

DUST COLLECTOR SYSTEMS AND EQUIPMENT FOR AIR CLEANING

APPLICATIONS FOR DUST COLLECTOR SYSTEMS

This is a short introduction of the application area Dust Collector Systems and more specific Fabric Filter systems, together with the relevant technical information on filter systems and pulse valves.

Air Pollution Control techniques

Air Pollution Control techniques, like all environmental protection systems, have become a subject of global concern. There are six (6) major technologies used for air pollution control:

- mechanical collectors
- fabric filters
- electrostatic precipitates
- wet, dry and semi-dry scrubbers
- selective catalytic reduction
- flue gas desulphurisation

An important driving factor for the investments in these systems are the local, and for Europe the European, legislations. But also the public opinion, the concern for their image can be a driving factor, especially for industrial companies, to invest in air pollution control systems.

Fabric filter systems are using pulses of air and therefore form an interesting market niche for us, being one of the leading companies for (solenoid) valves and pneumatic components.

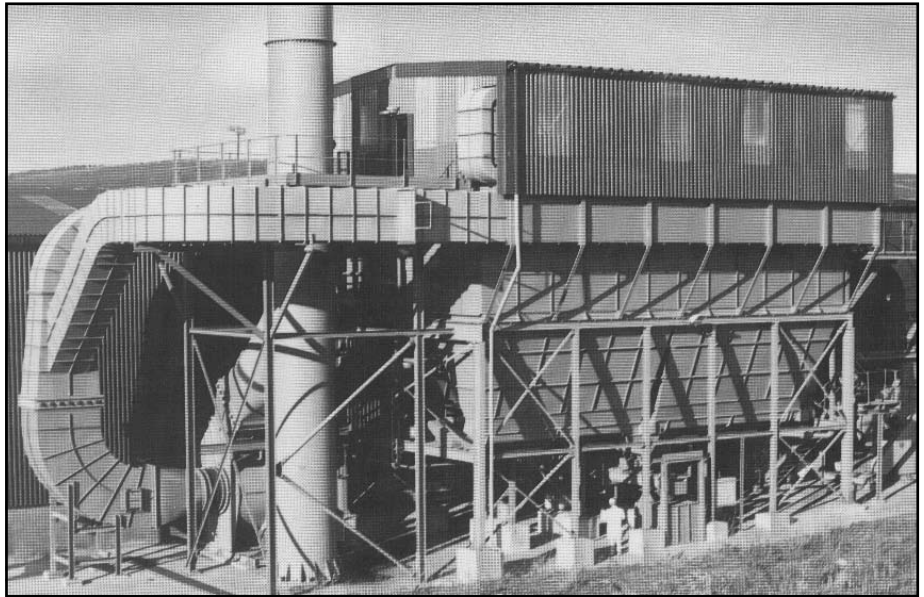
Fabric Filter Systems

The history

The first industrial applications for fabric filter systems were developed for the recovery of valuable products from dusts on fumes in nonferrous smelting and refining operations. Already in 1852 a man called S.T. Jones applied for a patent on a single bag design for the recovery of zinc oxide fume in the U.S.A.

Major improvements came after 1950, although a lot of patents and developments existed from before that time. In that period the Reverse Air Jet system was developed which had many advantages over the systems using a mechanical shaking mechanism to clean the bags.

At the end of the 50's the Pulse Jet Filtration system was introduced. This type of system provides, in a continuous cleaning filter operation, a uniform air flow and a



high air-to-cloth ratio. The design is very simple and contains almost no moving mechanical parts.

In the 70's and 80's developments were speed up because legislation more and more forced industries, power stations and waste incinerators to use air pollution control systems. This of course guaranteed an interesting market potential for the filter building companies.

Type of Fabric Filter installations

In general terms a fabric filter system consists of a porous flexible layer of textile material through which a dusty gas is passed to separate particles from the gas stream. Deposits on the textile are removed periodically by powerful moving and thereby cleaning of the cloth to maintain the pressure drop across the filter within practical operating limits.

There are several methods to make the movement of the textile which we will describe later.

Depending on the physical shape of the fabric (textile) we speak about bag or hose and envelope or pocket filter systems. The filter bags consist of round, oval or square bags (hoses) with a diameter from one to several decimeters. In the envelope or pocket filters the fabric is folded in the shape of an envelope.

The dust which is collected on the fabric during the filtration process has to be removed from time to time. Several techniques have been developed to do this.

Fig. 1 gives a schematic overview of the

cleaning systems most commonly used. The cleaning system has an influence on the maximum load of the fabric. This figure also shows the type of load used on the fabric. It's also clearly visible which side of the filters is open.

The major types of filtration systems to remove dust from the filter media are:

- shaker systems
- reverse air cleaning
- pulse/jet cleaning

A short description of each technique can be found below.

Shaker filtration systems

The filter bags or envelopes are intermittently shaken by means of an eccentric rod assembly and can only take place if the filtration process through the fabric is stopped. This cleaning technique is mainly used in smaller sized filter systems as the fabric load has to stay low. In general, this system is used in combination with weaved fabric filters. The cleaning function is not optimal, therefore the use of shaker systems is decreasing and is being replaced by the following techniques.

Reverse Air Cleaning

In this type of system the air or gas stream will be forced by a ventilator in the reverse direction to clean the filter bags. During this filtration action the filter system or a relevant section has to be shut off. This type of system can be used for low up till medium fabric loads. Also, the filter medium for this system is normally a woven fabric.

Pulse/Jet Cleaning

Pulse jet dust collector systems periodically inject short, powerful pulses of compressed air, in the direction opposite to the air flow, into a filterbag or a row of filterbags. This air shot creates a sudden bag expansion that breaks the dust cake from the outer surface of the bag's fabric. The dust is effectively removed by inertial forces as the bag reaches maximum expansion and falls down into a hopper. Depending on the type of installation, typical pulse time is around 100 msec. while the interval between the pulses in each bag or row of bags is around 3 to 6 minutes. More and more the pulse sequence will depend on the differential pressure measurements over the filter bags.

Sequential controllers or PLC's are used to program the interval time setting and commands to the pulse valves. There are systems using medium pressure (2-3 bar) and systems for high pressure (6-8 bar). Venturies are used to increase the air speed. The cleaning normally takes place

while the filter system is in operation. The fabric materials used in these systems have to be adapted to:

- the particle size
- degree of filtration
- filter resistance

See also figure 2, showing a typical setup of an air/jet dust collector system. The cleaning degree of this type of systems is very good which made the system very popular. A disadvantage is the high energy consumption and limited length of the bags.

Applications

Fabric filter systems are suitable for a broad application area because:

- small particle sizes down to 0,01 micron can be filtered
- with the enormous variety in fabric materials, most particle types can be filtered
- the temperature range has been increased due to the availability of new

filter materials such as Teflon (PTFE) for maximum 250°C and ceramic filter bags for a maximum continuous operating temperature of 1150°C

- investment level is relatively low compared to other air pollution control techniques.



Fig. 3

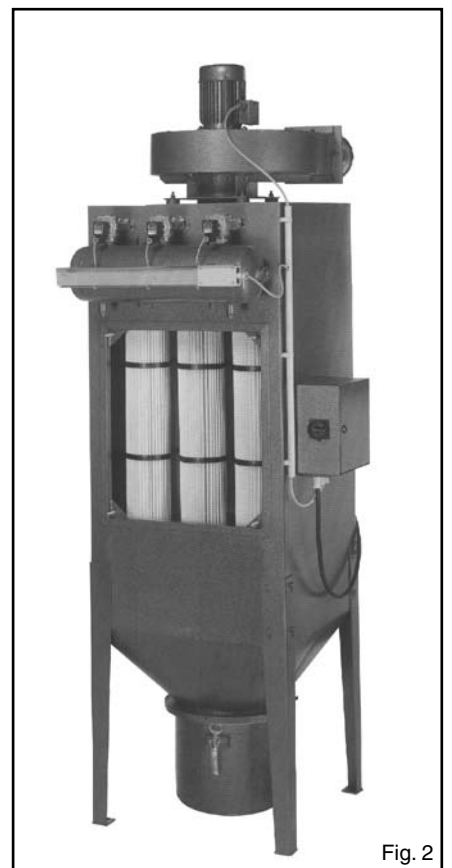


Fig. 2

Different types of filter cleaning

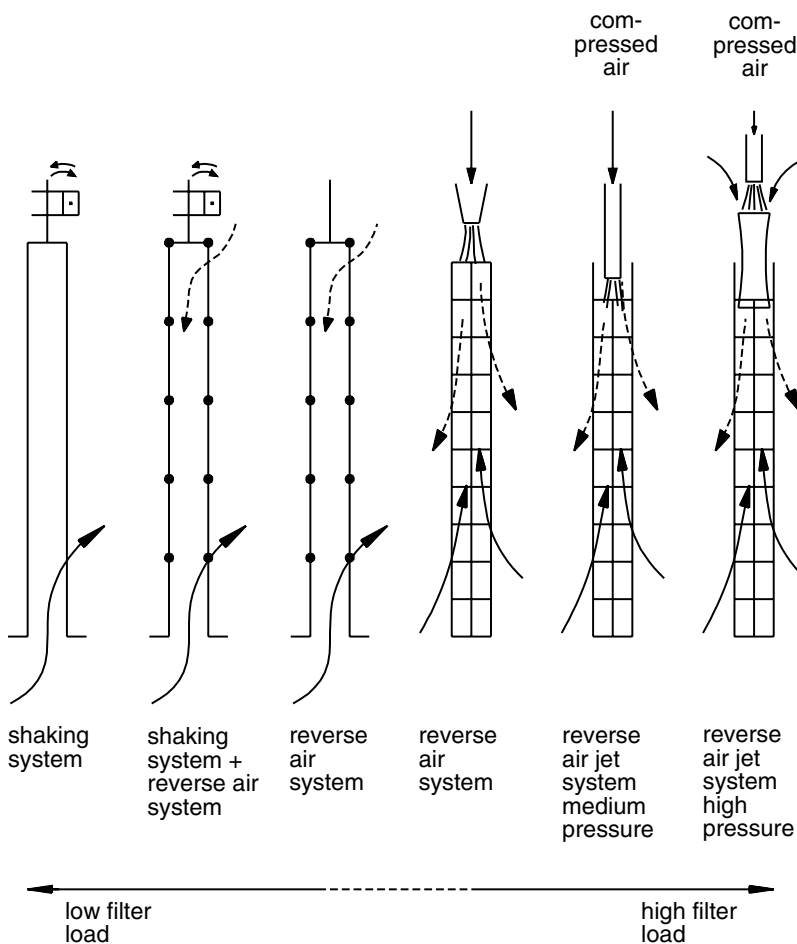


Fig. 1

DUST COMES UNDER THE ATEX DIRECTIVE 94/9/EC

ATEX is not just about potentially explosive gaseous environments, dust is equally dangerous. Therefore we have complemented our existing ATEX approvals for gaseous atmospheres with dust approvals for dust collector products.



The ATEX directive, which came into force on July 1, 2003, has concentrated the minds in all sectors of industry on the dangers of potentially explosive atmospheres.

The IECEx International Certification Scheme is a global certification scheme based on standards of the International Electrotechnical Commission and offers a certification of conformity with the IEC series of standards 60079, 61241 and 61779. This certification facilitates the international trade of electrical equipment intended for use in explosive atmospheres and contributes to avoiding the multiplicity of national certifications while guaranteeing an adapted level of safety. The certification is issued by an organisation recognised by IECEx, and all the certificates are available on the IECEx website.

ATEX and IECEx are more than welcome for the focus that they provide on industrial dust as a potential source of explosion. Almost all types of industrial dust can be considered to be potentially explosive, so it comes as no surprise that the procedure for technical evaluation of safety measures used to avoid the risks of dust explosions is both complex and extensive.

In order to describe the explosion risk posed by dust, a number of factors need to be described. These include particle size, explosion limits, the maximum explosion pressure, the destructive power of the combustion, moisture content and the minimum ignition energy required.

Once the dust has been characterised, an examination then needs to be made of the industrial processes concerned. This takes into account possible ignition sources, explosive volumes, operating temperatures and an assessment of the possibility of a dust explosion under given conditions.

Helpfully for engineers involved in safety evaluations of dust-laden atmospheres,

ATEX simplifies explosion protection with a three zone concept.

Zone 20 or category 1D, the most critical of the three, is an area in which an explosive atmosphere in the form of a cloud of combustible dust in the air is present continuously, or for long periods, or frequently. Typically, these conditions would be encountered on the inside of containers or pipelines and enclosed conveying equipment.

Zone 21 or category 2D, is a place in which an explosive atmosphere in the form of a cloud of combustible dust in the air is likely to occur in normal operation occasionally for example when discharging and filling equipment.

Zone 22 or category 3D, is a place in which an explosive atmosphere in the form of a cloud of combustible dust in the air is not likely to occur in normal operation but, if it does occur, will be persist for a short period only.

Areas in which dust escapes and forms deposits are included in this category. Whatever the zone, one of the biggest risks when it comes to preventing dust explosions, is posed by enclosures.

The ATEX directive defines the type of protection provided by enclosures, based on limiting the maximum surface temperature of the enclosure and using dust-tight and dust-protected enclosures to prevent dust entry.

The legislation covers two degrees of protection: dust-tight, for use of equipment in Zone 20, 21 and even 22 in the case of the presence of conductive dust; and dust-protected, for use of equipment in Zone 22 areas in the presence of non-conductive dust.

The scope of the ATEX directive on enclosures is comprehensive, extending down to electrical actuators used on individual valve types. This is important due to the increasing use of solenoid valves in the dust collector systems that reduce industrial pollution.

Our know-how on explosion proof enclosures and dust collector valves has resulted in the widest range of solenoid valves complying with the new directive for use in dust-laden and of course gaseous environments. The enclosures meet the needs of all industry types, being available in metals such as aluminium, cast iron and stainless steel and also the convenient epoxy encapsulations.

In addition our pilot boxes and Power Pulse Tank Systems are ATEX approved and the latter is also IECEx approved. Even the remote design can be offered as an ATEX approved product, following the Non-Electrical ATEX approval according to EN 13463-1.

