Why does the Gold Cone work so well?

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The pleated filter cone in the middle of the Gold Cone cartridge has four benefits:

- Adds additional media area to the cartridge to allow for more airflow per cartridge in a more compact space than has ever been achieved before
- The hole in the bottom of the filter opens up more useable area in the dust collector, thus reducing interstitial can velocities
- Disperses the pulse air more evenly throughout the length of the filter cartridge for more effective use of the pulse energy
- The fourth benefit is perhaps the most important: The direction of the pulse coming out of the cone is straight down into the hopper away from the filters. This forces light dust particles into the hopper and out of the air stream.

This paper will explore each of these four benefits, but first lets address a fundamental issue of horizontal vs vertical filter configuration. For this discussion "can velocity" will refer to the average velocity of air approaching the filters using the entire cross sectional area of the dust collector. "Interstitial can velocity" will refer to the accelerated velocity where air passes into the filter section and is calculated by taking the total cross sectional area of the collector minus the cross sectional area of the filters.

Horizontal Cartridges?

Why would anyone want to lay a filter cartridge on its side? The reason was to overcome upward can velocity effects used in traditional baghouses and in the early cartridge collectors. Air would enter the hopper and flow up into the filter housing. The dust could only be cleaned off the filters if the up flowing air was slow enough to allow the dust to fight back down through the air stream. This system works well on heavy dusts, but not on light dusts like weld smoke and fume silica.

This upward air flow created a limitation on the amount of air you could put in a given size cartridge dust collector where the media is packed much tighter than in a baghouse. It was devised that if you laid the filters horizontally, thus moving the clean air plenum to one side of the collector, you could expose the dirty air plenum to the top of the collector and thus bring the air into the top of the dust collector. This resulted in a down flow effect helping overcome the upward can velocity issue. This improved the performance of the cartridge collector over the old hopper entry inlet design.

The down flow style collector, however, presented many limitations in its inherent nature of laying a filter on its side. The biggest problem is that the dust does not get cleaned off the top of the filter. The dust blinds at least 1/3 of the entire filter because it cannot be cleaned off. This increases the air to media ratio in the collector and has caused premature failure of the filters in many instances. Many Operation and Maintenance manuals from horizontal cartridge filter manufactures recommend opening up the collector and rotating the filters monthly to overcome this problem. See Figure 1.

Fig. 1 Filters lying on their side results in top loading of the filter cartridges.

Another major issue with horizontal cartridge collectors is the fact that 100% of the incoming dust is dumped on top of the filters. There is no chance for pre-separation of heavy or abrasive particles from the air stream before coming in contact with the filters. This is also a major problem on spark generating application because any spark entering the collector will wind up on a filter cartridge increasing the risk of a fire.

Vertical Cartridges

So how do you over come upward interstitial can velocities without turning the filters on their sides and wasting much of the filter? You cross flow the air into the side of the collector as is done the Farr Gold Series dust collector. This is achieved with a high entry inlet that brings the

air into the dust collector at the same height as the cartridges themselves. The air is first sent through a series of staggered channel baffles that distribute the air and also act as a classifier separating out the larger particles and dropping them straight into the hopper without ever seeing the filters. Sparks also have a torturous path and change of direction to make it to the filters. See Figure 2.

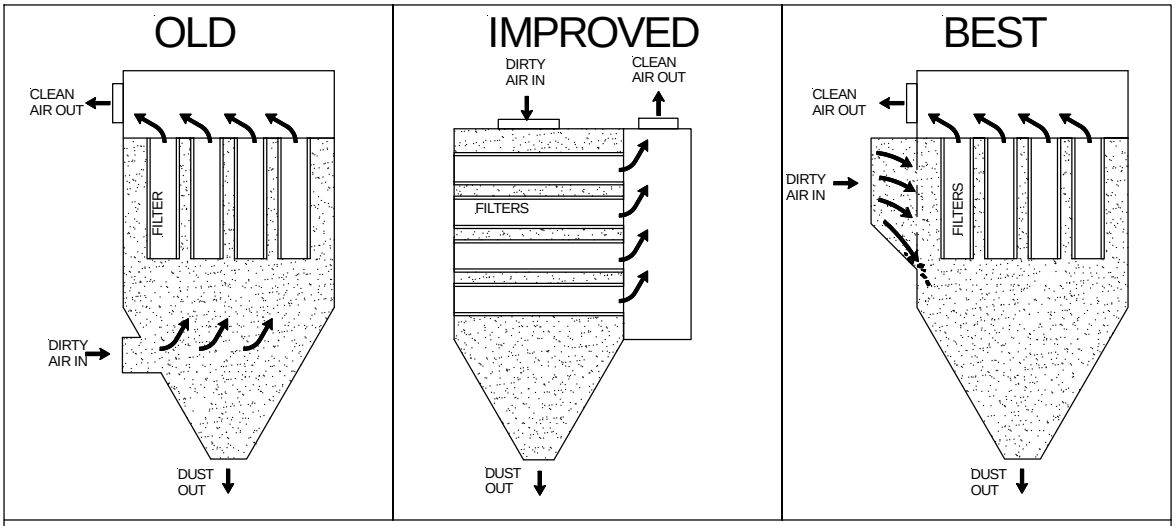


FIGURE 2 - High entry inlet with vertical cartridges is ideal.

This cross flow effect eliminates upward interstitial can velocities. Since the air is brought into the collector at the cartridge level, there is no longer air flowing upward towards the filters. This system combines the benefit of a down flow style air pattern without turning the filters on their sides and wasting a large portion of the media.

The Gold Cone

Now that this fundamental interstitial can velocity issue has been solved with vertical cartridges, a new development in cartridge dust collection has exploded into the industry, dramatically increasing filter life for the end user. This development is the Gold Cone. What is the Gold Cone? Simply put, it is a cone of pleated filter media that makes a previously unused portion of a dust collector cartridge, useable filter space. See Figure 3 (next page).

Gold Cone Filter

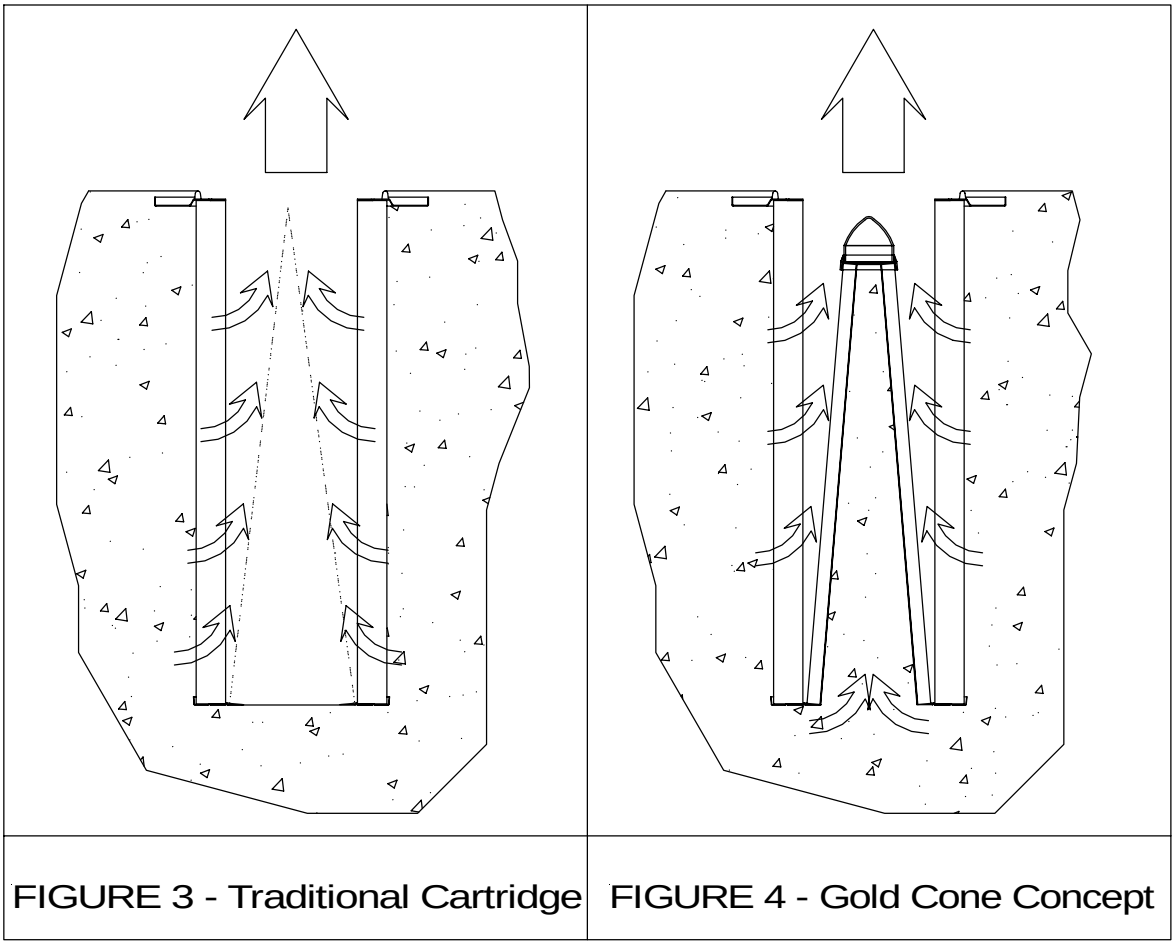


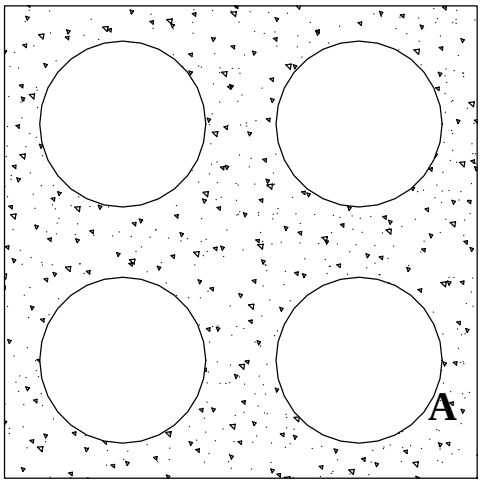
FIGURE 3 - Traditional Cartridge | FIGURE 4 - Gold Cone Concept

This is a velocity profile of a traditional cartridge on the inside. Notice a natural "cone" forms of dead air. Farr Patent #5,972,059 describes a revolution in dust collection where this dead space is turned into efficient, useful filtration area. Figure 4 shows the same cartridge now with the Gold Cone concept using this dead air space.

Now, lets take an in depth look at the four benefits listed at the beginning of this paper that the Gold Cone adds to a cartridge collector, and thus to lower the operating cost for the end user of the equipment.

Benefit #1: The cone puts more useable media area into a give collector size than was previously thought possible. Adding a cone of pleated filtration media to a traditional cartridge adds approximately 20% to 30% more usable media area to a given size cartridge. This extra filtration area reduces the air to media ratio so the media does not have to work as hard to filter the particulates. This results in lower pressure drop, which leads to less cleaning pulses. Both of these effects reduces energy consumption and extends filter life. So, how good does the cone really pulse? Does the dust really come back down out of the cone? Read on.

Benefit #2: The hole in the bottom of the cartridge opens up usable area in the dust collector for air flow. See Figure 5 to see the effect the hole has in opening up the space of the dust collector for flow.



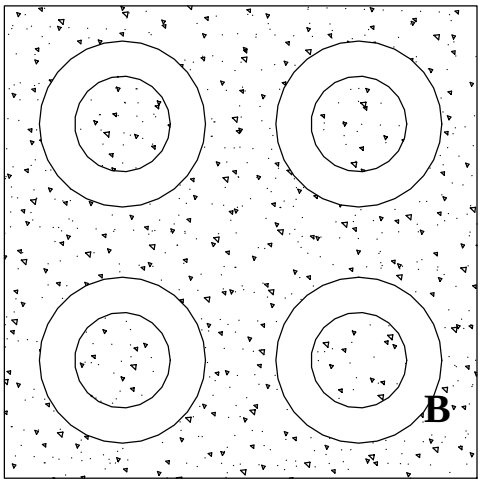


FIGURE 5 - Traditional Cartridges Gold Cone Cartridge Configuration

In part A of Figure 5, you can see that in a traditional collector that the air can only flow in the shaded area around the filters. In the Gold Cone housing in part B, the usable airflow space is expanded to the shaded area around the filters plus the shaded holes in the center of each filter. This extra cross sectional area for air flow added to the collector is what allows the extra filter media area from Benefit #1 to be useful media area. If all you did was stretch the filters to add the extra media area, but did not have the cones, the higher interstitial velocities around the filters would negate the benefit of the extra media.

Benefit #3: The cone distributes the reverse pulse air more evenly through out the filter for more effective cleaning and lower pressure drop. Figure 6 shows traditional cartridge pulsing vs Gold Cone pulsing.

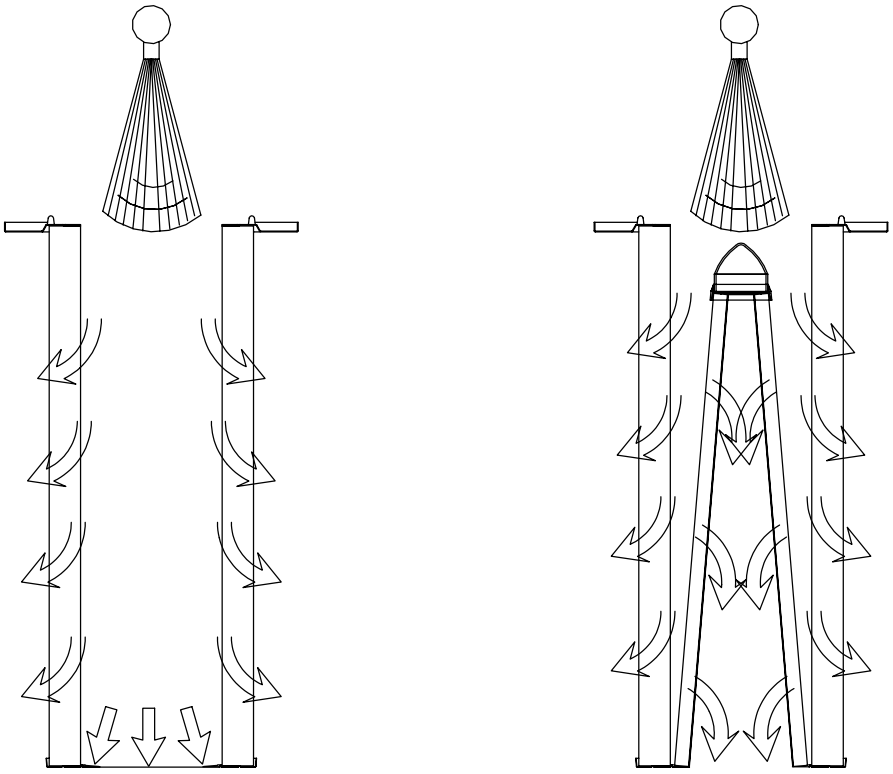


FIGURE 6 - Gold Cone uses wasted pulse energy.

As you can see, a significant portion of the pulse energy is wasted pulsing the bottom pan of the cartridge. With a cone placed in the center of the cartridge, the pulse energy has to be entirely used up in pulsing the cone or the outer cylinder. This is a neat effect – the cone does not use any of the energy that is normally being used to clean the out pack. It simply makes use of the pulse energy that would have ended up being wasted pulsing the bottom pan of the filter in all other cartridge pulse systems, horizontal or vertical.

Benefit #4: Here is the biggie that really makes the cone the key for long filter life: the direction of the reverse pulse energy coming out of the cone is straight down into the hopper. This forces light dust particles into the hopper and out of the air stream. This is the only system available on the market today that does not push the dust at the other filters during the pulse. Think about it, in a horizontal or vertical cartridge, when you pulse the filter the majority of the dust is sucked onto to the adjacent filter. The cone does not do this. The exiting pulse air and dust is traveling straight into the hopper. See Figure 7.

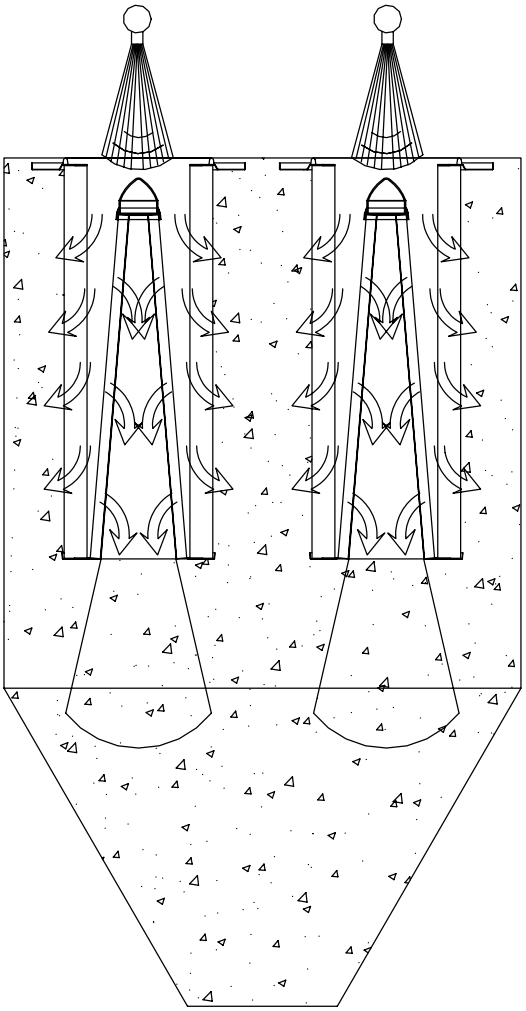


FIGURE 7 - Gold cone ejects dust into the hopper

This fundamental point results in allowing the Gold Cone to pulse off difficult materials like toner dust and plasma smokes, and even fibrous dust like textiles and paper dust because these light weight materials are forced down into the hopper by direction of the pulse air out of the cone. So, answering an earlier question, yes the cone really does get cleaned by the pulse, and it contributes significantly to the proper operation of the dust collector.

Summary

The vertical filter design combined with a crossflow inlet combined with the Gold Cone result in a dust collector that delivers unparalleled performance in maintaining low pressure drop. This results in long filter life and extremely low energy consumption.