Woodshop Dust Collection

Presented by
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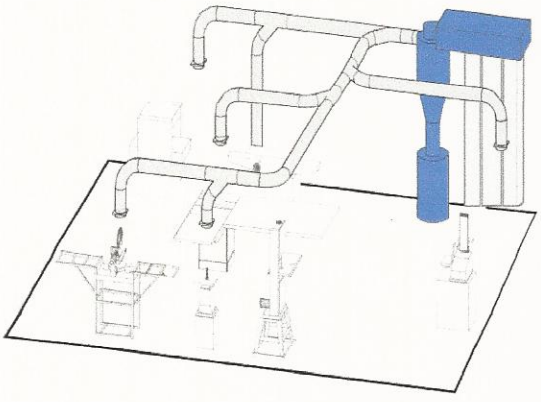
- How much air do I need?
- How much CFM (cubic feet per minute) is required for a hood outlet diameter?
- Manifold sizing for multi-port moulders and multi-port wide belt sanders.



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Indraft Velocities for Hoods and Conveying Velocity in Ducts

Indraft Velocities *Air velocities recommended through openings in hoods enclosing operation or over zone of dust generation.*

Method of Generation	Usual FPM	Typical Processes
Released without noticeable movement	50-100	Evaporation of vapor; exhaust from pickling, washing, degreasing, plating, welding.
Released with low velocity	100-200	Paint spraying in booth; inspection, sorting, weighing, packaging; low speed conveyor transfer points; rotating mixers; barrel filling.
Active generation	200-500	Foundry shakeout; high speed conveyor transfer points; crushers, screens.
Released with great force	500-2000 & higher	Grinding; tumbling mills; abrasive cleaning; metal working.

Recommended Minimum Duct Velocities

Metalworking dusts	4500 fpm branches	4000 fpm mains
Woodworking & other light dusts	4000 fpm branches	3500 fpm mains

Conveying Velocities

Material Conveyed	Conveying Velocity in Ducts-FPM
Vapors, gases, fumes, very fine dusts	1500-2000
Fine dry dusts	3000-3500
Average industrial dusts	3500-4000
Coarse particles	3500-4500
Large particles, heavy loads, moist materials, pneumatic conveying	4500 and higher

* NOTE: For 60° elbows — Loss = 0.67 x loss for 90°
45° elbows — Loss = 0.50 x loss for 90°
30° elbows — Loss = 0.33 x loss for 90°

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CFM Requirements at Specified Velocity

Diameter	3500 FPM	4000 FPM	4500 FPM	5000 FPM
3”	170	195	220	245
4”	300	350	390	430
5”	475	550	610	680
6”	700	785	880	975
7”	950	1100	1200	1330
8”	1200	1400	1570	1750
9”	1550	1800	1990	2200
10”	1900	2200	2450	2700
11”	2300	2630	3230	3230
12”	2800	3175	3600	3900
13”	3200	3630	4600	4600
14”	3800	4300	4800	5300
15”	4250	4900	6000	6100
16”	4900	5600	6300	6990
18”	6200	7100	8000	8800
20”	7700	8700	9900	10990
22”	9400	10600	12000	13100
24”	11000	12800	14100	15800
26”	13000	14900	16800	18200
28”	15000	17100	19300	21100
30”	17200	19800	22100	24500

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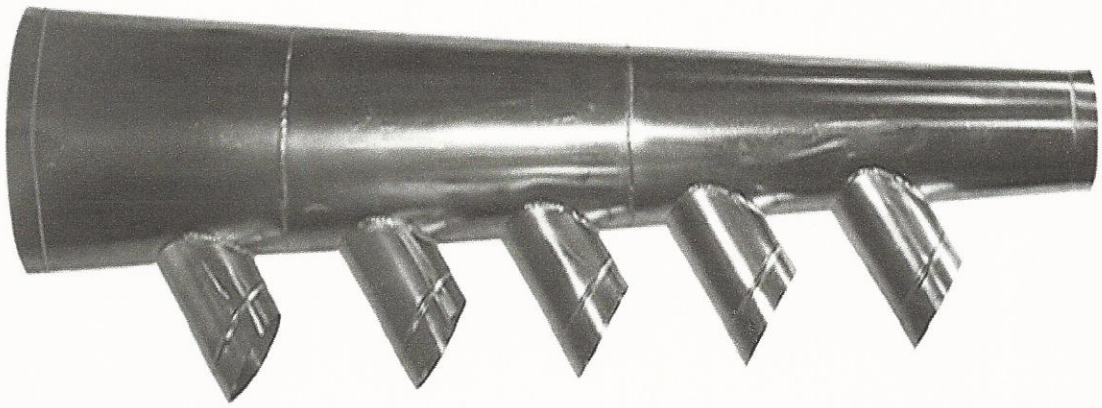
- Multi Tap Manifolds are now required for most:
  - Moulders
  - Edgebanders
  - Wide Belt Sanders
  - Double End Tenoners



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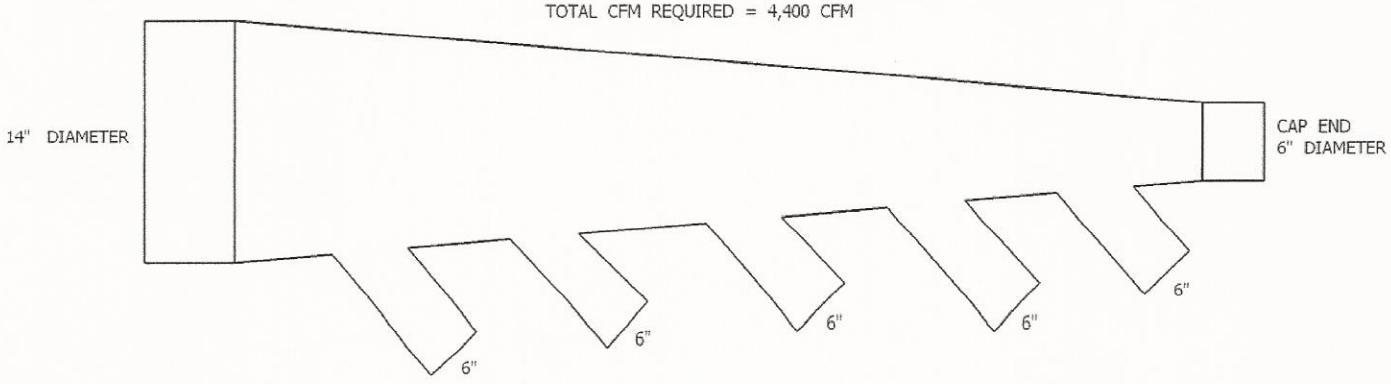
5 TAP TAPERED MANIFOLD

5, 6" DIAM 45 DEG TAPS
6" DIAM = 880 CFM AT 4,500 FPM VELOCITY
TOTAL CFM REQUIRED = 4,400 CFM



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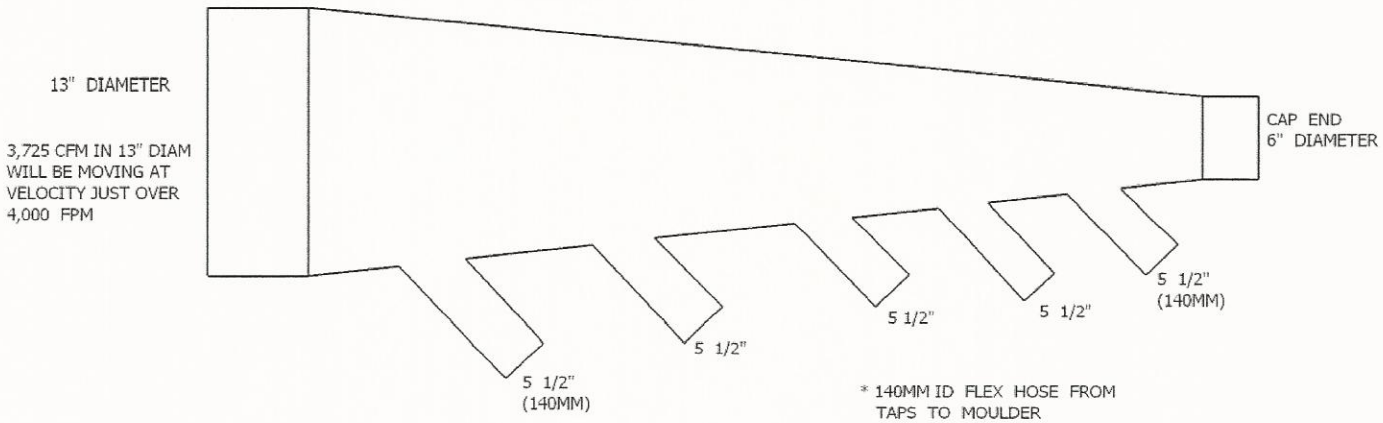
5 TAP TAPERED MANIFOLD

5, 140MM (5 1/2" DIAM) 45 DEG TAPS
5 1/2" DIAM = 745 CFM AT 4,500 FPM
VELOCITY. TOTAL CFM REQUIRED = 3,725



* 140MM ID FLEX HOSE FROM TAPS TO MOULDER

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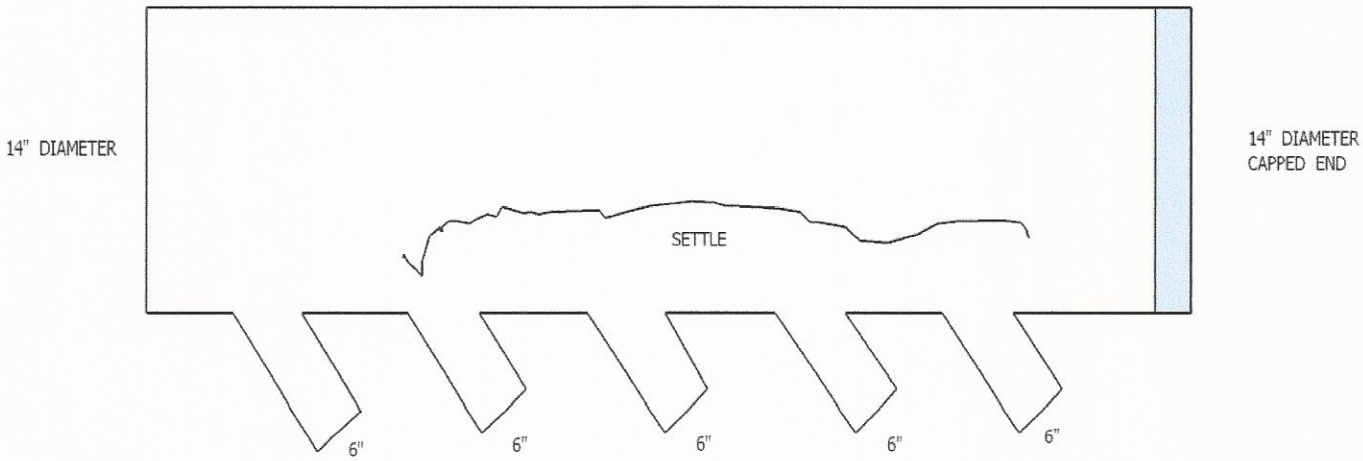
5 TAP MANIFOLD

NOT RECOMMENDED



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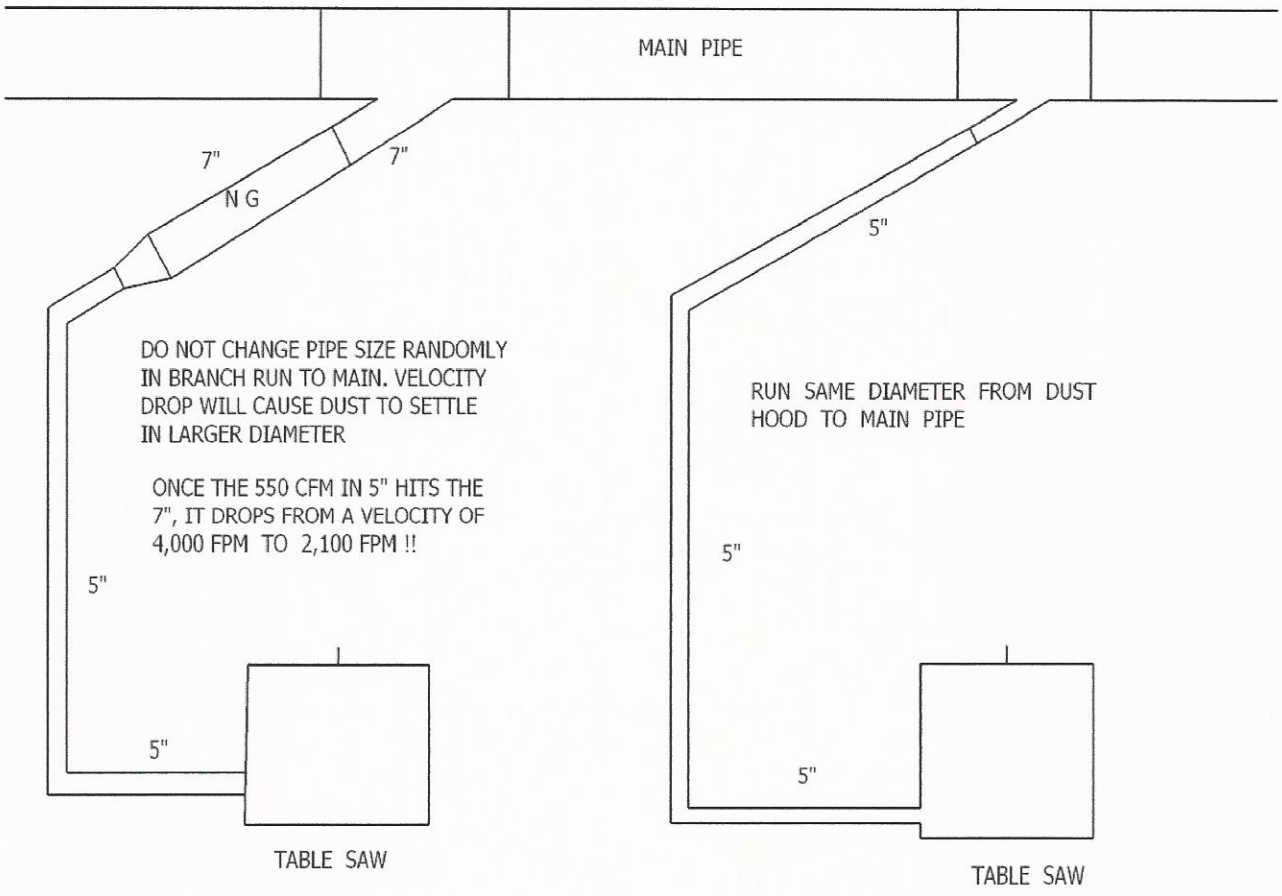

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Summary & Questions

Contact Information

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For future reference this power point "Woodshop Dust Collection" can be downloaded here:
http://www.airhand.com/tech.aspx

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THE PROPER THREE ARE THE KEY
Hooding, Piping, Dust or Fume Collector

There are 3 important aspects to a proper dust or fume control system. Number one is the hooding. It is very critical that a hood encompasses the area where the contaminant is being discharged without interfering with the operation. The hood shall be created as small as possible. The larger the hood, the more air volume that will be required. Once the size of the hood opening is determined, the necessary velocity is then applied which will designate the amount of airflow. Please refer to Chapter 3 of the Industrial Ventilation Manual (www.acgih.org) which will give you all of the information on hood design. We must create a proper hood first. This is our starting point as we pursue a safe and operational system.

Number two is the piping. Dust and fume control piping is available in many different materials and thickness. The contaminant being collected shall determine the piping design. Is the material abrasive, corrosive, hot, cold, sticky, light, heavy, volatile, explosive, or stringy? One size does not fit all. Hooding material will normally reflect the piping. Once the piping material and thickness is determined it is now time to pursue proper piping design. What is the angle of entry at a junction? What is the required radius of elbows? What is the size of the main duct and branches? What is the transport velocity? All of the questions must be answered as we pursue proper piping design. Please refer to Chapter 5 of the Industrial Ventilation Manual, Exhaust System Design Procedures.

Number three is the collection device. Do I need a dust collector? What type of dust collector is required? What should filter material be made of? Do I need a fume scrubber? Can I just use a blower and emit to the atmosphere? Collection devices come in many different types and sizes. Each device is designed for a specific amount of airflow and the contaminant being collected. Again, one size does not fit all. Please refer to Chapter 4 of the Industrial Ventilation Manual, Air cleaning devices, or consult with dust or fume control equipment manufacturer. They will help you determine the proper piece of equipment. A supplementary device called a make up air unit may be necessary. If we emit exhaust air to the outside, we are depleting air from the plant, which must be replaced. A make up air unit will take outside air and replace the amount being exhausted. In cold weather climates, the make up air can be heated.

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Innovation or Gimmick

Back in the early 80's I represented a dust collector product line. Their parent company was a leader in cartridge filters for various applications, such as engine and vehicle exhaust. After several years of research and development, the filter cartridge dust collector was introduced for fine dust filtration. The principle was to have the dust exposed to the outer pleats of cartridge where the maximum amount of surface area was located. Air was drawn through the core of the cartridge. Compared to bag filters, the cartridge provided a substantial amount of filter area in a confined space. The units provided as much filter area as a bag house and required a substantially smaller foot print. They were primarily designed for fine, dry dust. A shaker mechanism or air pulse was used to knock off any cake build up. Used properly, the cartridge filter was a major innovation to the dust collection industry. Today, there are many types of filter material and outside wrappers that can prevent cling, cake build up, and even collect mist. I applied several units to toner dust, graphite dust, glass bead dust, and lead dust, just to name a few.

Then, a few years ago, I noticed an ad for a woodworking dust collector company promoting the cartridge filter as an after filter for a cyclone. My immediate thought was, this is a misapplication. A couple months later, I noticed more ads for single stage dust collectors promoting them as a viable replacement for the upper filter bag. To my dismay, it seemed everyone jumped on the band wagon, right or wrong. At first, they were sold without a method for cleaning. I received feedback from customers that had purchased these collectors. Most said the filters were quickly getting clogged due to cake and cling. Within a short period of time, they were sold with an internal brush for cleaning. Then, came the feedback about the brushes. It appeared the cake was forced into the core filter material and clogging the pores. The replacement cost for the cartridges averaged from $200 - $300 a piece.
Some only lasted weeks and the best case I heard of was six months. These were woodworkers that used the collectors on a daily basis. Some guys were using compressed air to blow out the inside in order to use them. In some cases, this was done every other day.

Bag filter material offered today is substantially improved. There are 10 oz and 16 oz polyester felts with singe to avoid cling (1-5 micron range filtration), fabrics that control electrostatic build up, special surface treatments that improve performance, fabrics that extinguish sparks, and so on. The filter bag longevity with today's fabrics can be at least 5 years or more. If the air to cloth ratio and fabric is correct, I am convinced that the filter bag is substantially better than the reverse use of a filter cartridge. Certainly, those hundreds of dollars and hours of labor can be well spent elsewhere.

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How much CFM will my dust collector deliver?

There are many woodworkers that buy a dust collector on the basis of a CFM number. Unfortunately, the air volume they are given is called **"free air delivery"**, which means there is not any pipe attached to the dust collector. This CFM number may very well be enough air to evacuate the machines, but when you add pipe to the collector you add resistance (static pressure). When resistance is put on a collector, the CFM delivery decreases. The actual air delivery of a dust collector is typically half of the **"free air"** factor once it is piped in. It is important to first find out your systems CFM and RESISTANCE (static pressure), then purchase the right collector. We have several tools to enable you to achieve this. A dust collector must be able to overcome the piping resistance and pull vacuum from the machines you need to operate simultaneously.

What is Static Pressure?

Static Pressure is resistance to flow caused by friction and the channeling of airflow through a round pipe. If you turn on a dust collector without anything attached to it – spiral pipe, flexible hose, or filter bags, it will pull max volume at free air without any resistance. Attach filter bags and 10 feet of spiral pipe to the inlet and you have added resistance. Add 20 more feet of spiral pipe and so on – you increase resistance as you add more spiral pipe and fittings.

It is the dust collector's job to overcome the duct work resistance and pull the proper amount of CFM when you open a branch or branches in a central dust collection system. When you drink a soda with a regular straw it does not take much effort. If you have ever seen kids trying to drink a soda with a curly straw, they strain trying to get the soda to flow. They are trying to overcome the resistance of the long run.

You can run as much duct work in a system as long as the resistance has been compensated for and the CFM is delivered as required.

"Inches of Water" on a scale is used to measure the resistance in a duct system. It can be equated to the resistance to lift water by inches in a tube.

One more resistance analogy is from the old days of siphoning gas. Remember the resistance in the garden hose we had to overcome to get the gas flowing?

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Be sure to check inlet collar ID and OD

Blower and dust collector manufacturers do not adhere to standard dimensions on their inlet collars. Most of them, you cannot slip spiral pipe over or a coupling inside. It is critical that these two measurements (ID and OD) are relayed to your duct fabricator. A construction drawing might state the inlet is 12 inch in diameter, but not whether it is ID or OD. Even if it does, don't trust it. Have your equipment salesperson measure the inlet collar in the factory prior to shipping or field measure it yourself upon arrival.

It is important to get the actual circumferences. For the outside diameter (OD), wrap a string around the collar until it meets itself and measure the length. Then, divide by 3.14. The figure will be the actual outside diameter (OD).

For the inside diameter (ID), stick a piece of masking tape around the inside of the collar until it meets itself, pull it off, measure it, and divide by 3.14. It is a nightmare when the ductwork (spiral pipe, fittings and flexible hose) arrives and the installer cannot make the initial connection.

We find that over 75% of the time a simple custom adapter can easily be fabricated. From that point, the duct system is modular and spiral pipe, fittings and flexible will all connect with ease.

Fitting Tip

Many dust collection systems require a special fabricated round to round reducer or rectangle to round transition. It is very important to have an allowance when requesting such fittings. Let's say you have a blower outlet that measures 12" X 10" on the outside and you want to transition to 12" round duct. When requesting such a fitting, add 1/16" to the inside of the fitting. Example, rectangle to round transition, 12 1/16" ID X 10 1/16" ID to 11 15/16" OD for 12" ID round duct. We have added 1/16" for the end that fits over blower outlet and subtracted 1/16" from round end to fit into 12" ID duct.

In addition, let's say you have a blower inlet 12 1/8" OD and 11 3/4" ID and want to connect to 12" spiral pipe. Can't fit spiral pipe over, can't fit a spiral pipe to spiral pipe coupling into. If you request a custom reducer 12 1/8" ID to 11 15/16" OD for 12" ID round duct, you probably won't get it over the collar, way too tight. Add that 1/16" to the ID and request the custom reducer with 12 3/16" ID to 11 15/16" OD to fit into 12" ID round duct.

Proper fully welded dust collection fittings need a minor allowance. Even that minor allowance is a little tight, but that's good. Welded fittings are made of a minimum of 20 gauge sheet stock which creates a fairly solid fitting. I remember asking one customer how his custom reducer fit. He said," ok, but I had to slice the collar to get it on. I should have asked for a tweak larger." It was a shame to slice up a good quality fitting in order to fit it on the collar.

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