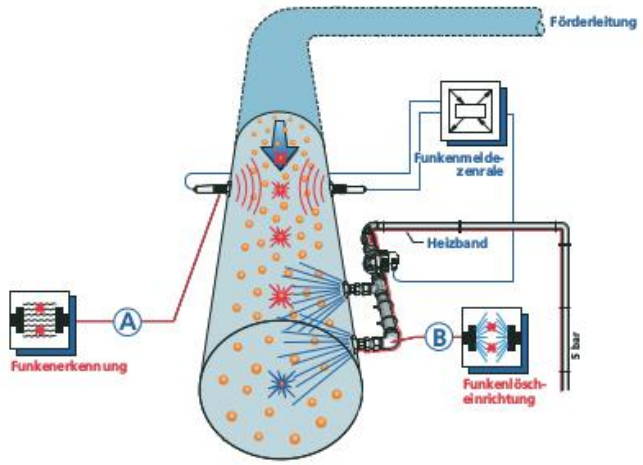
Spark detectors also installed in the pipeline detect passing sparks and initiate an extinguishing process.

The sparks in the pipeline are extinguished by injected water.
Advantages:

- Low investment costs
- Does not impair the function of the plant technology
- Space-saving, compact design

Disadvantages:

- Unsuitable for substances that react chemically with water
- Residues in the pipeline after the extinguishing operation



Defensive fire protection

Fire detection techniques

The following plant technology is available for the detection of fires in filter systems:

Heat sensors
The heat sensors are set to a temperature range and trigger an alarm if the range is exceeded.

CO alarm
This detection technique is based on a fire-related increase in the CO content in the air. The CO content is measured continuously on both the raw gas and clean gas side. A fire alarm is triggered if a maximum permissible difference value is exceeded.

Flame alarm
The flame alarm detects a fire by the flickering frequency of the flames and then triggers a fire alarm.
With all three versions, either a display can visually report the fire or an installed extinguishing system can be automatically triggered.

Defensive fire protection

Extinguishing of fires

The following constructive protective measures are available for extinguishing a fire detected in the filter system:

Extinguishing of fires

During the extinguishing process, water is injected via nozzles into the filter system as a fine spray mist. The extinguishing process can be triggered either manually or automatically via an installed extinguishing system. In addition, it is possible to inject the water into the filter system by attaching connection nozzles (so-called dry risers) for fire hoses.

Advantages:

- Extinguishing equipment is available in sufficient quantities
- Low investment costs
- Cooling effect of the extinguishing agent

Disadvantages:

- Unsuitable for substances that react chemically with water
- High dead weight when flooding systems (must be taken into account in the statics)
- Extinguishing water must be collected (contamination)
- Possible consequential damage caused by the extinguishing water
- Unsuitable for electrical installations

Extinguishing with inert gas

After detection of a fire, the flooding of the complete filter system with inert gas is triggered manually or automatically. The extinguishing gases argon, CO2 or other inert gases are used. By introducing these gases, the oxygen content is removed from the source of the fire and the fire is thus extinguished.

Advantages:

- Also suitable for substances that react chemically with water
- Extinguishing agent is not electrically conductive

Disadvantages:

- No cooling effect
- High investment costs

Extinguishing with multi-area foam

After detection of a fire, the injection of extinguishing foam via installed foam nozzles is triggered manually or automatically. The foam introduced extinguishes the fire by means of oxygen depletion. A sufficient storage quantity of foam medium – according to the dimension of the plant system – must be ensured.

Advantages:

- Fewer weight problems when injecting than with water
- Thus suitable for flooding large spaces
- Suffocating and cooling effect

Disadvantages:

- Major cleaning work required after extinguishing process
- Disposal of the extinguishing agent

The solution that is possible in your case should be determined in a personal conversation on site. Please do not hesitate to contact us if you have any further questions on this topic.

Fire alarm system and extinguishing systems

System description

LET® meschede fire alarm and extinguishing systems take into account the

- **Fire hazards**
  - Substance-specific ignition sources
  - Process ignition sources
  - Trivial ignition sources
- **Spread of fire**
  - Structural fire protection
- Fire fighting
  - With the appropriate extinguishing agent
- **Fire detection**
  - Temperature detectors
  - Ionisation smoke alarms
  - Thermal sensors
  - CO gas meters
- **Fire alarm**
  - Signal horn
  - Flashing light
  - Direct notification of fire brigade

A fire alarm panel, which is equipped with an emergency power supply, monitors the extraction and separation system in the standstill and operating states. The corresponding fire detectors ensure that fire is detected at an early stage. The fire alarm panel also ensures that the alarm is forwarded to the operating personnel or the fire brigade.

In a fire alarm and extinguishing system from LET® meschede is triggered, the entire system is fully functional again within a very short time.
There are no major operating interruptions and associated losses of production, which affect your ability to deliver and thus your competitiveness.

Advantages of our fire alarm and extinguishing systems

- Preventive fire protection
- High operational reliability
- Fast fire detection
- Alarm forwarding to the operating personnel or to the fire brigade
- Fast introduction of the extinguishing agent into the area to be protected
- No extinguishing water damage
- Entire system is ready to operate again very quickly
- Low production losses
- No costs for disposal of the extinguishing agent
- Easy retrofitting of existing systems
- No static problems as in the case of firefighting with water

The fire alarm and extinguishing system from LET® meschede guarantees you an operational safety of 98 % for the industrial ventilation system to be protected, in accordance with the relevant VDS (Association of Property Insurers) guidelines.

False alarms and triggering are also prevented due to the safety factor of 98%. All components of the fire alarm and extinguishing system from LET® meschede are VDS-tested.

Almost all extraction and separation systems can be retrofitted with a fire alarm and extinguishing system from LET® meschede.
Arrange a personal consultation, because there's no second chance for your production reliability!

Explosion protection

Definition

An explosion is a fast-running oxidation with flame formation, whose effect increases with increasing oxidation rate.

Fire → Darting Flame → Deflagration → Explosion → Detonation

Explosions are accompanied by high temperatures and high rates of pressure increase. People can be injured, buildings or plant parts destroyed and other combustible substances ignited.

Explosion hazards can occur when handling flammable, i.e. oxidisable substances if these substances are present as gas (e.g. methane, propane, pentane), vapour, mist or dust.

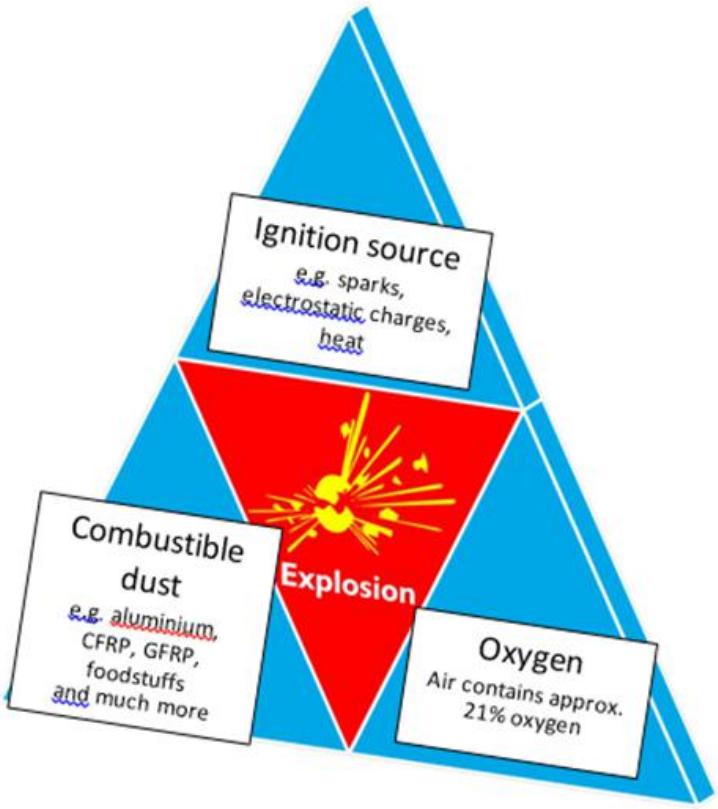
Prerequisites for an explosion

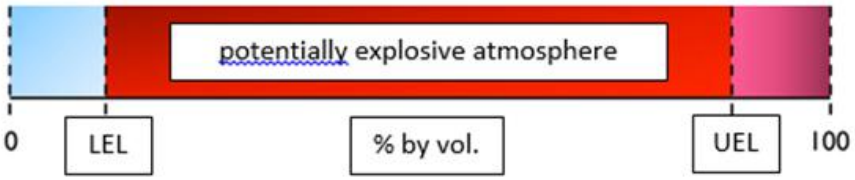
So a fire or an explosion can occur, three conditions must be met at the same time:

- the presence of air or pure oxygen
- the presence of an ignition source with sufficient energy
- the presence of a combustible substance (solid, liquid and/or gaseous)

In this context, not only obviously combustible substances can develop a considerable hazard potential. Even materials that are not flammable at room temperature can be very dangerous if finely dispersed as dust, vapour or mist.

Explosions triangle





Der Explosionsbereich ist begrenzt durch eine untere (UEG) und eine obere (OEG) Explosionsgrenze. Die untere Explosionsgrenze ist die niedrigste Konzentration, bei der eine Entzündung und eine selbstständige Flammenausbreitung beobachtet wird. Die obere Explosionsgrenze ist die höchste Konzentration, bei der gerade noch eine Entzündung und eine selbstständige Flammenausbreitung beobachtet wird.

Explosion protection

Reactive dust/air mixtures

- Aluminium
- Flavourings/organic
- Titan/metals
- Iron
- Powdered milk
- PC, GFK, PP, PE, polyester/plastics
- Paint powder
- Wood
- Herbicides
- Magnesium
- Medicines/chemicals
- Flour
- Zink

All dusty substances <500 m are reactive.

Ignition sources

- Auto-ignition
- Hot surfaces
- Open flames and hot gases
- Mechanically generated sparks (e.g. falling metal parts)
- Electrical systems
- Electrical equalising currents, cathodic corrosion protection
- Static electricity
- Lightning strike
- Adiabatic ignition sources (heat generation due to compression)
- Ultrasound
- Chemical ignition sources

ATEX Directive

A large number of national standards and directives were intended to ensure that the risk of explosion is minimised.

On 1 July 2003, the numerous national standards and directives for explosion protection were harmonised throughout Europe.
ATEX 95 (short for ATmosphère EXplosible) lays down requirements for products and is primarily addressed to manufacturers.
The directive concerns all electrical appliances, protective systems and their components that are located in potentially explosive atmospheres.

The following obligations arise for the manufacturers:

- Carrying out a risk assessment of the products
- Classification into equipment categories
- Stipulation of the intended use and operating conditions

ATEX 137 describes requirements for workplaces and is relevant for plant operating companies. It deals with occupational health and safety and has been implemented in German national regulations in accordance with the Industrial Safety Regulations. It essentially lays down the following obligations for employers:

- Determination of the explosion-related dust parameters
- Zoning according to explosion hazard
- Marking of areas at risk of explosion
- Definition of protective measures and operating instructions for the employees

Explosion protection

KST value

The KSt value is a useful dust and test-specific parameter that corresponds to the value of the maximum increase in pressure over time in a container with a volume of 1 m^3. The basic principles are the test conditions specified in the standards EN 14034, EN 14491 and ISO 618 4/1.

The KST value is calculated from the cubic law:

(dp/dt)max x V1/3 = const = KSt

bar	sec	=	bar/sec	*	1 m^3/3	=	KSt
10,8	0,025	=	432	*	0,333	=	144

(dp/dt)max
Under prescribed test conditions, the highest possible value for the increase in pressure over time that occurs in the event of an explosion in a sealed container.

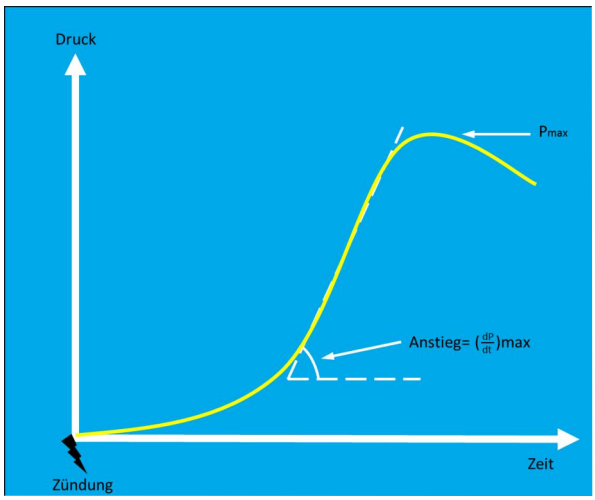
The KSt value is used to divide the dusts into so-called dust explosion classes:

Dust explosion classes = St. in bar * m * s-1

St 1 > 0 to 200

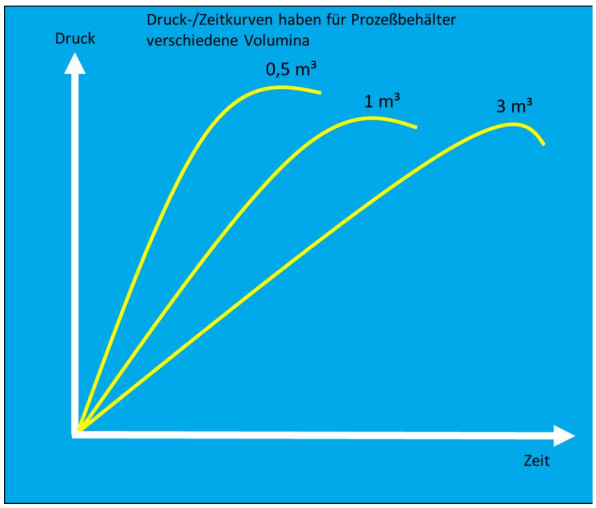
St 2 > 200 to 300

St 3 > 300



The image shows a time-pressure diagram as is typical for a dust explosion, the rate of pressure increase (dp/dt)max and the max. explosion pressure (pmax). They represent characteristic data for each type of dust.

Diagram: KIDDE DEUGRA



The picture shows the explosion sequences with the same dust, but in containers with different volumes. As you can see, the larger the free volume in the container, the slower the pressure increases, so that there is more time for countermeasures.

Diagram: KIDDE DEUGRA

Explosion protection

Planning steps

For all types of reactive dust, an investment in explosion-proof plant technology is legally required from the point of view of cost-effectiveness aspects and the consideration of hazard analyses and feasibility studies.

The possible solution for the specific application case must be determined on site.

- Hazard analyses
- Feasibility studies
- Cost-effectiveness aspects

Overall concept
(global system solutions)

Protective measures

Primary protective measures:

- Sufficient ventilation
- Concentration control (observe LEL /UEL)
- Replace medium with a non-combustible one
- Vacuum

Secondary protective measures:

- Avoid ignition sources
- Hot surfaces
- Open flames
- Mechanically generated sparks
- Electrical balancing currents
- Lightning strike, etc.

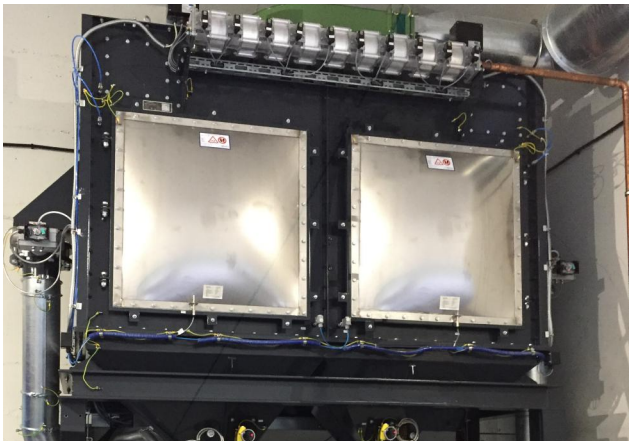
Structural protective measures for dust fires and dust explosions
Hazards – Assessment – Protective measures:

- Pressure-relieving design according to EN 14491
- Pressure shock resistant design according to VDI2263 - Sheet3
- Pressure-resistant design according to EN 14460
- Suppressive design according to EN 1437 3 and VDI2263 - Sheet 4
- Wet separation of the dust by wetting it in a wet separator according to VDI367 9
- Solid inertisation by adding inert dusts, e.g. rock salt or sodium sulphate according to VDI2263 - Sheet2

Structural protective measures

Pressure-relieving design according to EN 14491

Pressure relief installations are, for example, rupture discs, which can be installed in any position and ensure dust-tight closure. In the event of explosion-related overpressure in a plant section, these discs burst at predetermined break points and thus release relief openings.

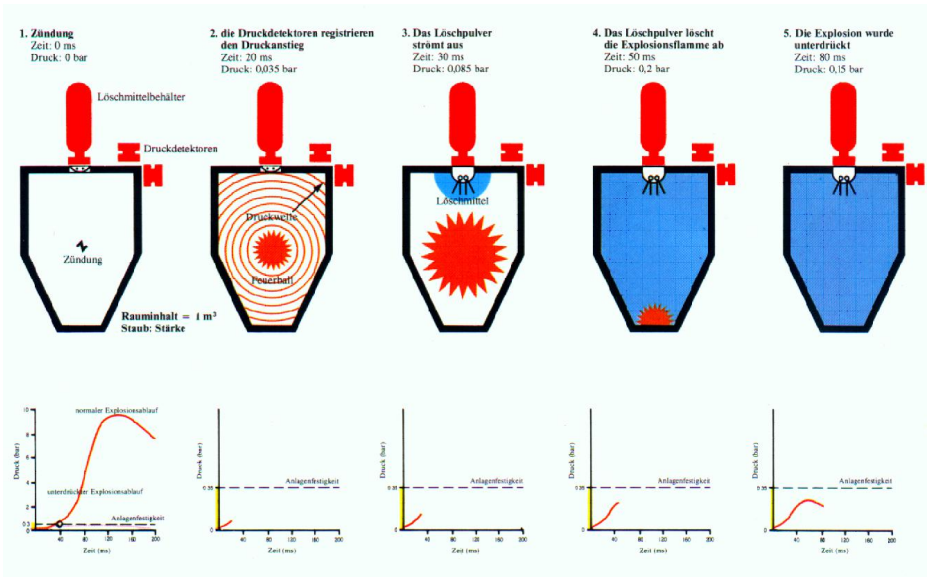


In addition, it should be noted that the pressure relief requires further measures, e.g. explosion-related decoupling of the pipeline and the design of a dust discharge facility with safe system closure.

Both the maximum explosion pressure and the KSt value of the dust must be known in order to dimension the relief surfaces. In addition, many other parameters must be taken into account.

Pressure shock resistant design according to VDI2263 - Sheet3

Explosion-suppressing design according to DIN EN 1437 3



Structural protective measures

Wet separation of dust - advantages of dry dedusting

In the field of fire and explosion protection, the wet separation of the dust can be achieved by wetting it in a wet separator. However, the wet separation variant, which is cheaper in terms of acquisition costs, has some disadvantages for plant operating companies.

Known disadvantages of wet scrubbers include corrosion, lower separation efficiencies, the need for treatment or reuse of used liquid and the costs of sludge disposal. In addition, there are extensive inspection obligations for plant operating companies for Legionella. In addition to the monthly in-house tests, plant operating companies must commission accredited laboratories and external experts with legionella testing at prescribed intervals according to the 42nd BImSchV (German Federal Immission Control Regulations).

For these reasons, LET® meschede has been relying for decades on the advantages of dry extraction in the field of industrial extraction and dedusting and is constantly developing this technology further.

Advantages of dry dedusting:

- The availability of the systems is set at six working days per week in 24-hour continuous operation.
- The high degree of purity of dry dedusting ensures that the purified air can even be returned to the production area via a recirculation process.
- The low energy requirement and the possibility of unrestricted heat recovery, e.g. recirculating air, guarantee the cost-effectiveness of the system.
- Dry dedusting requires only one energy source – electricity.
- Many materials (e.g. aluminium) do not incur any disposal costs, as the separated dust can be returned to the material cycle.

- The self-cleaning of the system makes hazardous and tedious manual cleaning work on and in the filter systems superfluous. Harmful germs and fungi are excluded due to dry dedusting.
- Additional chemicals, e.g. to avoid the foaming of drawing greases, are no longer

The higher investment sum compared to the dry filter system/wet scrubber system is relativised by:

- the lower operating costs
- the longer service life of the system
- Due to the compact and safe design, the systems are not tied to a location, e.g. the technical facility room or outdoor installation.

With many years of experience in the field of extraction of critical substances and the associated fire and explosion protection, LET® meschede offers individual and tailor-made solutions based on a dry and reliable separation technology.

Contact

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