bomaksan®
INDUSTRIAL AIR FILTRATION SYSTEMS

CNC PLASMA, LASER and OXYGEN CUTTING

Dust Collector
SELECTION GUIDE

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1) Selection of Dust Collection Unit for CNC Thermal Cutting Machines

Compact Jet-Pulse Cartridge Filters can be easily used in many processes that generate dust and fume. They are generally preferred in applications where the inlet dust load is up to 12 g/m³. The applications where Jet-Pulse Compact Cartridge Filters are most frequently used are metalworking applications.

These applications are;
- Welding fume extraction system
  - o Manual welding
  - o Robot Welding
- CNC Laser / Plasma Cutting tables
- Grinding dust extraction system
- Powder coating extraction system
- Sandblasting extraction system

In this document, you can get information about CNC Thermal Cutting Machines (Plasma/Laser/Oxygen) Extraction System. You can benefit from our brochure, where you can get detailed information about the filter units and suction accessories used in the suction and filtration of dust and fume released from CNC Plasma, Laser and Oxygen Cutting applications.

If you want to get detailed information about other applications, you can access the "DOWNLOAD CENTER" on our website by scanning the QR code below from your phone.

DOWNLOAD CENTER
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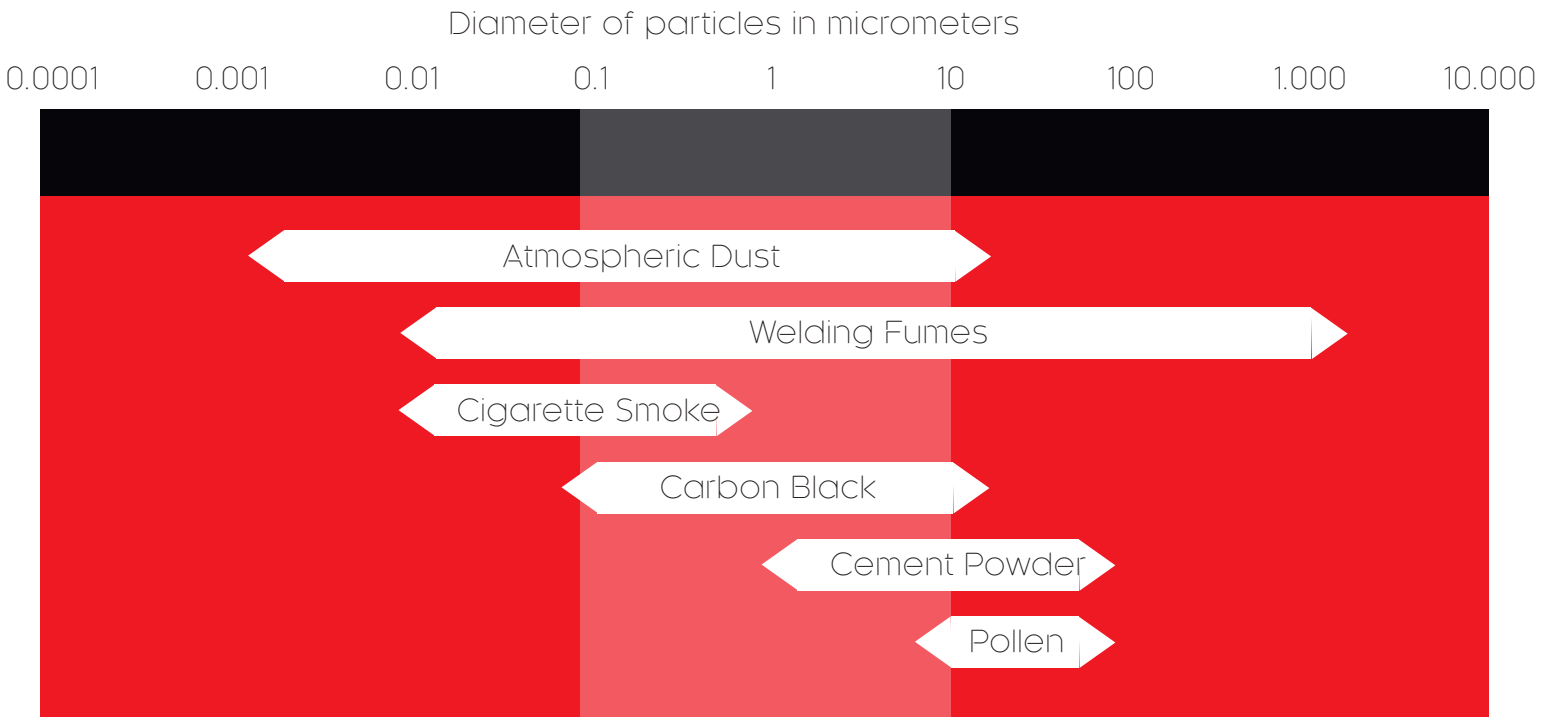


CNC Thermal Cutting Machines are a common method used in cutting sheet (Plate) metals. It has different technologies such as oxygen, plasma or laser. Although each technology has its own significant advantages and disadvantages, they are not much different from each other from the dust collection aspect. In addition to the fact that the dust and fumes released from these processes are dangerous for human health, a dust collection system is necessary for the healthy operation of the CNC cutting machines. The points to be considered when designing the filter unit and extraction system for CNC Thermal Cutting tables are;

1. Extraction / Cutting Bench

a. CNC Thermal Cutting Process is usually performed with a cutting torch connected to a bridge system moving on an downdraft extractoin table. Although this torch differs in cutting technology, the suction system usually does not differ too much.

b. Suction / Cutting benches must be designed modularly. Otherwise, the capacity requirement of the dust collection unit will be very high and it will return as unnecessary electricity consumption and dust collector unit cost.

c. Each suction module should have a flap. The flap of the module where the cutting process takes place is opened and the other flaps are closed. Thus, the suction takes place only from the module where the cutting is.

d. The air velocity in the ducts inside the cutting bench should be min. 20 m/s, and max. it should be 27 m/s.

Dust Conveying Speed is Important!

At speeds below 20 m/s, dust may accumulate inside the machine.
At speeds above 27 m/s, there is a decrease in suction due to high in-duct resistance.

2. Ductin Design

a. Ducting can be done with flanged connection or high-strength flexible hoses. However, it should not be made of thin spiral galvanized ducts. Thin spiral galvanized ducts may experience wear, tear and puncture over time. This is a very risky situation in terms of OHS.

b. It is very important that the ducting is done in a way that does not create turbulence in the air flow. For this reason, make sure that the ducting is checked and approved by experts.

3. Filter Unit

a. Filter units with jet-pulse cleaning system should be preferred for Thermal Cutting (Oxygen, Plasma or Laser) dust filtration.

b. Spark Arrester:

i. A spark arrester integrated in the filter unit should be used. Intense sparks are released during the thermal cutting process. If these sparks reach the filter unit, it may cause a fire. A spark arrester should be used to minimize this risk of fire.

Fire Risk!

Fire is an important risk in CNC Thermal Cutting Machines. Even if some precautions are taken to eliminate this risk, it is not possible to completely eliminate the risk of fire.

ii. As the spark arrestor can be integrated into the filter unit, it can also be positioned in front of the filter unit, in the ductline.

c. Radial, backward curved medium pressure fans with thin blades should be preferred. Fan types such as cell aspirators, axial fans, dense bladed fans, jet fans that are not suitable for dust and fume extraction.

d. According to the type of metal cut, min. F9 or H13 class filters should be preferred.

e. Filter media;

i. If polyester-based;

A.It should be min 260 g/m².

B. Filtration speed should be max. 1.5 m³/m²/min

C. ePTFE membrane filters should be preferred. Standard polyester filters are not suitable for this application.

ii. Cellulose-based filters should not be preferred for thermal cutting applications.

iii. If it is a mixture of Cellulose/ Polyester

A. It should be min. 110 g/m².

B. Filtration speed should be max. 0.85 m³/m²/min

C. It should be coated with nanofiber. (Required for F9 class efficiency)

D. FR (Flame Retardant) coating should be used.

Polyester Based Filters!

1,50

100% Polyester filters should be coated with ePTFE membrane. In this case, the filtration velocity should be at most 1.5 $m^3/m^2/min$.

Cellulose/Polyester Filters!

0,85

Cellulose/Polyester blend filters should be coated with nanofibers. They should provide min. F9 class efficiency. Filtration rate should be 0.85 $m^3/m^2/min$ at most.

f. If the Filter Unit will be located indoors;

i. Sound pressure level should be max. 80 dB(A). If this is not possible, the unit should be located outdoors.

g. Electric panel;

i. Panels with delta-star, soft starter or frequency inverters can be preferred.

ii. The panel must be manufactured in accordance with the machinery safety directives and must have the necessary electrical equipment.

iii. In order to work in harmony with CNC machines, there must be a process operation option in the filter unit. Thanks to this option, the filter unit can work synchronously with the CNC machine.

Attention to Control Board!

1) There must be an "Emergency Stop Button" on the panel. When this button is pressed, the power to the motor is cut off and the fan stops. It is one of the indispensable elements for machinery safety directives.

2) Fan rotation direction warning on the panel will prevent possible faulty commissioning. It is therefore recommended to have this warning.

3)The process run option is essential for co-operation with CNC machines. Question this option.

Risk of Occupational Diseases!

Exposure to Welding Fumes, CNC Thermal Cutting Fumes, Grinding and Polishing Dusts causes occupational diseases. Occupational disease not only takes away the health of the employee and puts him in a difficult situation, but also causes his employers to suffer under heavy compensation burdens.

2) What are Jet-Pulse Compact Cartridge Filters?

Compact Cartridge Filters or compact dust collection units are the general name given to dust collection units that combine fan, filter, control panel, dust discharge equipment and jet-pulse compressed air cleaning system in a single product. The main purpose of these products, which are also referred to as Plug&Play, is to collect all the accessories in a single body, to provide ease of transportation and assembly, and to save space in the region where they are installed.

2.a What is Compact?

"Compact" means that all accessories are together and that the device does not require different equipment for its operation. In compact products, fan, filters, cleaning system and dust removal elements are located directly on the device. In this way, while providing ease of transportation and assembly, it also saves space.

PLUG & PLAY

It is the general name given to the devices that do not need additional installation other than Electrical and Compressed Air Connections.

2.b What is Jet Pulse?

"Jet-Pulse" is the universal name for compressed air cleaning system. In Jet-Pulse systems, filters are automatically cleaned with compressed air. In this way, maintenance costs are reduced and companies that make serial production are provided with the opportunity to work continuously. Not every jet-pulse system is the same. As Bomaksan, we offer a state of the art jet-pulse cleaning system in all of our products, thanks to the R&D project which we develop to improve our Jet-Pulse systems.

The biggest difference between Round Cartridge Filters and Panel filters is their shape. While panel filters are in the form of a rectangular box, cylindrical cartridge filters are in round form. The biggest advantage of panel filters is that they can be cleaned more easily and naturally have a longer service life.

Cartridge filters are often compared to bag filters. There are 2 points to consider here;

1. Which type of cartridge filter is compared?

2. What is the application in which the filter unit will be used?

2.c What is Cartridge Filter?

"Cartridge Filter" is a general name given to pleated filters. In cartridge filters, more efficient filtration systems can be created in smaller areas by increasing the filter area by folding / pleating method. Cartridge filters are also divided into 3 types. These are;

- Round/Oval Cartridge Filters
- Panel Filters

Which Type of Cartridge Filter?

Cartridge filters are divided into types according to their physical structure and properties. Other types can be quite successful in applications where some cartridge filters do not work. For this reason, it is necessary not to be biased in the processes and to trust technically experts and companies.

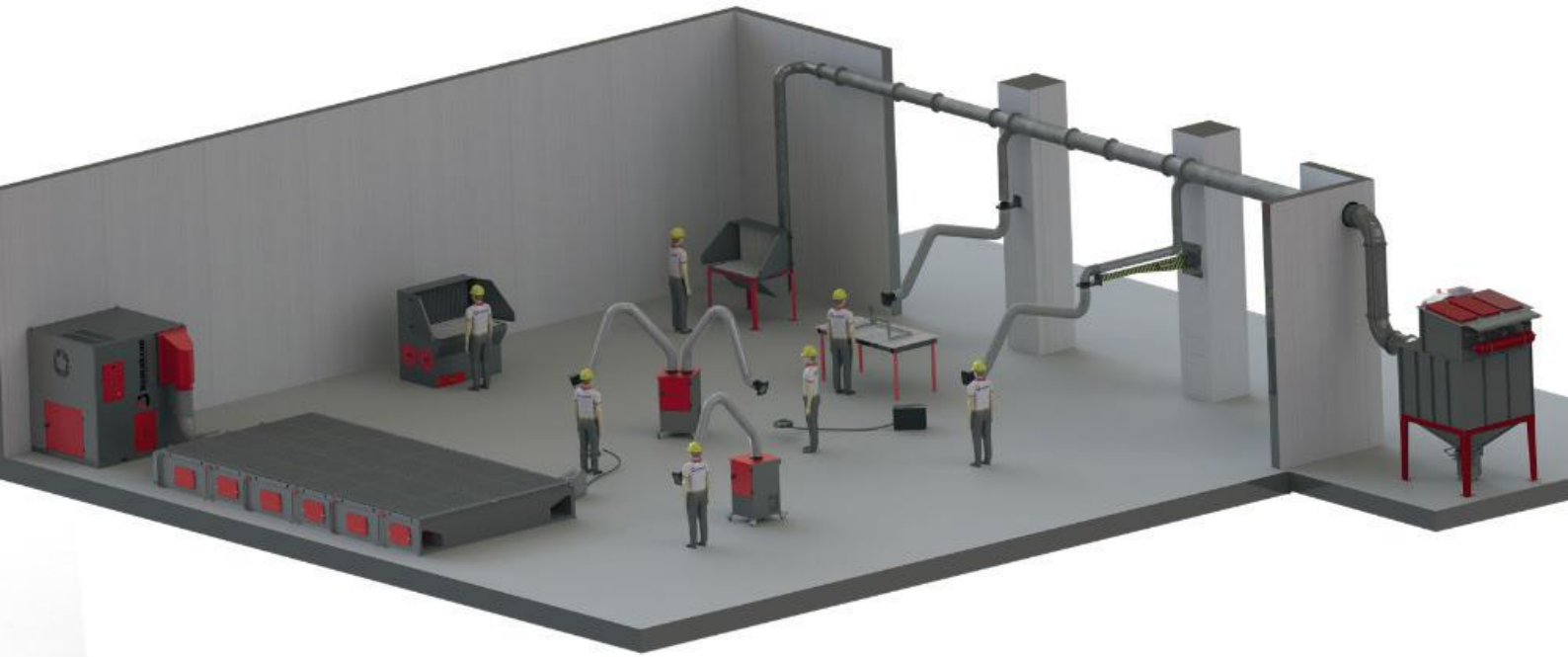
2.c.i. Which Cartridge Filter

Pleated Bag Filters, one of the cartridge filter types, can be used safely in almost all applications where bag filters are used. The most important difference that distinguishes pleated bag filters from other types is their pleat depth. While the pleat depth can be 45-50 mm in round cartridge filters, this depth is around 18-22 mm in pleated bag filters. In this way, pleated bag filters can be cleaned more efficiently with the jet-pulse cleaning system and can be easily preferred in many applications where round cartridge filters do not work.

Pleated Bag Filter

2.c.ii Which Application?

Round cartridge filters and panel filters can easily be used in many dust and fume applications, but in applications where the dirty air inlet dust load is very high, the cartridge filters can quickly become clogged. You can get information about the right solution for your application from your Bomaksan sales representative.



3) Features to consider when comparing offers

Apple-to-apple comparisons are difficult, as dust collection systems require a technical and highly specialized purchasing process. Our aim is to help our customers choose the right solution for them when investing.

The first thing you should do when choosing a dust collection system is to have each company fill in the "dust collection system offer collection table" for the offers you receive. You can get this chart from our clean air experts. The explanations of cells in this table are given in detail later in the document

3 a. What is Suction Flow?

Different terms such as Suction Flow, Air Flow, Capacity can be used. Suction Flow is the name given to the air flow that the used fan gives at a certain pressure value. The critical thing here is to specify the value of the suction flow at the pressure to be used. The flow rate specified in some technical catalogues is stated as the maximum flow rate that the fan can give, which is quite misleading. Because the fan will never reach that value under real conditions.

The most accurate approach in this regard is to determine the air flow rate given by the fan at the calculated fan pressure over the fan performance curve.

3.b. What is Fan Pressure?

Fan total pressure is the name given to the total pressure loss that the fan can overcome. In suction lines;

- Suction Hood
- Dust / Fume transport ducts (Elbows, etc.)
- Pre-Seperator (Cyclone, Spark arrester etc.)
- Filter unit
- Ducting between filter and fan
- Silencer
- Stack
- Jet-Cap etc. equipment

There are areas that are resistant to suction. Each of these areas are areas that resist suction or, in other words, cause pressure loss. The total pressure loss created by these areas constitutes the total pressure that the fan you will buy must be overcome. While selecting the fan, it should be noted that the fan reaches the requested flow rate at this total pressure.

Be Careful

While Evaluating the Fan

The point to be considered when examining the technical specifications of the fans is that the required flow rate can be obtained at the required pressure. While some companies give max. fan capacity information as "extraction capacity". However, this value has no meaning for you, because you will never experience this level in your process. Therefore, it is useful to examine the fan capacity and motor power together.

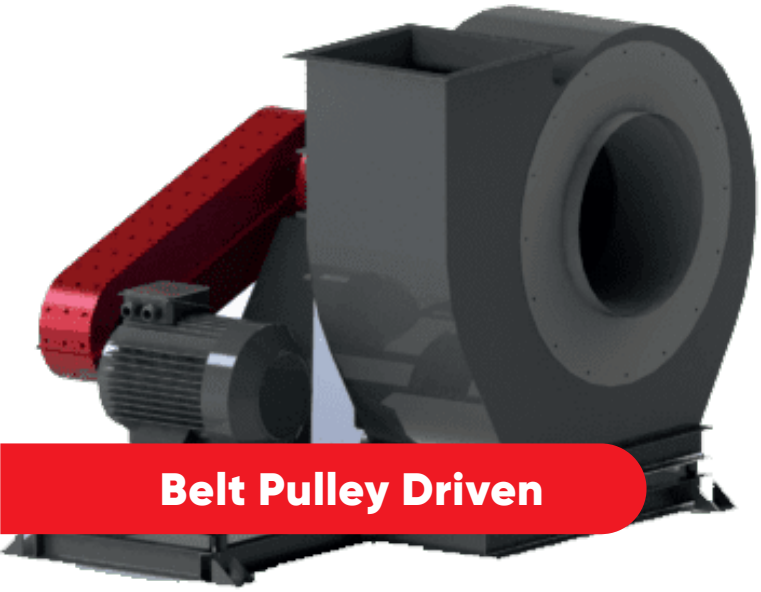
3.c. What is Fan Drive Type?

Fan drive type specifies how the motor drives the impeller in the fan. Three types of drives are generally used in radial fans;

- Direct Drive: These are the fans in which the motor drives the impeller directly via a shaft.
- Direct Coupling: These are the fans in which the motor drives the rotor via a coupling shaft.
- Belt Drive: These are the fans in which the motor drives the rotor with a belt

Which Is Better?

It would not be correct if someone say one is better than another in all applications. Any one of them can be the right choice according to the needs of the process.



Belt Pulley Driven

3.d. What is Shaft Power?

Shaft power is the total power required to rotate the shaft relative to the suction capacity of the fan and the total fan pressure. The spindle power calculation is a mathematical calculation. The formula is given below;

Shaft Power Calculation

$P = (P(t) \times Q) / (102 \times \eta(m) \times \eta(mech.) \times 3.600)$

P : Spindle Power (kW)

P(t) : Fan Pressure (mmSS)

Q : Suction Flow (m^3/h)

$\eta(m)$: Motor Efficiency

$\eta(mc)$: Mechanical Efficiency

$\eta(mc)$: Mechanical Efficiency

The critical factor here is fan efficiency. Fan efficiency can never be 100% and it is generally acceptance is;

- Motor Efficiency: 85% (Standard acceptance differs according to the IE class and power of the motor)
- Mechanical Efficiency;
  - o Direct Drive: 90-95% efficiency
  - o Direct Coupling: 80-85% efficiency
  - o Belt Drive: 80-85% efficiency

Example Calculation;

Q = 4.000 m^3/h

P(t) = 275 mmSS

Fan Drive = Direct Drive

Shaft Power

= (4.000 / (102*0,85*0,90*3600))*275

= 3,92 kW

Shaft power calculation is critical in motor selection. The motor to be used should be chosen at least 5% higher than the calculated shaft power.

3.e. What is Motor Power?

Motor power is the power of the fan included in the compact filter unit you will buy. As mentioned on the previous page, it should be selected above the shaft power. It is expressed in HP in the imperial system and in kW in the metric system.

Motor power is one of the most important parameters in a dust collection system, because motor power directly affects the suction performance. It is not mathematically possible for 2 fans with different motor powers to show the same performance. Although many Purchasing professionals want to buy a fan that consumes less electricity, if the fan they bought does not perform enough, they will make a wrong investment. This will return as a higher cost at the end of the day.

For this reason, in order to provide energy efficiency during the first investment, instead of reducing the motor power, the use of VFD or a motor with higher IE efficiency should be preferred.

Be Careful
While Evaluating the Fan

Although many Purchasing professionals want to buy a fan that consumes less electricity, if the fan they bought does not perform enough, they will make a wrong investment. Instead, using an VfD or choosing a motor with higher IE efficiency would be more accurate.

3.f. What is Filter Cleaning System?

In dust collection systems, the filters need to be cleaned from time to time. Otherwise, as the filters get dirty, their air permeability will decrease and the resistance (pressure loss) they create will increase. This pressure loss will affect the fan performance and in a short time, there will be inadequacies in the suction performance.

For Dust Collection and Fume Extraction!

Cleanable filters should be preferred for dust collection and fume extraction systems.

In order to avoid this problem, cleanable filters are preferred for dust collection and fume extraction systems. Cleanable filters are the general name given to filters that can be cleaned and reused with compressed air. Different types of cleaning systems can be used in filter units, depending on the frequency of operation. In some cases where the frequency of the welding operation is too low, manual cleaning systems are preffered. In such case, maintenance teams are expected to do manual cleaning. In cases where there is continuous use, there are 3 commonly used methods;

3.f.i) Jet-Pulse Cleaning System:

It is the most widely used method in dust collection systems. This method has an header tank, solenoid valves and selenoid valve control unit. Thanks to the dP sensor that monitors the filter level, the filters are cleaned with compressed air when needed. It is used for cleaning cartridge filters, panel filters, bag filters and pleated bag filters.

3.f.ii) Cleaning with Shaker:

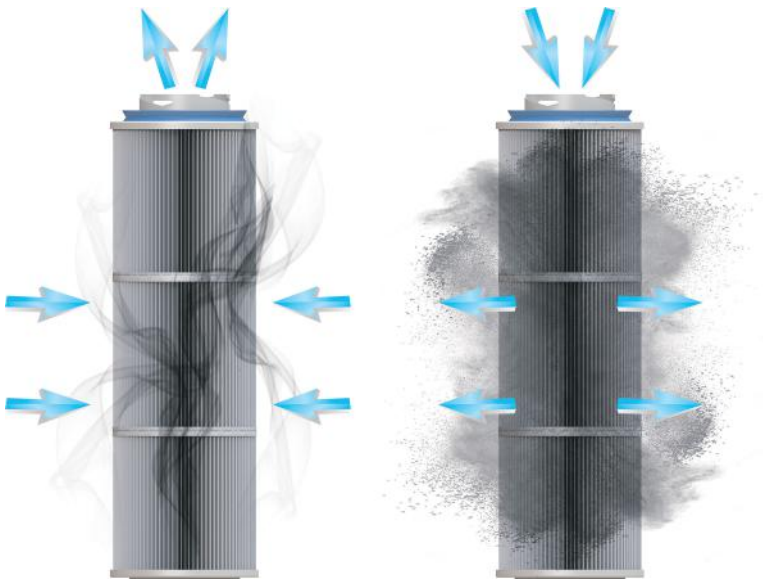
It is one of the oldest methods used in dust collection system. A vibrator motor shakes the filters mechanically, allowing the dust on the filter to be poured into the hopper. It is preferred in applications where large particles such as splinters are filtered rather than dust and fume. It is used for cleaning bag filters.

3.f.iii) Reverse Air Cleaning:

It is a rarely seen system in dust collection system. It is similar in method to Jet-Pulse cleaning, but the most important difference is that it can blow at low pressure. For this reason, it is difficult to ensure the effective cleaning of the filters. It is suitable for use in very special and rare applications. It can be used for cleaning bag filters.

Which Is Better?

Jet-Pulse systems are newer technologies. The usage areas of Reverse Air and Shaker systems are very narrow.



3.g. What is Total / Net Filtration Area?

Total filtration area is the total area of all filters in a dust collection unit. In systems called OFFLINE, there is a difference between the filter area where the air passes instantly and the total filter area. For example, in an OFFLINE filter unit with 3 compartments, when filter cleaning starts in 1 compartment, the air flow to that compartment is cut off. Therefore, the net filter area of this unit is 2/3 of the total filter area.

Net / Total Area Difference?

Total filtration area is the total area of all filters in a dust collection unit. The net filter area is the sum of the filter area filtering the polluted air passing through the unit.

The total filter area is one of the most important parameters to consider when purchasing a dust collection system. It is directly proportional to the air cleaning capacity of the filter unit. However, the most important point to be considered here is the base material of the filter used. Some filter materials can have the same filtration efficiency when they have a higher filter area due to their technology. For example, when comparing the filter areas of a cellulose/polyester blended filter media with a 100% polyester filter media, the filter area of a 100% polyester filter should be multiplied by 2. An example calculation is given below;

Equivalent Filter Area

20 m^2 110g/m^2 80% Cellulose / 20% Polyester media and 10 m^2 260 g/m^2 100% Polyester filter media are equivalent in terms of filtration capacity.

3.h. What is Filtration Media?

Filtration media, or filter material, forms the heart of a dust collector. The filter media is the area where the air is cleaned and if the right selection is not made, it will affect the operating performance of the entire system. There are 2 basic elements in the selection of filter media.

3.h.i) Base Material:

Indicates the base material of the filter media. The type of the base material and the weight of the same species are also important criteria. The most commonly used base materials are listed below;

- **Spunbond Non-Woven Polyester:**

It is a synthetic filter media with different weight types. A minimum density of 250 g/m² should be preferred in dust collection applications. It can be used in cartridge filters, pleated bag filters and panel filters.

- **Cellulose / Polyester Blends:**

It is a blend filter media with different weight types and different cellulose / polyester ratios. In dust collection applications, a minimum density of 115 g/m² and a mixing ratio of 80/20 should be preferred. It can be used in cartridge filters, pleated bag filters and panel filters.

- **Needle Felt Polyester :**

It is used in bag filters, but cannot be used in cartridge filters. Because Needle Felt Polyester media is not a pleatable media. It starts at 450 g/m², but in heavy powder applications, choosing a density of 500-550 g/m² is ideal.

- **mAramid :**

It can be used in bag filters. There are also technologies developed for cartridge filters. mAramid media is preferred at high temperatures (up to 180°C).

- **PTFE :**

It is a base media used in bag filters. It can also be used as coating or membrane. PTFE bag filters are used in applications where high temperature and high filtration efficiency are demanded.

3.h.ii) Media Coating/Membrane:

It is the general name given to the coatings made on the base material. Thanks to the rapidly developing technological developments in recent years, important breakthroughs have been achieved in media coating technologies.

- **ePTFE membrane:**

PTFE is the abbreviation of polytetrafluoroethylene material registered with the Teflon brand by DUPONT. ePTFE is referred to as expanded PTFE. The PTFE material is expanded with temperature and adheres to the surface of the material to be coated for a long time. It is a high-tech membrane application which can be applied on Spunbond Non-Woven Polyester and Needled Felt.

- **Aluminum Coating:**

Aluminum coating is a coating process on Spunbond Non-Woven Polyester material. The main purpose is to neutralize the load of statically charged dust on the filter media, to ensure that they can be cleaned more easily and to prevent the potential risk of sparks. Aluminum-coated filters are usually shipped with a grounding wire.

- **Oleo and Hydrophobic Coating:**

Oleo and Hydrophobic coating is a type of coating that can be applied on all materials. Another name of the oleo and hydrophobic coating is the Water and Oil Repellent coating. This feature can be achieved with many different techniques.

- **PTFE Spraying:**

PTFE material is sprayed to cover the material. Coating life is low compared to ePTFE.

- **Nanofiber Coating:**

It is the name given to the creation of nano-sized fibers and spraying them on the filter media with different techniques, thanks to the technology developed in recent years. Thanks to this coating, the efficiency of base filter media with low filter efficiency is increased.

- **Flame Retardant:**

Also called FR, it is a type of coating that aims to reduce the spread of fire. It does not prevent the fire, but by delaying it, creates the chance of early intervention.

Right Known Mistakes!

Unfortunately, there is incomplete and incorrect information on the market about filter media. Some of these are given below;

1. TEFLON = Non-Woven Polyester:

Unfortunately, many filter manufacturers call spunbond non-woven polyester filter media without any coating, TEFLON. However this is not true. TEFLON is the registered trademark of Dupont for PTFE material. You should be very careful about this.

2. ePTFE = PTFE Spraying:

Unfortunately, one of the biggest mistakes made worldwide is mixing PTFE spraying with ePTFE coating technologies. There is a very serious difference in quality and price between these two products. (ePTFE is more expensive). For this reason, this issue should be specifically questioned in proposals.

3.i. What is Filtration Velocity? (Air-to-Cloth Ratio)

Filtration velocity (or Air-to-Cloth Ratio) is the name given to the rate at which polluted air passes through the filter surface area. It is expressed in $m^3/m^2/min$. The filtration velocity value is a value that has a direct effect on filter efficiency and filter life. The calculation is quite easy;

Filtration Velocity Calculation

ACR = (Q / A / 60)

ACR : Filtration Velocity (m/min)

Q : Air Flow Volume (m^3/h)

A : Filter Area (m^2)

Example Account:

Air Flow (Q) = 12.000 m^3/h

Net Filter Area (A) = 240 m^2

Filtration Rate (ACR)

= (12,000 / 240) / 60

= 0.83 $m^3/m^2/min$

When comparing the filtration velocity values of 2 offers, the base material must be the same.

Equivalent Filter Area

It would not be right to directly compare an offer that uses a blend of 80/20 Cellulose Polyester as the filter base material with an offer that uses spunbond non-woven polyester. The media technology of spunbond non-woven polyester is a more advanced technology. Therefore, the filtration rate can be up to 2 times.

Example:
Base Media: Cellulose / Polyester Blend
Coating: nanofiber
Filtration Velocity: 0.83 $m^3/m^2/min$

Base Media: Spunbond Non-Woven Polyester
Coating: Hydrophobic
Filtration Velocity: 1.5 $m^3/m^2/min$

Although the filtration rates of these two filters are different, their working performance will be very close to each other.

When comparing 2 proposals using the same base material, the filter life and filter efficiency of the lower filtration velocity will be higher.

Example:
Base Media: Spunbond Polyester
Coating: Hydrophobic
Filtration Rate: 1.5 $m^3/m^2/min$

Base Media: Spunbond Polyester
Coating: Hydrophobic
Filtration Rate: 1.1 $m^3/m^2/min$,

The filter life and efficiency of the second proposal will be higher.

Beware of Coatings!

Before comparing offers with the same base media and different filter coating, agree on one of the coating types and ask all companies to use the same coating technology.

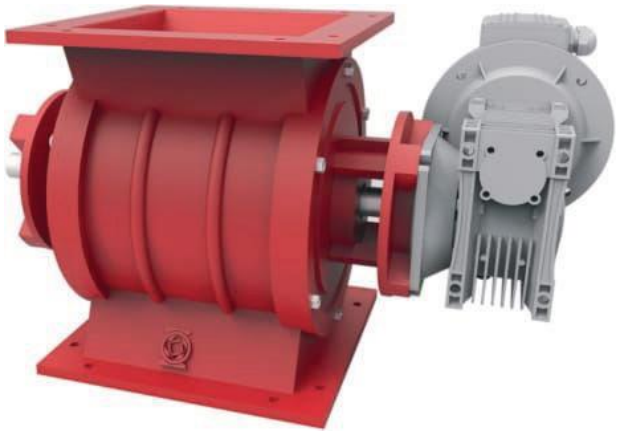
3.j. What is Dust Discharge?

Dust collection units collect dust and accumulate them in a chamber inside or outside of the filter unit. They have to empty the dust they have accumulated from time to time. Different technologies can be used in the dust discharge process;

- **Dust Drawer:** It is a drawer with low dust collection volume inside the filter unit. It is preferred in applications where continuous operation is not performed and there is low dust density.
- **Dust Bin:** It is a container with medium dust collection volume inside the filter unit. It is preferred in applications with continuous operation and medium dust density. Dust bins are generally used in compact filter units.
- **Rotary Valve:** Also called Air Lock. it is the equipment that is located under the hopper in the filter unit and ensures that the dust collected in the hopper is discharged in a healthy way. It usually pours the powder into a BIG-BAG or Container. It is preferred in applications with continuous operation and high dust density.
- **Screw Conveyor:** Screw conveyors are equipment that is located under the hopper of the filter unit and ensures that the dust collected in the hopper is discharged in a healthy way. Unlike the air lock, it empties all the dust poured into the hopper from a single outlet, even in large filter units. It is preferred in applications with continuous operation and high dust density.

There is no such thing as good or bad in dust discharge technologies. Selection can be made according to the suitability of the application and the location where the filter unit will be placed. Of course, dust bins with high dust collection volume should be preferred over dust drawers. This is because dust drawers with a low dust collection volume should be maintained frequently and the dust inside should be emptied. However, this maintenance can be done less frequently in dust bins with higher volumes.

Again, Rotary Valves or Screw Conveyors that can provide continuous discharge are more advanced technologies than dust bins. However, they should be preferred according to the application



Indoor Installations

Dust Drawer or Dust Bins are generally preferred in dust collection units installed indoors. The reason for this is that the Rotary Valve and Screw Conveyor greatly increase the size of the dust collection unit. Of course there can be exceptions.

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