

Introduction

Dust collection is essential in the woodworking industry, whether in a basement, garage, school, or industrial shop. Woodworking generates fine particulates that, if not properly managed, can pose health risks through inhalation over time. Additionally, accumulated wood dust can create significant fire hazards, potentially leading to explosions. Installing an effective dust collector is crucial to minimizing these dangers. This handbook will provide a comprehensive understanding of dust collectors and guide you in sizing a small system to ensure you select the best solution for your needs.



Explosion and Fire Protection (NFPA compliance)

In the wood industry, managing the risks associated with wood dust is crucial for ensuring workplace safety. Wood dust is inherently combustible. Under certain conditions, it can pose a significant explosion hazard. When fine dust particles accumulate in a confined space, such as in a dust cloud, the potential for an explosion increases, if a spark is introduced.

Not all wood dust is explosive; the risk primarily arises from fine particles. Dust particles smaller than 500 microns are more likely to contribute to explosive conditions. Additionally, wood dust with higher moisture content may not ignite as easily, thus reducing the explosion risk. It is therefore essential for wood industry operators to assess their dust generation processes and understand the specific characteristics of the dust they produce.

The size and design of dust collection systems is critical in explosion protection. For instance, if a dust collector is smaller than 8 ft³, explosion protection may not be required, but it's important to verify this against your local regulations. Proper maintenance of dust collection systems is essential; regular inspections and cleaning can prevent dust buildup, reducing the risk of ignition and explosion.

Always consult local ordinances regarding dust control and explosion protection requirements. Implementing best practices such as regular training for employees on the hazards of wood dust, proper equipment use, and emergency response procedures can significantly enhance safety in the workplace.

For additional information on explosion protection, you can check out the following NFPA specifications.

1. NFPA 664 - Standard for Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*
2. NFPA 652 - Standard on Combustible Dust*
3. NFPA 68 - Standard on Explosion Protection by Deflagration Venting
4. NFPA 69 - Standard on Explosion Prevention Systems

* These will be replaced by NFPA 660



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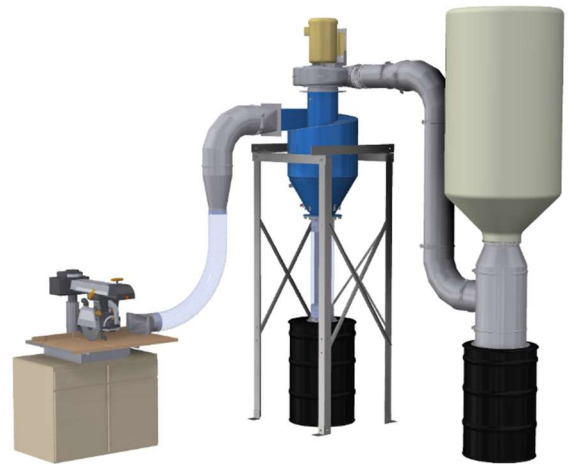
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Summary of Best Practices

Home/Garage Shops:

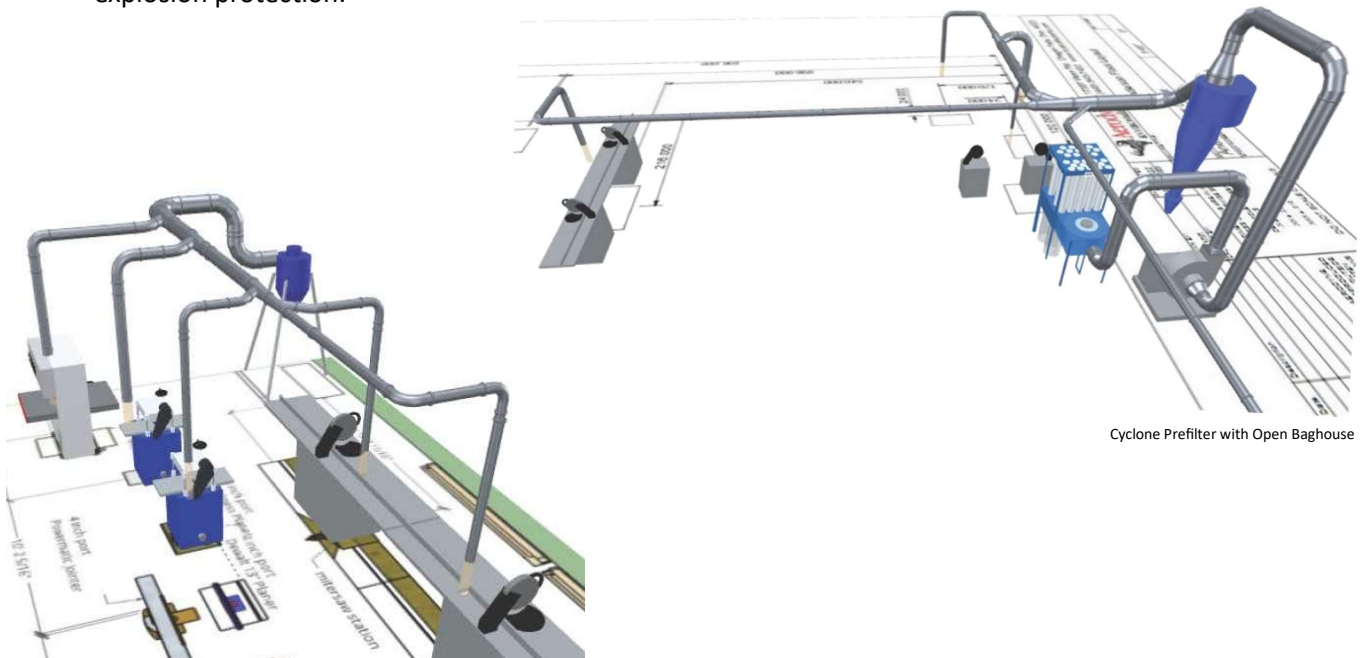
- Ensure your workspace is well-ventilated and maintained to reduce fire and explosion risks.
- Opt for a compact dust collection system (under 8 ft³). Regularly changing connections may be necessary, but this approach minimizes explosion hazards without the need for costly explosion protection measures.
- Adhere to all local laws and ordinances regarding dust management.



Typical Dust Collection System

Schools and Businesses:

- Perform a Dust Hazard Analysis (DHA) to identify areas that require explosion protection.
 - DHAs typically assess dust from each collector to determine its explosive potential. If you plan to switch wood types, it's advisable to use ST-1 (Kst – 200 bar m/s, Pmax of 10 bar) as the design conditions for your dust collection system.
- Implement regular housekeeping practices to minimize dust accumulation.
- Consider using smaller, strategically spaced dust collection systems to reduce the need for extensive explosion protection.



Cyclone Prefilter with Open Baghouse

Typical Dust Collection Zone System



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System Design

To accurately size your dust collector, you must determine the airflow necessary to capture dust from your woodworking equipment effectively. Start by checking the operations manual for each machine to find the recommended airflow requirements. If the manual does not provide this information, you can use the following airflow estimates (in ACFM):

Machine	Airflow (ACFM)
Saws (bandsaw, table saw, radial arm saw, miter saw)	350
Belt sander (<6")	440
Belt sander (7" to 9")	550
Disc sander (13"-18")	440
Drum sander (<200 in ² of sanding surface)	350
Drum sander (201-400 in ² of sanding surface)	440
Jointer (<6")	350
Jointer (7"-12")	440
Planer (<13")	400
Planer (14"-20")	785
Router (table-mounted)	195
Shaper	350
Lathe	350

Keep in mind that the design of the hood or pickup can influence the required airflow. For more detailed design information, consult the **Industrial Ventilation Handbook** or reach out to a qualified consultant for assistance in calculating the airflow and designing the system.

After determining the airflow for each machine, you'll need to size the ductwork, aiming for a minimum air velocity of 4,500 FPM (feet per minute). Create a sketch of your ductwork layout, specifying duct sizes and using transition pieces where air streams merge. Next, calculate the static pressure needed for the system, which depends on the size and length of the ductwork as well as air velocity. Many ductwork suppliers offer sizing tools or can help calculate the required static pressure.

If additional guidance is needed, use the following chart:

Duct Diameter	CFM @ 4500 ft/min	Static Drop (In W.C./100ft)	Equivalent Linear Feet of Elbows
4"	400	9	4-7
5"	600	6	6-9
6"	900	6	7-11
7"	1200	4	9-13



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Notes:

- Calculate the total linear distance of your ductwork.
- For each elbow in the system, add the equivalent linear feet to your total.
- Convert the total linear feet into inches of W.C. using the chart.
- If you have specialized hoods or additional equipment, include their static pressure, then add the static pressure from your dust collector(s) to determine the final static pressure required for your exhaust fan.
- Add the duct static pressure to the pressure drop of any dust collectors and cyclones to find the total system static pressure required.

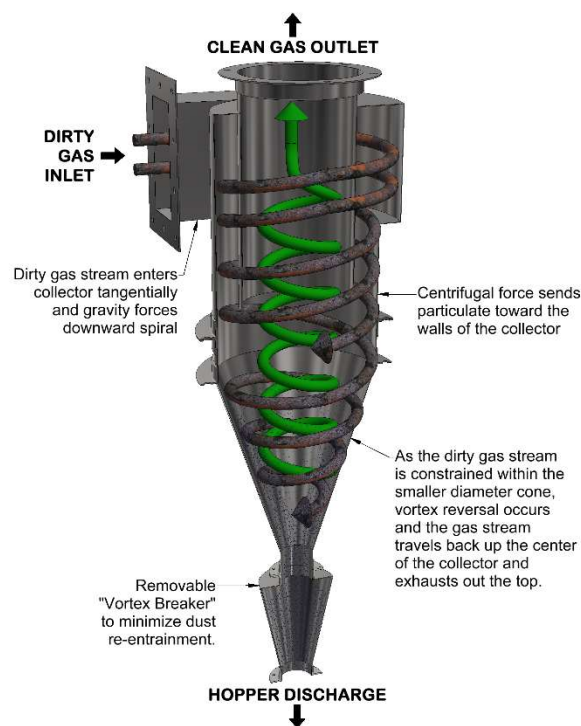
Once you've calculated the static pressure for the system, you can then size the fan accordingly, usually expressed as ACFM at the static pressure (in W.C.). Be aware that many commercially available dust collectors advertise a specific airflow, often at 0" W.C. This means that once ductwork is added, the airflow can drop significantly. Review the performance table for your system to ensure adequate airflow and static pressure for your needs.

Why Install Aerodyne Cyclones

Cyclones are among the simplest and most effective dust collectors available, efficiently capturing solids without filters. When dirty air enters the cyclone, it swirls around the separation chamber, creating centrifugal forces that push dust particles toward the walls. As the air-dust mixture descends near the hopper, it undergoes a directional change known as vortex reversal, exiting through the cyclone's center while solid particles accumulate along the walls and fall into the hopper for removal via an airlock.

The cyclone's high removal efficiency for larger particles means it captures most of the material by weight, allowing only the finest particles to escape. This significantly reduces the burden on downstream filters, resulting in less frequent cleaning and extending filter life. However, very fine particulate can still escape the cyclone, making it beneficial to employ an after-filter or baghouse/cartridge collector. Cyclone pre-filters help existing baghouse and cartridge collectors by removing the majority of the particulate load, enabling these filters to focus on the finer particles, ultimately lowering maintenance needs and increasing filter longevity.

Additionally, reduced cleaning requirements lead to lower compressed air needs for pulse jet cleaning, which can yield significant savings if the compressor size can be downsized for the facility. More information is available in [5 reasons to install cyclone pre-filter](#).



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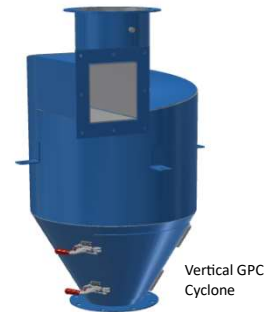
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GPC Cyclone

The GPC Cyclone is a compact dust collector that removes approximately 99% of 20-micron dust, achieving high removal efficiency without the height of a traditional cyclone. Its key differences include a shorter profile and an integral vortex breaker created by the interior ground plate. Aerodyne's low-profile cyclones will fit in areas that are just too big for standard cyclones. The vertical GPC cyclone is about 50% as tall as a standard cyclone, while the horizontal GPC is about 35% as tall as a standard cyclone for the same airflow. The main benefits of the GPC Cyclone include:

1. **Horizontal Design:** The unique horizontal design allows for installation in tighter spaces where traditional cyclones may not fit, facilitating the addition of explosion vents.
2. **Compact Size:** Its small footprint enables installation close to dust generation points, allowing for efficient material collection in areas where it can be reintroduced into the process. Models under 8 ft³ can handle up to 2,500 CFM.
3. **Quick Clean Design:** The horizontal layout allows for easy access through a backplate designed as a clean-out door. The cyclone can also be equipped with a hinged door for straightforward cleaning and maintenance.
4. **Explosion Protection:** The GPC's horizontal design allows for the installation of explosion vents outside the main separation chamber. This configuration protects the cyclone from explosions while preventing dust buildup or wear that could affect the vent panel's functionality.



Vertical GPC Cyclone



Horizontal GPC Cyclone with Hinged Door

Dust Hound Cyclone

Aerodyne's Dust Hound Cyclones are a variation of the GPC designed for higher production rates and are often available for quick delivery. These units come as standard without the option for custom modifications or explosion vents.



TR Cyclone with Vortex Breaker

TR Cyclone

The Aerodyne TR Cyclone is a more traditional dust collector. While it is taller and often offered at a lower cost, it is not suitable for explosion vent installation. A vortex breaker can be added to enhance dust removal efficiency and reduce wear on the hopper. The TR can be manufactured in galvanized steel, carbon steel, or stainless steel.



DH Cyclone with Support Stand



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Point of Use Systems

Aerodyne offers compact point-of-use dust collection systems that are highly adaptable. These units effectively capture dust generated by saws, floor sweeps, and low airflow applications. Their designs vary from straightforward configurations, such as a 55-gallon drum equipped with a fan and filter bag, to larger, more efficient systems. Ideal for workshops and industrial environments, these systems help maintain a cleaner and safer workspace by minimizing airborne dust particles. Additionally, they can be tailored to fit specific needs, ensuring optimal performance for various applications. With easy installation and maintenance,

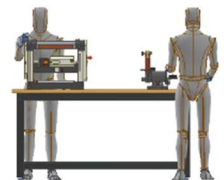
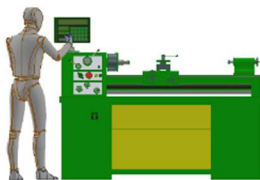
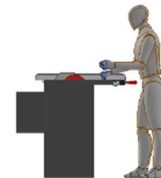
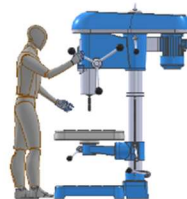
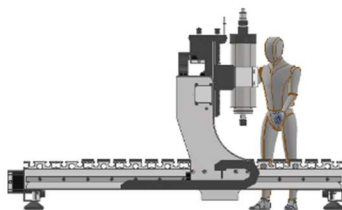
Point-of-Use systems are an alternative to installing a large, high-maintenance dust collector that requires expensive explosion protection. Smaller systems designed for one or a few systems may be a more effective solution.



Floor Sweep Point-of-Use System

Woodworking Applications

- Sawing
- Sanding
- Moulding
- Planing
- Drilling
- Jointing
- Routing
- Shaping
- Floor Sweep



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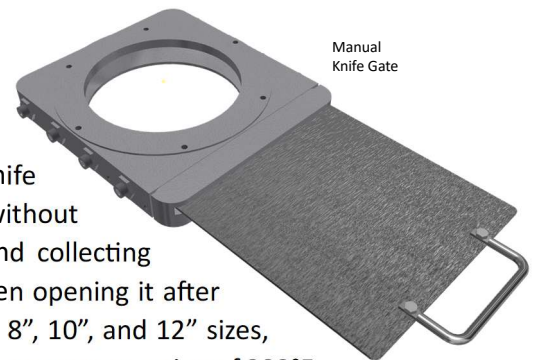
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Airlocks

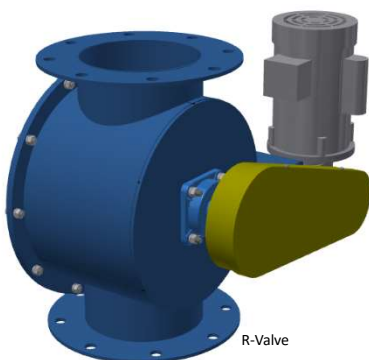
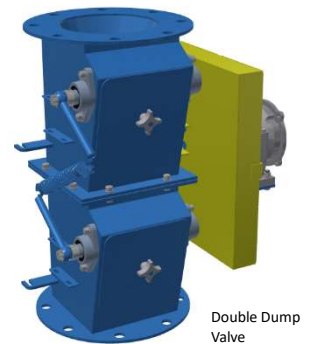
This section discusses common airlocks used in cyclones and filters within the woodworking industry.

Knife Gate: A knife gate is suitable when the dust collector's hopper is directly connected to the collection bin. It's important to factor the dust bin's volume into the dust collector's total volume for explosion calculations. Ideally, the knife gate should remain open during operation to allow material to fall into the bin. Once the bin is full, the knife gate can be closed, enabling the bin to be removed and emptied without interrupting the collector's operation. Aerodyne does NOT recommend collecting material in the dust collector hopper with the knife gate closed and then opening it after operation to drain the contents. Aerodyne stocks manual knife gates in 8", 10", and 12" sizes, made from cast aluminum with stainless steel blades, with a maximum temperature rating of 200°F. Pneumatic options are available upon request.



Flex Connection: A simple flex connection is often used between the dust collector hopper and the dust bin in non-explosive applications. However, this type of connection should NOT be used for explosive materials, as it does not prevent an explosion in the dust collector from escaping the system, which could lead to propagation. For non-explosive applications, Aerodyne offers a flex connection kit designed for 55-gallon drums.

Double Dump Valve: The double dump valve is a low-leakage valve capable of handling larger or irregular materials. It consists of two chambers with a flapper mounted on top, ensuring that one chamber is always closed to prevent a direct path between the hopper and the external environment. The operation involves the top chamber opening to the process, allowing material in the hopper to drain into it. Once the top chamber closes to the hopper, the bottom chamber opens to the top chamber, allowing the material to drain out of the process. This design minimizes leakage, with only gas sharing the chamber with the material in the hopper. Note: For non-explosive applications.



Rotary Valve: For non-explosive applications, the Aerodyne R-Valve is a cost-effective, high-capacity rotary valve available in sizes of 8", 10", and 12". Constructed from carbon steel with EPDM wipers, the R-Valve is often in stock and well-suited for wood applications with high moisture content. Motor horsepower options range from ½ HP to 1.5 HP. Please note that the R-Valve does not meet NFPA 69 requirements and should not be used in explosive applications.



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[Top 5 Reasons to Use a Cyclone Before a Baghouse or Cartridge Collector](#)



[GPC Cyclone](#)



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