## Introduction

Aerodyne Environmental supplies equipment to the foundry industry. The Vacu-Valve airlock is an ideal alternative to expensive and hard to maintain rotary valves. While our GPC cyclone's compact size and unique horizontal design allows it to be installed into existing systems as a pre-filter for a baghouse or cartridge collector. The Aerodyne Double Dump Valve provides low leakage air locking and the StopTight Knife Gate provides hopper control.

Aerodyne's experience in the foundry industry started in the 1970s providing Vacu-Valves for airlocks located on dust collectors. The Vacu-Valve simple design, uses the vacuum located in the hopper to seal the hopper from the outside. Then as the material builds up inside the hopper, gravity will slowly let the material flow through the sleeves.

The Aerodyne GPC cyclone is a great pre-filter for baghouses and cartridge collectors that have heavy loading. The GPC knocks out the larger particles allowing the filters to concentrate on the finer material, thereby extending filter life and increasing removal efficiency of the system.

## Aerodyne Cyclones

### Why install cyclones?

Cyclones are one of the simplest dust collectors available on the market. Dirty air enters the cyclone which then causes the dirty air to swirl around the separation chamber. The centrifugal forces caused by the swirling air forces the particles out towards the walls.

Once the air / dust mixture gets down near the hopper, the air changes direction (called vortex reversal) and leaves through the center of the cyclone separation chamber. The solid particles that were concentrated near the wall fall into the hopper and are then removed from the hopper via the airlock.



17387 Munn Road • Chagrin Falls, OH 44023
(440)543-7400 • FAX: (440)543-7404
www.dustcollectorhq.com

A cyclone dust collector will capture the solids without using filters. Filters retain particles even after cleaning, which can lead to early plugging of the filters. Plus, any sparks that enter the dust collector can cause pin holes or fires if they make contact with the filters.

The cyclone high removal efficiency of larger particles means it usually captures most of the material (based on weight) while only the very fine particles pass by. So, this means that most of the material will be captured in the cyclone before it sees the filters.

Any sparks from the process and most of the abrasive dust is removed before they can reach the filters, thereby preventing fires in the filters or premature plugging of the filters. A cyclone pre-filter also significantly lowers the loading on the filters.

This reduces the cleaning that is required on the filters, thereby extending the life of the filters. Less cleaning also lowers the amount of compressed air required for cleaning (pulse jet type). Significant saving can be seen if the compressor loading can be downsized for a facility.

## GPC Cyclones

GPC Cyclone are compact cyclones that remove around 99% of 20 micron dust. They compare in removal efficiency with traditional cyclone designs. The big difference being that the GPC cyclone is shorter and the internal ground plate provides an integral vortex breaker.

The unique design of the GPC cyclone allows it to be designed horizontally, thereby minimizing the height required for installation, allowing a cyclone pre-filter to be installed in applications where a traditional cyclone won't fit.

The compact size of the GPC means it can often be installed right by the location of dust generation, and allowing the material to be collected in area where it can be re-entered into the process. The horizontal design of the GPC means that it's backplate can be designed as an easy clean door access. This will allow easy access to the cyclone internals for cleaning.



17387 Munn Road ● Chagrin Falls, OH 44023
(440)543-7400 ● FAX: (440)543-7404
www.dustcollectorhq.com

## SplitStream Cyclone

The SplitStream cyclone uses a secondary airflow to capture dust particles and convey them to the hopper. In a vertical unit, the primary (dirty) airstream enters the separation chamber just above the hopper, through a stationary spinner which cause the airflow to begin spinning, this forces the solid particles out towards the walls of the cyclone.

A secondary airflow enters the separation chamber just below the outlet of the cyclone. This airflow enters through nozzles or vanes and traves down the walls of the cyclone, spinning until it reaches the hopper. Particles traveling from the primary airflow are collected by the secondary air and conveyed into the hopper. At the hopper the secondary airflow joins the primary airflow, while the particles fall into the hopper.

The SplitStream cyclone get a high removal efficiency when compared to traditional cyclone design. The SplitStream often gets 99% of 7 micron dust particles. And since the secondary airflow keeps material from coming in contact with the cyclone walls, the SplitStream has a long process life for abrasive applications. The secondary airstream also allows it to collect friable material without damaging it, since it keeps the material from contacting the cyclone walls.

The main benefit of the secondary airstream is that it allows a second airstream to enter the process while collecting particulate. The addition of a second airstream while collecting the particulate can be very useful in certain systems, here a few examples:

1) Hot / cold secondary airstream used to heat / cool the outlet stream and the particles being collected.
2) High nitrogen secondary (or low oxygen content) used to lower the oxygen level in the system so a fire/explosion cannot happen.
3) Recycled secondary airflow allows a second pass at the particulate to provide higher removal efficiency.

The SplitStream cyclone can be either vertical or horizontal in design. Since it requires a secondary airstream the SplitStream requires two (2) exhaust fans. The primary fan to provide overall airflow (usually located after the cyclone outlet) and a secondary fan to push the secondary airflow into the cyclone.

# Aerodyne Airlocks

## Vacu-Valve

The Aerodyne Vacu-Valve is an economical alternative to rotary valves. It's simple design and easy to maintain makes it a no-brainer when the application is right. The Vacu-Valve uses the vacuum in the hopper above it to shut the rubber sleeves. As material builds up above it, the material will slowly work its way through the sleeve and out of the system. The height of the head to cause movement through the sleeve and the flowrate of the material is based on a variety of factors including, material density, flowability, particle size distribution, vacuum above and valve spring setting.

The Vacu-Valve is NOT suitable for an explosive application. The rubber sleeve will not isolate the hopper in the event of a deflagration. The Vacu-Valve will also not work well with applications that have large, irregular particles, or material that regularly bridge or pigeon holes. Rather the Vacu-Valve is ideal for applications that are fine free flowing.

One of the main benefits of the Vacu-Valve is that it can be easily maintained. The replacement of the sleeve can be done with the valve installed and only takes about 5 minutes. Sleeve life varies with the process conditions and material going through the application.

## Double Dump Valve

The double dump valve is a low leakage valve that allows larger material through. It has a much smaller flow rate than a rotary valve (~10% of a rotary valve through put). The double dump valve is also about twice the height of a rotary valve, as its basically two (2) flap valves in series. The double dump valve can use gravity, be motorized or use pneumatic cylinders to operate the flaps.

## Knife Gate

The knife gate is one of the most basic airlocks available. It is often used to manually control the movement of material from a hopper or used to isolate a rotary valve during maintenance. The knife gate is available in both manual and pneumatic actuation.

## Foundry Applications

Aerodyne Environmental has provided equipment in multiple applications in the foundry industry. The cyclones are mostly used as pre-filter to baghouses and cartridge collectors located throughout the foundry. Many applications in the foundry create dust, whether it's the mold making, the casting process or the cleaning and grinding of the completed parts, dust is everywhere.

Baghouses and cartridge collectors are often used to capture the dust during these processes. However, heavy dust loadings often plug up the filters, thereby lowering the airflow in the system allowing the dust to escape the system and settle on everything.

Installing a cyclone prefilter can often remove most the dust before it reaches the filters, thereby allowing the filters to concentrate on the very fine particulate. And since the dust loading on the filters is much less, the filters won't plug as easily, thereby keeping the required airflow high enough to minimize the dust escaping the collection systems.

Cyclones also act as a spark arrester as they will extend the time before the spark reaches the filter, thereby giving it more time to burn out. Also, the cyclone will help cool down any sparks that might touch the wall but not be captured.

Unlike other specifically designed spark traps, which often use internal baffles, metal mesh, etc. to help cool the spark, the cyclone larger size just lets natural cooling and time do the job. But the cyclone captures dust at the same time, which is then removed from the system in an airlock. Spark arresters will also have dust buildup, but will require maintenance to clean out.

Grinding & cleaning up castings – cyclones help prevent sparks from catching filters on fire

Molding fabrication

- Cyclone provide very high removal of sand
- Vacu-Valves work very well on sand, are less expensive that rotary valves and much easier to maintain
- Double Dump valves provide a low leakage airlock for application where you don't want outside air entering the hopper
- Knife gates are used for manual control of hopper, such as sand preparation, etc.

## Pilot Test Case Studies

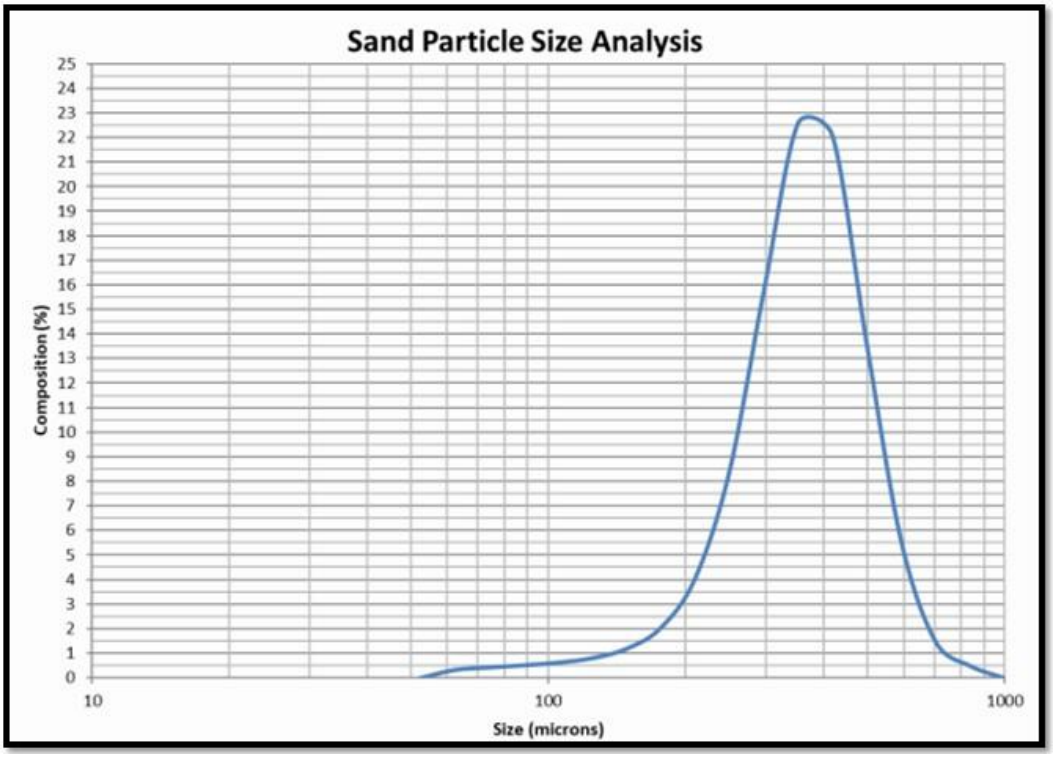
Aerodyne Environmental pilot lab has various pieces of equipment that are available for pilot testing. Some can be sent to a customer's facility while others have to be run at our lab. Both the GPC cyclone and SplitStream cyclone are available for testing both in our facility and at he customers site.

The following Case Studies are from lab testing of material on our GPC cyclone.

**GPC Cyclone Dust Removal Case Study**
**Steel Shot Powder Removal**

Aerodyne Environmental tested steel shot powder in our GPC-08 test lab. The test was done at room temperature with a pressure drop of 6" W.C. through the cyclone. The dust loading was 20 grains/ft3. The steel shot powder sample had a particle size distribution as shown in the graph below. Its mean particle size was 45 micron with a bulk density of 148 lbs/ft3.

**The GPC-18 cyclone got 100%* removal of the material.**

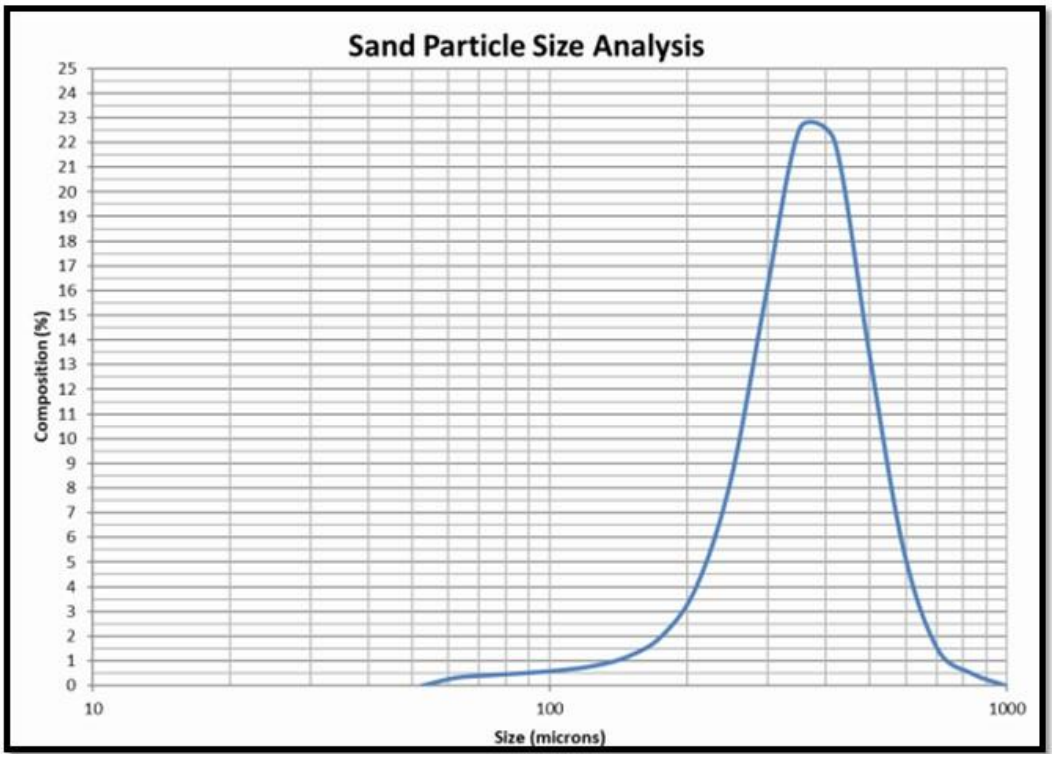



** Please note that particle removal efficiency is based on multiple factors in the process, including but not limited to cyclone size, pressure drop through the cyclone, particle size distribution, particle geometry, and material density. This test is a representative test, and results for your application may be different based on the above conditions.*

## GPC Cyclone Dust Removal Case Study
## Sand Removal

Aerodyne Environmental tested sand in our GPC-18 test lab. The test was done at room temperature with a pressure drop of 4" W.C. through the cyclone. The dust loading was 34 grains/ft3. The sand sample had a particle size distribution as shown in the graph below. Its mean particle size was 355 micron with a bulk density of 108 lbs/ft3.

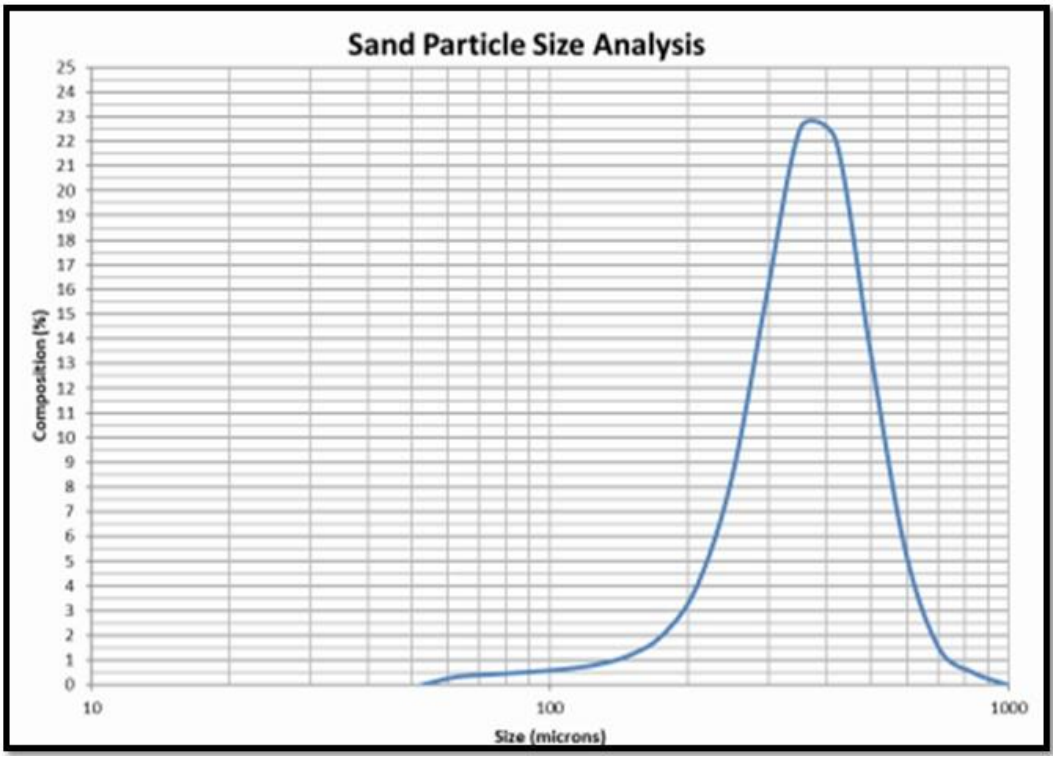
**The GPC-18 cyclone got 100%* removal of the material.**




** Please note that particle removal efficiency is based on multiple factors in the process, including but not limited to cyclone size, pressure drop through the cyclone, particle size distribution, particle geometry, and material density. This test is a representative test, and results for your application may be different based on the above conditions.*

## Vacu-Valve Case Study
## Sand

Aerodyne Environmental tested sand in our test lab with a GPC-08 and 8" Vacu-Valve. The sand had a particle size distribution as shown in the graph below. Its mean particle size was 355 micron with a bulk density of 108 lbs/ft3.




For the first test, No Spring Resistance - The Vacu-Valve was under -3" W.C. pressure and the springs were completely loosened. This resulted in approximately 8 lbs/min of sand flowing through the valve.

Here is how the Vacu-Valve operated under no spring resistance.

Here is another view showing the Vacu-Valve under no spring resistance.

For the second test, Half Spring Resistance - The Vacu-Valve was again under -3" W.C. pressure but the springs were halfway tightened. This resulted in approximately 10 lbs/min of sand flowing through the valve.

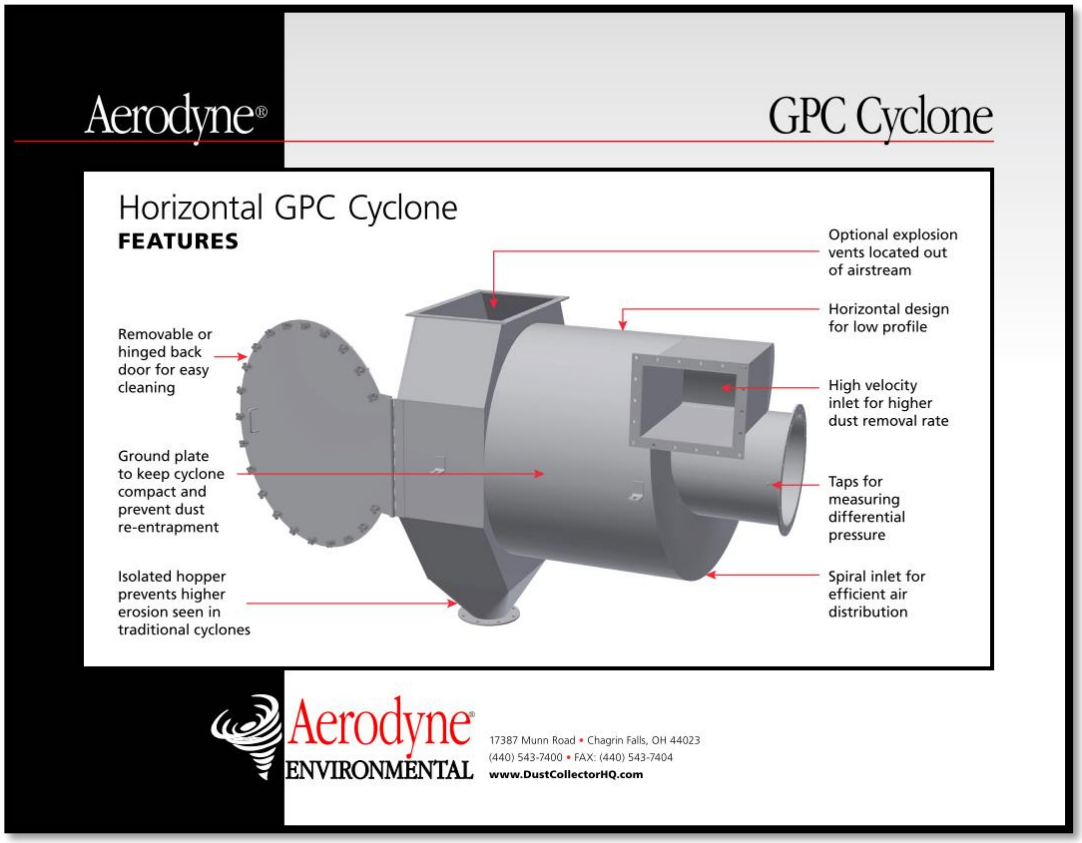
Here is how the Vacu-Valve operated with half spring resistance.

** Please note that flow rates are based on multiple factors in the process, including but not limited to cyclone and valve size, pressure drop through the cyclone and valve, spring tension, particle size distribution, particle geometry, and material density. This test is a representative test, and results for your application may be different based on the above conditions.*

## Aerodyne's Foundry Equipment Benefits

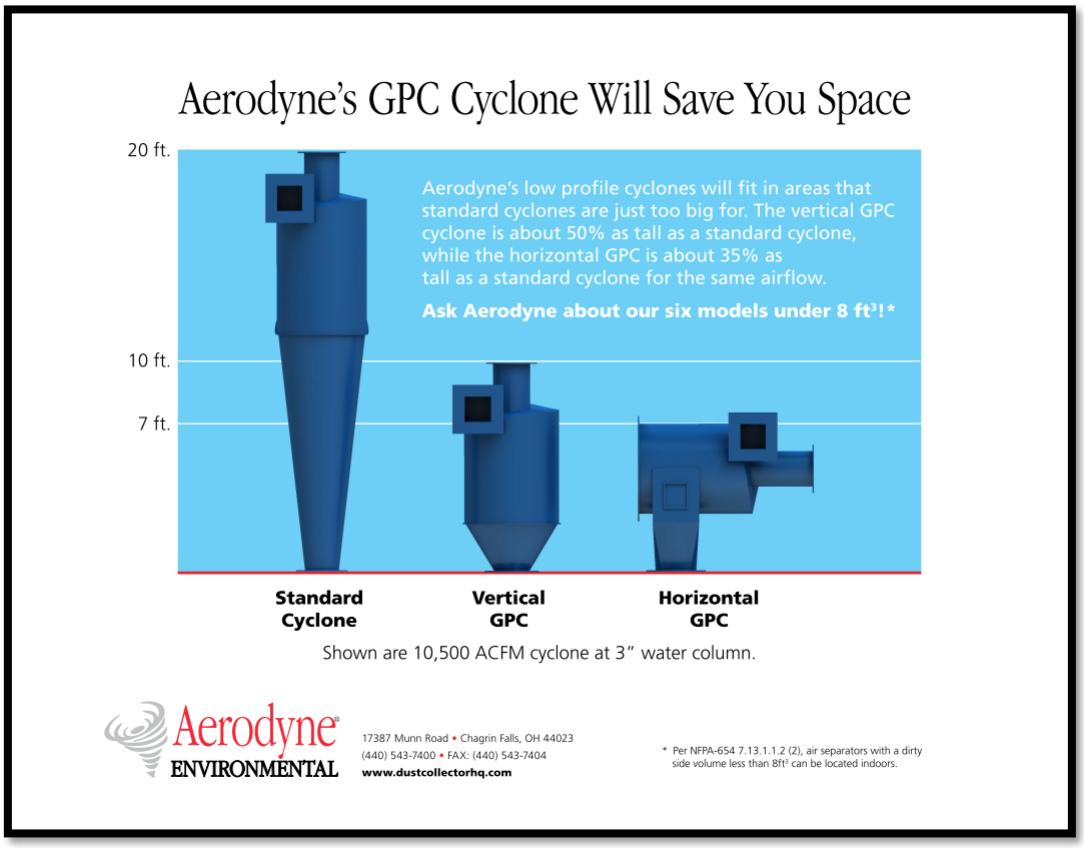
### 1) Horizontal Cyclone Design

The Aerodyne horizontal cyclone design allows cyclones to fit into areas where traditional cyclones won't fit. This allows cyclones to be retrofitted on to existing systems that is having operational issues without making major changes to the area around to fit a tall traditional cyclone. The horizontal design on the GPC cyclone also provides a back plate which on the smaller cyclone sizes is often removable, thereby providing access to the cyclone internals. Unlike other cyclones that are disassembled for cleaning, the GPC doesn't require disassembly or disconnecting from the ductwork for access. The cyclone acts as a spark arrester, thereby protecting filter from fire and pin holes.



## 2) GPC Compact Design

Both vertical and horizontal GPCs are compact compared to traditional cyclones. The vertical GPC cyclone is around 50% the height of a traditional cyclone. This allows the cyclone to be installed in pre-existing processes where a traditional cyclone won't fit.



## 3) Vacu-Valve Airlock Low Cost and Maintenance

The Vacu-Valve is an economical alternative to a rotary valve. The Vacu-Valves sleeves are easily replaced in 5 minutes or less. The valve cost around 33% the price of a rotary valve and doesn't require a motor for operation.