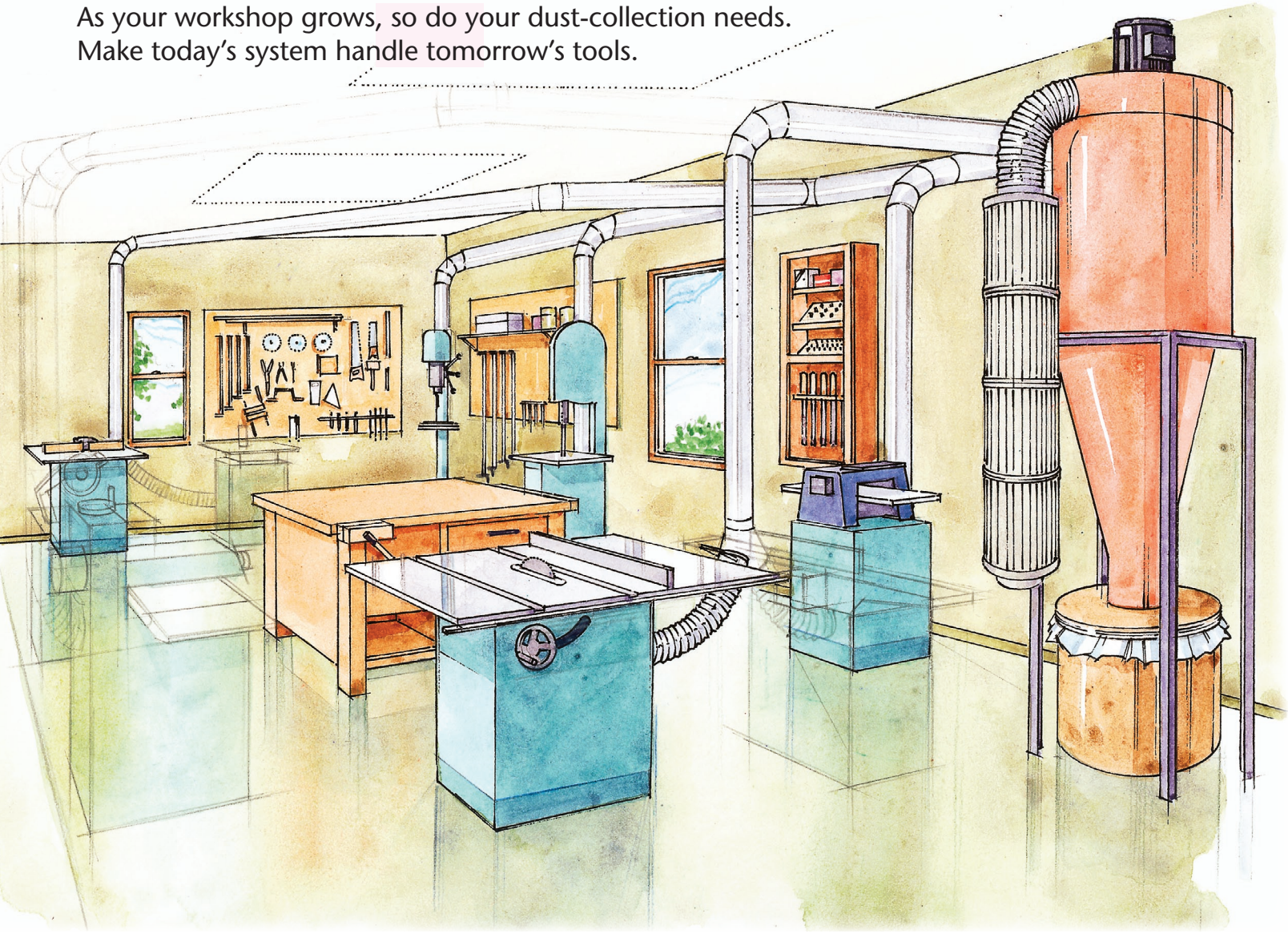
Dust Collection that Evolves with Your Shop

As your workshop grows, so do your dust-collection needs. Make today's system handle tomorrow's tools.



You know you need to upgrade your workshop dust-collection system when:

1. Your workspace looks like a shop-vacuum showroom, with a different one attached to each machine.
2. You postpone buying a jointer or planer because it would overwhelm your old vacuum or bury your shop in chips and dust.
3. If the dust in your lungs doesn't choke you, the people sharing your dust-filled house will.
4. All of the above.

Of course, a basic dust collector or cyclone plus ductwork can be installed for less than $1,000 while high-capacity systems cost several thousand—not exactly chump change. So, if you're about to make that kind of investment, install a system that will serve you for years to come, even as your dust-collection needs change (and they surely will). You'll find the extra money will be well spent if you value:

Healthier lungs. Few shop-vacuum filters and single-bag collectors trap 0.3- to 5-micron dust particles—the stuff that can lead to respiratory problems. (For the definition of "micron" and other dust-collection lingo, see the top of the *next page*.)

The option to add step-up tools, such as a 15" planer or 8" jointer, that need the power of a dust collector.

Less setup time and clutter. A ducted system eliminates tripping over extension cords and corrugated hoses, and repositioning a portable collector.

Convinced? Then start designing a system for both the shop you have today and the one you'll have tomorrow.

Learn the language of dust collection

Before shopping for a dust-collection system, familiarize yourself with a few of the common terms you'll encounter during your search.

Static pressure resistance. Before a system can carry away debris, air already filling the duct needs to be moved out of the way. That produces static pressure resistance measured in inches. Unnecessarily narrow ducts, sharp duct bends, and corrugated hose increase static pressure resistance by restricting airflow or adding friction between ductwork and the air.

Cubic feet per minute (cfm). Be careful how a manufacturer measures air-volume movement. Measurements taken on a "free air" basis—without any attachments that add static pressure or hinder airflow—help you compare one collector with another. But they're not a real-world measure of how a unit will actually perform when hooked up to a system that creates static pressure resistance. Measurements figuring in static pressure resistance better mimic collector performance when hooked up to ductwork and tools.

Drop. A duct descending from an overhead main duct or branch to connect to a tool; drops typically include a 45° wye for the main duct, a 45° elbow, vertical pipe, blast gate, and corrugated hose to attach to the tool. Some use a wye splitter to serve two tools.

FPM/air velocity. This is the speed of air, in feet per minute, moving through the ducts while the system is on. Aim for air velocities of 4,000 fpm in the drops, and 3,500 fpm in the main ducts.

Micron. In this unit of measure for dust particles, 397 microns equals 1/64".

Plan a system for your changing workshop

First, estimate the dust-collection needs of your future, expanded shop. Make a list of your existing machinery, and what you plan to buy within five years. In a typical home shop, you'll likely be working alone on one machine at a time with the others closed off by blast gates. If you plan to share your shop, you'll need a collector large enough to serve machines working simultaneously.

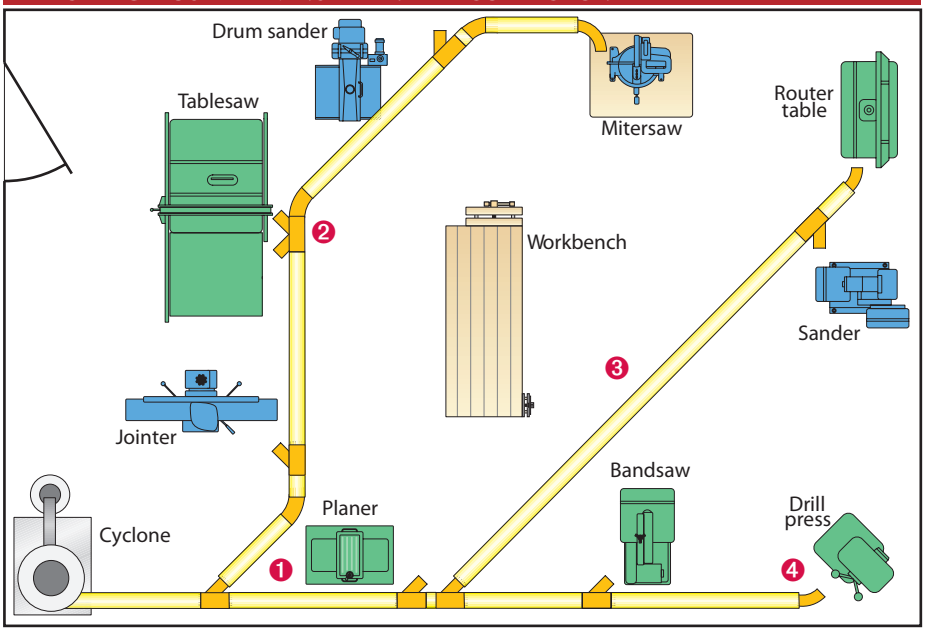
Next decide how much your shop space might grow. Added space requires a more powerful collector to pull debris through longer ducts.

Then map your shop layout with the existing equipment as well as machinery you'll add. To lay out your shop, use graph paper and paper cutouts to represent the size and shape of stationary tools; a computer modeling program such as Google SketchUp; or an online tool such as Grizzly Industrial's planner at grizzly.com, as shown *below*.

Dust-collector suppliers will often help you position the collector in the shop and lay out the ductwork efficiently. The service is free for purchasers of larger cyclones.

We worked with Penn State Industries (800-377-7297) to lay out a 16×24' sample shop, at *left*, that starts with a 10" tablesaw, a bandsaw, a 12" planer, a drill press, and a router table. Future tools include a 6" jointer, 10" mitersaw, 16" drum sander, and a belt/disc sander. Oneida Air Systems also offers a ductwork design service (800-732-4065, or oneida-air.com).

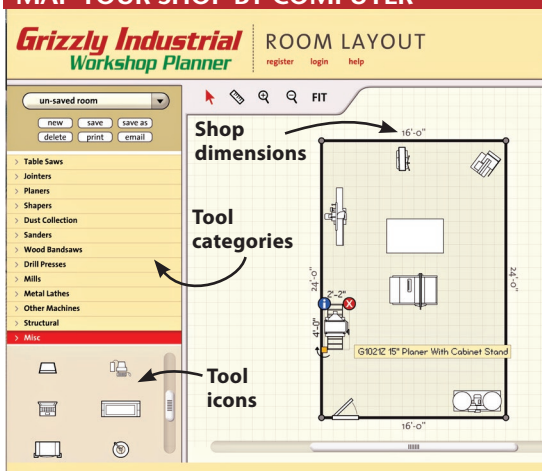
PLACE BIG DUST-MAKERS NEAR THE COLLECTOR



This system designed by Penn State Industries uses a 2.5-hp cyclone and 6" ducts leading to 4" drops that connect to the tools using short, flexible hoses. (Existing tools are shown in green, future tools in blue.) Economy ductwork and connectors, instead of spiral ductwork and premium connectors, cut the estimated price from $2,403 to $2,044. Features include:

1. The planer and (future) jointer both generate large amounts of dust and chips, so both are positioned as close as possible to the collector, where static pressure resistance is least.
2. The drop to the tablesaw splits into two hoses—one for the saw's dust port, and another for an aftermarket dust-collecting blade guard.
3. Diagonal runs cover a large portion of the shop for adding still more tools while minimizing the number of 90° connections.
4. Even the drill press connects to the system by way of a rigid adjustable hose that can be repositioned at the drill-press table as needed.

MAP YOUR SHOP BY COMPUTER



This online shop planner at grizzly.com lets you virtually arrange shop tools so you'll know where to run dust-collection ducts.

Ductwork dos and don'ts

To avoid common duct-design flaws:

DO use the largest ductwork that fits your collector. Just because a tool comes with a 4" dust port doesn't mean you should use 4" main ducts or drops. Instead, look at the intake port sizes for the collectors you're considering. Most cyclones have intake ports of 6" to 8", and some two-bag collectors have 5"- or 6"-diameter intakes, so consider at least a 5" main duct. Tapered reducers, like the one *below*, change duct diameters with minimal static-pressure loss.

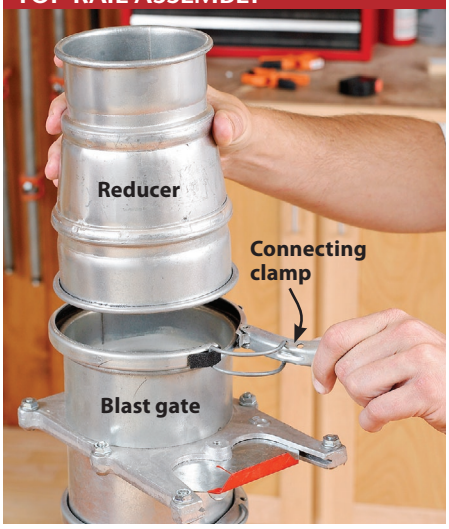
DO smooth out sharp curves. Think of air molecules as fast-moving cars on a freeway. Both change direction faster on a sweeping curve than a 90° turn. The PVC tee shown at *near right* adds more airflow resistance than the metal dust-collection pipe's gradual bend.

DON'T overuse flex hose. Corrugated tubing creates three times more static-pressure resistance than the same length of smooth pipe. Use just enough to link a tool to its drop pipe.

DO eliminate bottlenecks near the collector. (See "Give dust a straight shot to the collector" *below*.) Instead of two 90° bends, use two 45° bends. Better still, raise the collector until the main duct leads straight into the inlet.

DON'T create long duct runs. A single duct of 30' or more that wraps around more than two walls of a shop reduces air velocity and increases the risk of dust buildup. Instead, hang one shorter main duct, with diagonal branches leading to the tool drops.

TOP RAIL ASSEMBLY

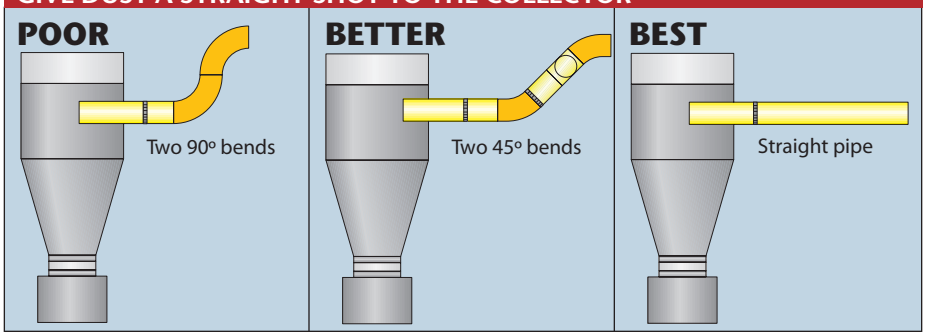


This reducer connects to corrugated hose or narrower duct. Connecting clamps let you reconfigure this type of metal duct.

DANGER: CURVES AHEAD

POOR	BETTER	BEST
This PVC tee's sharp bend raises static-pressure loss by slowing airflow.	A more gentle arc creates less resistance, but you can do better.	A shallow bend reduces static pressure resistance and improves airflow.

GIVE DUST A STRAIGHT SHOT TO THE COLLECTOR



The 90° elbows in the dust-collector setup (*left*) add turbulence and resistance. Two 45° bends (*center*) reduce resistance, but a straight run into the inlet port (*right*) works best.

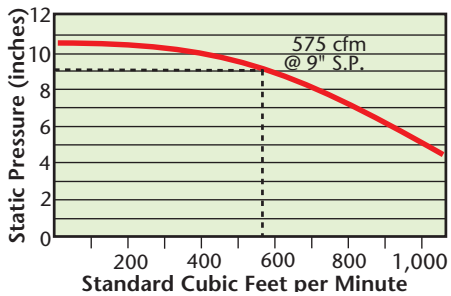
Buy enough suction power

To choose a dust collector that will handle your shop's future requirements, you first need to know which tool in your shop (or on your shopping list) needs the greatest airflow to pull away dust and chips. Because every foot of pipe and each fitting adds resistance to that airflow, you also need to know the amount of static-pressure loss between the collector and that tool. With your workshop layout and dust-collection system map in hand, use the charts on the *next page* to guide you from your floor plan to the collector you need.

Once you have both numbers, you're ready to shop. Skip references to "free air" or "maximum" cfm, and check manufacturers' literature and Web sites for performance curves like the example at *right*. (For head-to-head comparisons of several manufacturers' products, go to woodmagazine.com/cyclones.)

Manufacturers' curves may show how the system performs under ideal, carefully controlled conditions with a new, clean filter. Time and real-world use may lower a unit's actual performance, so opt for the next collector size up from what you've calculated you'll need. That way, no matter how far woodworking takes you, it won't leave a trail of sawdust along the path.

GRADE COLLECTORS ON A CURVE



Trace a horizontal line from your system's static-pressure total (9" in this example) and a vertical line up from your most-demanding tool's CFM requirement (575 cfm). If they meet on or under the curve, that collector has the power you need.

Estimate your dust-collection needs

Begin here

Estimate airflow needs

Find the tool you own (or will add) with the highest cfm requirement. Write the cfm on line ❶ below. Your system needs to meet this peak cfm. If you'll use more than one tool at once, add the two numbers.

Tool	Duct	cfm
Bandsaw	4"	350
Belt/disc sander	4"	550
Drum sander (12–24" drum)	5"	550–650
Jointer, 6–8"	4"–5"	350–550
Planer, 10–15"	3"–5"	500–600
Planer, >15"	6"	700–800
Radial-arm saw/mitersaw	5"	550
Router table/shaper	4"–5"	350-550
Tablesaw	5"	550

1 **Maximum cfm:** _____

Estimate your ductwork

Now that you know your maximum cfm needs, use that number to total the feet of ductwork required to connect the collector to the most-demanding tool (or tools). Circle the maximum cfm number from Step 1 in each of the cfm columns below, rounding up, if necessary. The duct size shown on the same line as the cfm you circled under "main" is the size you need for your main duct. The circled cfm under "branches" tells the duct diameter leading to individual tool drops. Now measure how many feet of each size you need to connect your dust collector to the tool, and write those lengths in the spaces on the right.

Main	Branches	Duct Size	Number of Feet Needed
170	195	3"	
300	350	4"	
475	550	5"	
700	785	6"	
950	1,100	7"	
1,200	1,400	8"	

Add up duct static pressure losses

Now translate the main and branch duct length into static pressure (SP) losses. Multiply the number of feet of duct by that size's SP loss per foot. Add up the numbers in the right column, and transfer the total to the next box.

Duct Size	No. of Feet	Static Pressure Loss per Foot	Total Static Pressure Loss (")
3"	×	0.1	= "
4"	×	0.07	= "
5"	×	0.055	= "
6"	×	0.045	= "
7"	×	0.038	= "
8"	×	0.032	= "
		Total Ductwork Static Pressure Resistance:	"

Add resistance from system parts

You're almost finished. For each duct diameter between the collector and the most-demanding tool, record the number of 45° elbows, 90° corners, and feet of flex hose. Next, add up the totals for each row, and multiply those by the SP values in the far right boxes. Add the subtotals down, and add the total SP loss from the box on the *left*, and write the total maximum static pressure resistance on line ❷. This, along with the maximum cfm from line ❶, are the two numbers you'll need to shop for a collector that meets your tool and system needs.

Fitting Diameter	45° Elbows	90° Corners	Flex Hose	Totals × SP (")
3"	_____×2.5= _____	_____×5= _____	_____ ×3= _____	_____ ×.1"= Subtotal:_____
4"	_____×3= _____	_____×6= _____	_____ ×3= _____	_____ ×.07"= Subtotal:_____
5"	_____×4.5= _____	_____×9= _____	_____ ×3= _____	_____ ×.055"= Subtotal:_____
6"	_____×6= _____	_____×12= _____	_____ ×3= _____	_____ ×.045"= Subtotal:_____
7"	_____×6.5= _____	_____×13= _____	_____ ×3= _____	_____ ×.038"= Subtotal:_____
8"	_____×7.5= _____	_____×15= _____	_____ ×3= _____	_____ ×.032"= Subtotal:_____
			Non-Duct Static Pressure:	
			Total Ductwork Static Pressure Resistance:	
			2 **Total Static Pressure:**	

Sources

Dust collectors, ductwork, and system design assistance: Grizzly Industrial, 800-523-4777 or grizzly.com. Oneida Air Systems, 800-732-4065 or oneida-air.com. Penn State Industries, 800-377-7297 or pennstateind.com.