Dust Collector Evaluation and Selection Guide

It is important to select the best type of filter elements for your pulse jet dust collector. The user has a dazzling array of choices. The choice may well affect process operation for many years as well as the cost of operation, pressure drop, compressed air usage during operation, filter element life, and efficiency of collection.

(Mechanical Cleaning) Shaker Dust Collectors

In general shaker collectors can be applied to almost any application where it is possible to clean collectors off line either by isolating with a damper(s) or stopping the exhaust fan to clean the collectors. They are limited on the dust concentration they can handle. We would generally say less than 5 grains per cubic feet. Another thing to remember is often off line cleaning for pulse collectors is an option. “Shakers” are applied most definitely for some crystalline dusts such as glass, ceramics, quartz and some plastics, where, when pulsed, the cake is blown apart and reverts to un-agglomerated fractions. These should be covered in separate application bulletins.

Types of Pulsed Reverse Jet Collectors

Generally, the collectors are divided into two categories; fabric (baghouse) and cartridge (pleated filter). It used to be a matter of whether the media was pleated or not pleated. Or it used to be a matter of filter media itself. Now this distinction has blurred. Some new pleated fabric media are applied to cartridge collector designs while pleated media construction is applied to replacement filters on existing fabric collectors.

For purposes of this dust collector guide we must redefine the categories to include new technical breakthroughs in construction, media, media construction and uses. In order to make this distinction, we will consider all pulse cleaned collectors as having pleated media. An old collector with cylindrical bags would be considered to have pleats that are equal to the circumference of the bags with a zero pleat depth. With this definition in mind we can define the collectors and their application as being separated by the characteristics of the pleat shape.

Category 1; Cylindrical Filter Elements (i.e. Baghouses)

These cylindrical element dust collectors are further divided into two distinct designs.

Category IA; Conventional Technology

These reverse jet configurations, developed in the early 1960s, were characterized by venturi like cylinders and modified cones that fit into the exit openings of the bags.

Category 1B; Advanced Technology

These reverse jet configurations, first developed in 1978 (upgraded in 1982 and again 2004 by ULTRA-FLOW), in which the flow and velocity characteristics of the cleaning jet are modified to develop and maintain a more efficient porous filter cake that operates a half the pressure drop, lower compressed air usage, as well as higher collection efficiencies and longer filter element life than the conventional technology designs.

Category 1A; Conventional Technology cylindrical bag collector

these designs, with close to one million installations worldwide, have dominated pulse cylindrical filter element dust collectors for almost 50 years and continued to be specified by most engineers and contractors. Originally, they were specified to run at filter ratios of up to 14 [volume as CFM per bag divided by square foot area of the filter element]. However, subsequent changes in reverse jet design in 1969 altered the jet characteristics which resulted in the filter ratio reduction to less than half of the original values. The filter ratio reductions were an effort to extend filter element life beyond 24 months on typical applications. The 1969 design also ran at pressure drops of 4.5 to 6.5 inches water gauge, which was up from 3.5 to 4.0. Compressed air usage is was doubled from the pre-1969 designs. The post-1969 designs also and dust penetrations three to four times higher than the original designs. The post-1969 designs owned their deterioration in performance to the high velocity cleaning jet which was increased by 70%. Since the velocity of the dust leaving the bag during a cleaning pulse is proportional to the jet velocity, the dust was propelled against the adjoining rows of bags in the filtering mode. This high velocity cleaning mechanism caused the filter cake to have lower permeability and increased "bleeding" of dust after each cleaning pulse. The dust that bled through the bags was primarily the finer components. Bag life was shortened and the filter ratio was further lowered by the specifying engineers to extend filter element life. As a further demonstration of this design principle, very low density dusts such as foam and paper dust can be collected at low pressure drops in high efficiencies if upward can velocities are very low or high inlets are applied.

Category 1B; Advanced Technology reverse jet configurations for cylindrical bag collectors

These relatively new designs were developed around 1978. Cleaning jet velocities were reduced and flow volumes of the cleaning air jet was increased beyond levels used in the pre-1969 conventional designs. The jet volume was increased to allow more filtering volume per bag. The Venturi tubes were eliminated so that maximum filtering capacity was tied to filter element bag opening area (usually bag diameter). The pressure drops were reduced to 1.5 to 2.5 inches water gauge for an overwhelming majority of applications. The dust penetration was reduced by 70 to 90%. Bag life was increased by at least 200%. While compressed air consumption was decreased by at least 200%. Because of the increase collection of the finer dusts, due to the gentle yet powerful cleaning action, inlet and associated gas and dust distribution had to be modified to eliminate or drastically reduce can velocity in order to allow these finer dust components to fall into the collection Hopper. There are also some revolutionary yet well documented arrangements to allow Hopper inlets to accomplish very low can velocities.

Category 2; Pleated Filter Elements (i.e. cartridge style dust collector)

These filter elements have pleats which eliminate the main disadvantage of the type 1A conventional cylindrical collectors described the above. The jet velocities can be higher or lower. During the cleaning cycle the dust ejected from the filtering surface is propelled toward the opposite side of the pleat solar filter cake is maintained porous and with the low pressure drop regardless of the reverse jet velocity. When properly designed pressure drop in performance is similar to category 1B performance. These pleated elements can be classified into one of two sub categories.

Figure 1 illustrates both category 2A, type NA and category 2B type WA filter elements.

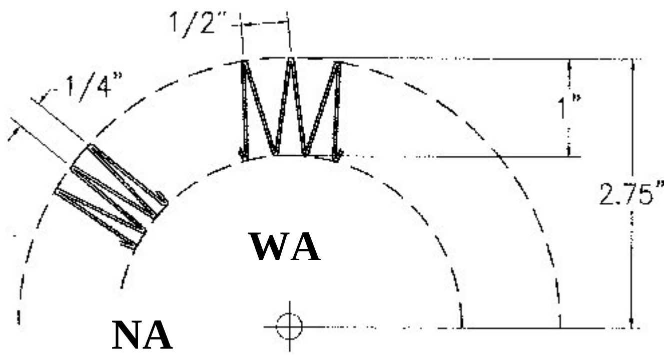

Figure 1

Category 2A; (NA) Filter Elements with narrow angle pleat angles

Narrow angle pleated filter elements are those whose pleat configurations are such that where much the dust captured by the filter element will not flow freely into the hopper from between the pleats propelled by the force of gravity. Bridging may occur with many granular dusts. The best application for Category 2A filter element self cleaning collectors is on application where the filter cake is 1/64th of an inch or thinner. These are ideal for application where extremely fine dusts, like fume are collected. When applied to other dusts where the thickness of the cake causes the dust to bridge across the bottom of the pleat, the area of the filter element is no longer cleaned so it is no longer active. This may reduce the active filter media to as low as 15% of the area in the pleat. The effective filter in a pulse jet collector can be defined as the cleanable area. The other limitation of a Category 2A is that the collector must be cleaned frequently enough to prevent the dust cake bridge to increase if the load is too high. It is often susceptible to temporary failures of the cleaning systems or unexpected surges in dust load. The cleaning system must be set at a frequency that will keep it stable at the highest anticipated dust loads. For instance a collector with an anticipated load of 20 grains per cu. ft. must be able to handle that load and not set to an average load of half that level. This can also be accomplished by a pressure switch control when set properly. (That discussion is beyond the scope of this paper)

Category 2B; (WA) Filter Elements with wide pleat angles.

This filter element can be freely be applied in what we consider the WA category. There is no sharp definition of the pleat angle. What makes a filter element fall into the WA category is that, if the cleaning system is suitable to its configuration, it will be able to be recovered by off line pulse jet cleaning to a pressure drop that is essentially the same as the initial pressure drop when the collector has a new filter element change. **In figure 1,** we have the range of offerings by a particular supplier with pleat spacing 1/4inch wide at the outside compared to his offering with the most pleats per inch of 0.25 inches. It is quite obvious that the wider pleat spacing will allow the dust to freely fall vertically into the hopper for most dusts. If we use a filter element length of 40 inches it will have a filter area of approximately 19 sq ft. which would be approximately the filter area of a 12 foot long by six inch diameter bag. We can look at cylindrical bags as a wide angle filter element with a pleat width equal to the circumference of the bag. **WA** filter elements can be interchanged in most applications if the cleaning system is sufficient to clean opposed to the dirty gas flow through the filter element. This applies to granular free flowing dusts or powders with filter cake thicknesses of less than 1/16th of an inch.

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<u>Other Considerations for Cartridge Dust Collectors</u>

Advanced pleated filter technology has allowed us to increase filter flow per size of cartridge. Formerly, the limitation on application was to be able to use <u>all of the filter media to filter the dust.</u> Even spreading the pleats widely apart was only an improvement rather than a solution. When a pleat, with conventional media, is placed under pressure across the filter element, the pleat collapses and squeezes together so that media on the filtered side is no longer in service. This squeezing has several direct and indirect effects:

1. The pressure drop goes up and squeezes even more of the media and the additional pressure drop disables a larger percentage of the media in the filter element.
2. This decrease in effective media decreases the quantity of dust that can be stored in the element between cleanings. To compensate for this effect, the cleaning frequency is increased to keep the pressure drop stable.
3. Since the dust penetration through the filter element is a direct function of the cleaning frequency, the collection efficiency will be reduced by up to 90%, especially in applications with varying dust loading.

The latest advanced technology, we have developed, is the media that is applied has sufficient resiliency (or springiness) to prevent any squeezing or pinching of the pleats. The new media allows the cartridges even to recover from failures of the cleaning system where a presumably plugged filter element can recover completely within a few off-line cleaning cycles. Another innovation is a tandem pleat with a stiff backing, to prevent pinching. This in effect allows us to have a permanent re-cleanable filter that can be washed manually in a laundry tub. Be the first in your company to take advantage of this technology. We can usually supply retrofit cartridges to bring an older conventional dust collector into the 21st century.

<u>Factors affecting Maximum gas flow rate through either Category 1 or Category 2 self cleaning pulse jet collectors</u>

Pressure drop is a basic concern as it affects power consumption in exhaust fans, compressed air consumption and indirectly cleaning system design**.** Disregarding the cleaning system considerations, if we double the air flow through a filter element the pressure drop across the filter element will increase by two to four times. Four times the value occurs when the initial pressure drop is over 2 inches w.c.

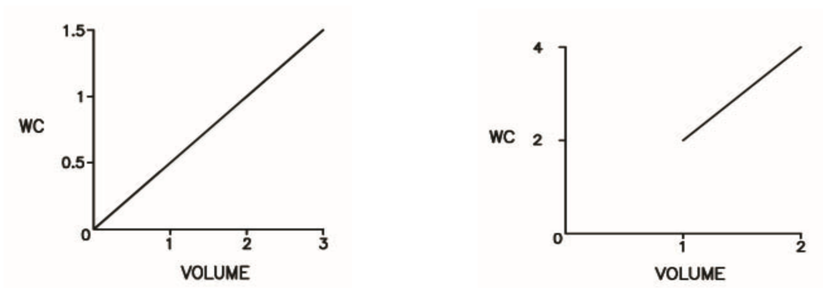

Figure 2

Cleaning air volume is critical. It is obvious that the cleaning jet must have sufficient air volume and pressure to:

1. Stop the process flow through the filter element
2. Increase the reverse flow to a flow more than the filtering process flow. If this reverse air flow is equal to the filter flow, the resistance in the reverse direction is the same as the forward direction. There is no pressure to blow the dust from the filter element surface. By increasing cleaning flow further the pressure drop and flow in the reverse direction can clean the filter element.

The ratio of reverse air flow to filtering flow must be high enough to develop a pressure in the cleaning jet higher than the operating pressure drop across the filter element. <u>Effective designs require this cleaning ratio to be between 3:1 and 5:1</u>. **It can be noted that air to cloth ratio does not enter into selecting this value.**

The total permeability of the filter media and the operating cake must be low enough to allow the cleaning jet to clean the filter element. This value is affected by the filter ratio of the filter element and permeability of the filter media. As a general rule of thumb for cylindrical or Category 1 filters, the filter ratio is limited to the same value as the permeability of the basic media. For instance a laminated media with a permeability of 12 cannot operate at more than 12:1 filter ratio. The typical felted media with a permeability of 18-21 can operate at filter ratios up to 18:1. <u>This assumes that the design of the element allows all of the element to be cleaned.</u> The filter element must be de-rated by the portion of the media that can not be cleaned by the cleaning system.

Category 2 (NA) collectors with thick filter cakes are deceptive. If the permeability of the media is 15, and the cleanable media area is 20% of total filter area, the maximum operating filter ratio would be 20% times 15 or 3:1.

Category 1A collectors, with cylindrical shape filter elements, can be limited in filter ratio if the cleaning action of the cleaning jet is so violent that it drives dust into the adjoining filter elements. This increases the cake permeability and raises the pressure drop to high levels even at low filter ratios. <u>These cleaning systems are flawed.</u>

Operating Permeability of Different Types of Self Cleaning Collectors

The maximum operating permeability is without a filter cake. In the examples below we assumed that the media had a permeability of 18-20 and all media considered had the same permeability. Several categories will be compared below.

Category 1A Cylindrical bag with conventional cleaning system, 9.5 sq.ft of media in a 4 inch diameter filter element by 96 inches long, 1.87 inch diameter venturi, at 57 CFM per bag and filter ratio of 6:1.
Total operating pressure drop 4 inches w.c.
Pressure drop across venturi 0.6 inch w.c.
Pressure drop across media 3.4 inches
Operating permeability of cake + media = 1.7

Category 1B Cylindrical bag with advanced technology cleaning system, 9.5 sq. ft of media 4 inch diameter filter element, operating at a filter ratio of 18:1 and 177 CFM per bag.
Total operating pressure drop 2 inches w.c.
Pressure drop across mouth of bag O.70 inche w.c.
Pressure drop across media 1.3 inch w.c.
Operating permeability of cake plus media = 13.8

Category 2A type NA cartridge collector with 14 pleats per inch, 26 inch long, 13.25" OD, 8.25" ID, 362 pleats 260 sq. ft of media, 350 cfm per filter element. Estimated cleanable area above the bridges within the pleats 30-40 sq. ft. Use 35 sq. ft for calculations
Total pressure drop 3.0 inches
Estimated cleanable media 35 q. ft.
Apparent filter ratio 10
Gross filter ratio 1.0
Pressure drop across mouth of filter element 0.2 in. w.c.
Pressure drop across media 3.3 in. w.c.
Operating permeability of cake plus media = 10.6 (if we consider 35 $ft.^2$ as the cleanable media)

Category 2B type WA cartridge collector with pleat 1/2 inch wide and 1 inch deep by 40 inches long
Total pressure drop 2 " w.c.
Filter ratio 8:1
Pressure drop across the opening in the top of the filter element 1 – 1.2 inch w.c.
Net pressure drop across the media is 0.8 inch w.c.
Operating permeability cake + media = 10

Summary

Brand new media; operating permeability, no cake = 18 cfm per sq.ft, 100% open media
Category 1B NEW TECH cylindrical filter ratio 18:1;
operating permeability cake + media = 13.8 cfm per sq. ft., 75% open media
Category 1A OLD TECH cylindrical filter ratio 6:1;
operating permeability cake + media = 1.7 cfm per sq. ft, 10%open media
Category 2A cartridge 14 pleats per inch apparent filter ratio 10;
operating permeability cake + media = 10 cfm per sq, ft., 55% open area based on 35 sq.ft. media
gross filter ratio of 1:1, 3% open area based on 260 sq.ft. of media
Category 2B cartridge filter elements, 1/2 inch wide pleat, filter ratio 8;
operating permeability cake + media = 10 cfm per sq.ft, 55% open media

Conclusions:

These calculations show that for different designs of dust collectors with presumably the same dust and dust cake, the efficacy of the media is between 3 % and 75% effective. The ineffective media is plugged with dust.

See the attached tables for typical industrial applications.
Density is defined as lbs/cu.ft. of material.
Dust Loading in a collector is lbs/ cu.ft. of airflow through the collector.
Typical dust loading:

1. Fumes (welding) = 10 grains/ 1000 cu.ft. = 14×10^{-4} lbs/ 1000 cu.ft.
2. Material handling = 3 - 5 grains / cu.ft. = $4 - 7 \times 10^{-4}$ lbs/ cu.ft.
3. Typical dusts in a collector = 10-20 grains / cu.ft. = $14 - 29 \times 10^{-4}$ lbs/ cu.ft.

Example; 1200 CFM dust collector with typical dust = 15 x 1200 = 1.8 lbs / minute

SPECIFIC APPLICATIONS

Size= typical particle size, microns					Collector Types= 1A, 1B, 2A, 2B					Suggested air to cloth ratio in "type" column
Density= lbs/cu.ft						XP= explosion hazard				
Dust/application	**size**	**density**	**1A**	**1B**	**2A**	**2B**	**CFM/Cart**	**sparks**	**XP**	**Notes**
abrasive cut off	15	150	8 FR	16FR	yes	yes	500-900	yes		abrasion special inlets
aluminum	25	25	6 FR	16 FR	no	yes	no	no	yes	watch can velocity
alumnum oxide	25	75	6 FR	15FR	note	yes	notes	no	no	sometmes used for abrasive blast with cartridges
aluminum Sulfate	10	50	6 FR	15 FR	no	8 FR	no	no	no	decomposes at 250 degreesF
atmospheric	2		8 FR	15FR	yes	yes	500-900	no	no	watch can velocty or use off line cleaning
Asbestos		20	6 FR	12 FR	no	yes	no	no	no	Carcogenic needs after filter or Gortex
Asphalt Dryer	20	60	6 FR	15 FR		8 FR	no	no	no	up to 350 deg use preheat and purge cycle
Asphalt loading	20	60	no	12 FR	no	no	no	no	no	Hydrocarbons may require continuos coat from dryer
Baking Powder	10	60	6FR*	15FR	yes	8FR	500-900	no	no	* poor choice because of high density
Baking soda	10	60	6 FR*	15 FR	no	8FR	no	no	no	* poor choice (density) May require air heaters
Barium Sulfate	5	60	6FR *	12FR	no	8FR	no	no	no	* poor choice (density) low can velocty req'd
Bauxite	5	50	6FR	15 FR	no	8FR	no	no	no	special airlocks/abrasion
Blast Cleaning	25	to 150	*	15FR	*	8FR	500	*	*	depends on blast media consult factory
Boiler coal fired	25	60	4FR*	12FR	no	*	no	yes	no	Sulphur trioxide corrossion usually present consult factory
Boiler wood fired	15	10	4FR*	12FR	no	*	no	yes	no	requires good combustion control
Brick Dust	30	3to150	4 FR*	14FR	no	8FR	no	no	no	wide density range requires low can velocity
Buffing	10	15	6 FR	16FR	no	8FR	no	yes	yes	wide density range requires low can velocity
CalciumCarbonate	10	50	4 FR*	16FR	yes	8FR	500-900	no	no	*poor choice (density)
Carbon	8	60	4FR*	16FR	yes	8FR	500-900	no	yes	*poor choice (density)
Carbon atomic	0.3	10	2FR*	8FR	no	*	no	no*	*	requires inert gas flow and compressor
Carbon Black	2	60	4FR*	16FR	yes	yes	no	no	yes	*poor choice (density)
Cast Iron Machining	8	60	4FR*	16FR	yes	8FR	500-900	no	no	*poor choice (density)
Cellulose	5	10	4FR*	16FR	no	8FR	no	no	yes	upward can velocity considerations
Cement	8	60	4FR*	16FR	yes	8FR	500-900	no	no	*poor choice because of density
CemClinker cool	15	60	6FR*	12FR	no	no	no	no	no	*poor choice (density) beware of upset over 400 deg
Ceramic	10	80	*	*	*	*	*	no	no	* possible agglomeration problems (shaker)
Charcoal	10	20	6FR	16FR	no	yes	no	no	yes	can velocity considerations
Clay Bentonte	15	50	4FR*	4 FR no		8FR	no	no	no	*poor choice because of density
Coal Handling	20	60	4FR*	15FR	*	8FR	*	no	yes	*poor choice fire hazard when wet
Coke	10	30	4FR*	12FR	no	8 FR	no	no	yes	sticky and wants to mat, 70 deg hopper
Corian'artficial	10	25	6FR	12 FR	yes	8FR	500-900	no	no	
Corn	50	15	8FR	18FR	no	8FR	no	no	yes	low can velocity req'd
Cosmetics	30	up to 60	6FR	15FR	yes	8FR	500-900	no	yes	wide range of characteristics consult factory
Detergent	20	35	6FR	14FR	no	8FR	no	no	no	may require manfold heaters and pre and post heating.
Dirt	20	30	8FR	15FR	yes	8FR	600-900	no	no	may contain clay and require manfold heaters
Dolomite	20	75	4FR*	15FR	yes	8FR	500-900	no	no	* poor choice (density)
Electric arc	10	60	4FR*	15FR*	yes	8FR*	500-900	no	no	*off line clening only
Feeds-grains	19	20	no	15FR	no	8FR	no	no	yes	70 deghopper oversize air lock

Dust/application	size	density	1A	1B	2A	2B	cart/cfm	sparks	XP	Notes
Feldspar	15	62	4FR*	15FR	no	8FR	no	no	no	70 deghopper oversize air lock
Fertilizer	10	45	4FR*	15 FR	no	8FR	no	no	yes	corrosion potential
Fiber glass	100	30	6 FR	15FR	no	8FR	no	no	no	need off line ceaning because open cake
Flour	10	40	6FR	15FR	*	8FR	*	no	yes	* poor choice
Fly ash coal	15	60	4FR*	12FR	no	8FR	no	no	no	low can velocities spontaneous combustion risk
Fly ash wood	15	30	4FR*	12FR	no	8FR	no	no	no	low can velocities Spontaneous combustion risk
Foundry dryer	20	60	5FR*	12FR	no	8FR	no	no	no	special considerations for vapor handling
Foundryshakeout `	20	60	5FR*	12FR	no	8FR	no	no	no	special considerations for vapor handling
Foundry furnaces	4	60	7FR*	12FR*	no	8FR	no	yes	no	* off lne cleaning special media may be req'd
Fume Plasma	4	60	no	12 FR	yes	8FR	500-900	no	*	* special time after gun and before collector
Fumed silica	4	1	no	9 FR*	no	4FR*	no	no	no	* off line cleaning
Furnaces	0.4-1.5	40-70	4FR*	14FR*	no	8FR*	no	yes	no	off-line cleaning, special media, consult factory
Glass	15	80	4FR*	12FR	no	8FR	no	no	no	May requireGortex if cake will not form
Grain	10	30	8FR**	16FR	no	8FR**	no	no	yes	** requires can velocity below150 fpm or hi inlet
Graphite	5	60	4FR*	16FR	yes	8FR	500-900	no	no	* poor choice hi density
Gypsum	10	60	4FR*	16FR	no	8FR	no	no	no	* poor(choice) hi density; may req 70 deg slope/ lock
Incinerators	10	to 150	4FR*	14FR	no	8FR	no	yes	no	* poor choice hi density; consult factory
Iron oxide	15	to 150	no	14FR	no	8FR	no	no	yes	special inlets required
Kaolin	20	to 80	4FR*	14FR	no	8FR	no	no	no	corrrosion especially on dryers
Laser Cutters	5	to 250	no	10FR*	yes*	8FR*	500-900	yes	no	* special time after gun and before collector, consult factory
Lead/lead oxide	5	240	no	14FR	yes	8FR	500-900	yes	yes	may require HEPA
Leather	230	60	8FR	18FR	no	8FR	no	no	no	
Lime hydrate	15	50	4FR*	14FR	no	8FR	no	no	no	70 deg hopper large airlock/hoppr rappers
Limestone'quarry	10	60	4FR*	14FR	no	8FR	no	no	no	* poor choice hi densty
Limestone calcined	15	60	4FR*	14FR	no	8FR	no	no	no	* poor choice hi density; hygroscopic
Metallizing	5	to 90	no	no	yes	8FR	500-900	yes	yes	* special time after gun and before collector
Oxides metallic	5	to 200	4FR*	4FR	yes	8FR	500-900	no	no	* poor choice hi density
Paint pigment	5	to 120	6FR**	14FR	yes	8FR	500-900	no	?	** not suitable for hi densitypigments
Paint spay	10	to 150	4FR**	14FR	yes	8FR	500-900	no	?	** not suitable for hi densitypigments:usually booth spcl
Paper	15	4	8FR	18FR	no	?	no	no	yes	spcl inlets & baffles reqd
Perlite	50	4	8FR	18FR	no	?	no	no	no	spcl inlets & baffles reqd
Perchlorates	30	100	4FR*	15FR	no	8FR	no	no	?	
Petrochem dry	25	40	4FR*	15FR	no	8FR	no	no	yes	* poor choice hi density
Pharacuticals	20	to 100	6FR*	15FR	YS	8FR	500-900	no	?	* poorchoice hi density; require food grade features
Plastics, poly	40	to 20	8FR	18FR	no	8FR	no	no	no	spcl inlets & baffles reqd
Plasma Cutting	<1&up	50-80	no	10FR*	yes*	8FR*	500-900	yes	no	* special time after gun and before collector, consult factory
PVC	10	to 40	4FR*	12FR	no	?	no	no	yes	requires gortex media
Porcelain	10	60	6FR*	18FR	no	8FR	no	no	no	* poor choice hi density
Rock Drill	30	60	4FR*	18FR	no	8FR	no	no	no	* poor choice hi density; spcl design for Hi tech system
Rubber powders	30	40	4FR*	18FR	yes	8FR	500-900	no	yes	* poor choice hi density
Sand/fndry	30	60	4FR*	14FR	no	8FR	no	no	no	* poor choice hi density, water vapor
Sand Blast	25	60	4FR*	16FR	yes	8FR	600-900	no	?	* poor choice hi density; watch base material

Dust/application	size	density	1A	1B	2A	2B	cart/cfm	sparks	XP	Notes
Sandsludge dryer	25	60	4FR*	14FR	no	8FR	no	no	no	* poor choice hi density; Nomex to 400 deg
Sawdust	15	to 30	8FR	18R	no	8FR	?	yes	yes	needs low can veloctes and provde forstrip handling
Silica	5	70	4FR*	16FR	yes	8FR	600-900	no	no	* poor choice hi density
Soap	10	40	4FR*	12FR	no	6FR	no	no	no	* poor choice hi density: vapor present
Soda Ash	10	50	4FR*	12FR	no	6FR	no	no	no	* poor choice hi density; corrosive/vapor issues
Starch	10	35	4FR	16FR	yes	8FR	500-900	no	yes	* poor choice hi density: vapor present
Sugar	30	20	4FR*	16FR	yes	6FR	500-900	no	?	* poor choice hi density
Talc	15	40	6FR	16FR	yes	8FR	500-900	no	no	
Tobacco	30	15	4FR***	16FR	seldom	8FR	seldom	no	?	*** poor choice, damages tobbacco leaf
Waste Shredder	25	15	8FR	16FR	no	8FR	no	?	?	may require special baffles
Welding Fume	<1&up	30	no	16FR	yes	8FR	500-900	yes	no	oil may require filter aid, consult factory
Wood	15	15	8FR	16FR	no	8FR	no	yes	yes	requires low can veocity and baffles
Wood sanding	15	15	8FR	16FR	yes	8FR	500-900	no	no	requires drop out for cartridge units
Zinc melting	15	60	4FR	12FR	no	8FR	no	yes	yes	pulse off line during shutdown