Table 7 .... Exhaust Requirements for Woodworking Operations[41]

(Air Velocity: 4000 fpm in all branches unless noted otherwise)

Self Feed Table Rip Saw
Use 1–5 in. branch at bottom pulley; 1–4 in. branch at saw head.

Large Self Feed Rip Saws Other Than Table Saws
Use 1–6 in. branch at bottom; 1–5 in. branch at top.

Swing Saws
Up to 20 in. use 1–4 in. branch; over 20 in. use 1–4½ in. branch.

Circular Saws

Up to 12 in. dia.	1–4 in. branch
Over 12 in. dia.	1–5 in. branch
Dado head saws	1–5 in. branch

Gang Circular Saws
Ventilation rate depends on effectiveness of hood and maximum number and diameter of saws.

Disc Sanders

Up to 12 in.	1–4 in. branch
12 in. to 18 in. dia.	1–4½ in. branch
18 in. to 26 in. dia.	1–5 in. branch
26 in. to 32 in. dia.	2–4 in. branch
32 in. to 38 in. dia.	1–4 in. branch and 1–5 in. branch
38 in. to 48 in. dia.	1–5 in. branch and 2–4 in. branch

Multiple Drum Sanders (over the table)

Up to 31 in. wide	5 in. branch (see note)
31 in. to 49 in. wide	6 in. branch (see note)
49 in. to 67 in. wide	7 in. branch (see note)
Over 67 in. wide	8 in. branch (see note)

Note: One branch of size indicated required for each drum. Fewer branch pipes may be used as long as total branch pipe cross-sectional area is not reduced. Some manufacturers use 1 extra branch of equal size on feed side. 1-4 in. branch may be required for exhausting bed rubber cushions or mechanically operated brush

Single Drum and Spindle Type Sanders

Up to 50 sq in. sanding surface	1–3 in. branch
50 to 200 sq in. sanding surface	1–4 in. branch
200 to 400 sq in. sanding surface	1–5 in. branch
400 to 700 sq in. sanding surface	1–6 in. branch
700 to 1400 sq in. sanding surface	1–7 in. branch
1400 to 2400 sq in. sanding surface	1–8 in. branch

Horizontal Belt Sander or Edge Sander (see note)

	Drive Pulley	Idler Pulley
Up to 6 in. wide	1–4½ in. branch	1–4 in. branch
6 in. to 9 in. wide	1–5 in. branch	1–4 in. branch
9 in. to 14 in. wide	1–6 in. branch	1–4 in. branch
Over 14 in. wide	1–7 in. branch	1–5 in. branch

Note: Where more than one belt is used, the pipe sizes specified shall be required for each belt. Where a common hood is used for more than one belt, a single pipe of an area not less than the sum of the areas of the pipes specified may be used.

Where belt is reversible, pipe at idler pulley shall be the size specified for the drive pulley.

Vertical Belt Sanders (rear belt and both pulleys enclosed)

Up to 6 in. wide	4½ in. branch on bottom
6 in. to 9 in. wide	5 in. branch on bottom
9 in. to 14 in. wide	6 in. branch on bottom
Over 14 in. wide	7 in. branch on bottom

Band Saws and Resaws

	Bottom	Top
Up to 2 in. wide	1–4 in. branch	1–4 in. branch
2 in. to 3 in. wide	1–5 in. branch	1–4 in. branch
3 in. to 4 in. wide	1–6 in. branch	1–5 in. branch
4 in. to 5 in. wide	1–7 in. branch	1–5 in. branch
Over 5 in. wide	1–8 in. branch	1–5 in. branch

Jointers

Up to 6 in. knives	1–4 in. branch
6 in. to 12 in. knives	1–5 in. branch
12 in. to 20 in. knives	1–6 in. branch
Over 20 in. knives	1–7 in. branch

Single Planners or Surfacers

Up to 20 in. max. working width	1–6 in. branch
20 in. to 26 in. max. working width	1–7 in. branch
26 in. to 32 in. max. working width	1–8 in. branch
32 in. to 38 in. max. working width	1–9 in. branch
Over 38 in. max. working width	1–10 in. branch

Double Planers or Surfacers

	Upper head	Lower
Up to 20 in. max. working width	1–6 in. branch	1–5 in. branch
20 in. to 26 in. max. working width	1–7 in. branch	1–6 in. branch
26 in. to 32 in. max. working width	1–8 in. branch	1–7 in. branch
32 in. to 38 in. max. working width	1–9 in. branch	1–8 in. branch
Over 38 in. max. working width	1–10 in. branch	1–8 in. branch

Molders, Matchers, Sizers (see note)

	Matcher head	Top	Bottom
Up to 4 in.	2–4 in. branch	1–5 in. branch	1–6 in. branch
4 to 6 in.	2–5½ in. branch	1–6 in. branch	1–6 in. branch
6 to 8 in.	2–6 in. branch	1–7 in. branch	1–6 in. branch
8 to 18 in.	2–6 in. branch	1–8 in. branch	1–8 in. branch

Note: Where profiler is used, provide additional pipe not less than that specified for top head.

Wood Shapers
1–4½ to 10 in. branch for each spindle according to size and character of work.

Tenoner

For cut-off saws: Up to 12 in. dia.	1–4 in. branch
Over 12 in. dia.	1–5 in. branch

Use 1–5 in. branch minimum for each top and bottom tenon, cope, and dado head.

Automatic Lathes
Use 1–3 in. to 1–10 in. branch according to work length.

Hogs
Air volume based on 50 cu ft per lb of refuse conveyed. Use 4500 fpm minimum conveying velocity.

Floor Sweeps
Use 6 in. branch for fine dust to 8 in. branch for coarse material.
Mouth at floor, 10 × 4 in. to 12 × 5 in.

Note: Area of floor sweep pipe need not be included in computing main pipe area.

Miscellaneous Equipment
Pulley pockets and chain mortises-3 in. branch; dovetail and lock corner machines, dowel machines, duplex molding sanders, forming lathes, panel raisers (each head), ploughs, rail shears, routers, sash stickers (each head) 4 in. branch; pulley stiles-5 in. branch; glue jointer-6 in. branch.

Table 8 .... Approximate Conveying Velocities

Material Conveyed	Design Velocity Fpm
Vapors, gases, fumes, very fine dust	2,000
Fine dry dusts	3,000
Average industrial dusts	3,500
Coarse particles	3,500–4,500
Large particles, heavy loads, moist materials	4,500 and over

(Continued from p. 709)

4. Elbows and angles shall be a minimum of two gages heavier than straight lengths of equal diameter.

5. Hoods shall be a minimum of two gages heavier than straight section of connecting branches.

6. Where flexible piping is necessary, a non-collapsible type of flexible piping shall be used and its length shall be kept at a minimum.

Construction

1. Longitudinal joints of ducts shall be lapped, and riveted or spot-welded on 3-in. centers, maximum. Double-lock seams may be used on Class I application only.

2. Girth joints of ducts shall be made with lap in direction of air flow with 1-in. lap for diameters up to 19 in. and 1¼-in. lap for diameters over 19 in.

3. Elbows and angles shall have an inside or throat radius of two pipe diameters whenever possible. Large radii are recommended for heavy concentrations of highly abrasive dusts. Construct elbows 6 in. or less in diameter of at least five sections, over 6 in. diameter of seven sections. Prefabricated elbows of smooth construction may be used. Angles shall be pieced proportionately.

4. Hoods must be free of sharp edges or burrs and shall be reinforced to provide necessary stiffness.

System Details

1. Connect duct to fan inlet with split sleeve drawband one pipe diameter long but not less than 12 in.

2. Transitions in mains and sub-mains are to be tapered; a taper 5-in. long for each 1-in. change in diameter is recommended when possible.

3. All branches shall enter the main at the large end of the transition at an angle not to exceed 45 deg (30 deg is preferred). Connect branches only to top or sides of main, with no two branches entering diametrically opposite.

4. Provide dead end caps within 6 in. from last branch of all mains and sub-mains.

5. Provide access openings or cleanouts every 10 ft and near each elbow, angle, or duct junction in horizontal sections except for non-corrosive gases and vapors containing no particulate matter.

6. Support ducts sufficiently to prevent placing of any load on connected equipment and to carry weight of system if plugged with material. Use maximum supporting interval 12 ft for 8 in. or smaller ducts and 20 ft for larger ducts.

7. Provide 6 in. minimum clearance between ducts and ceiling, wall, or floor.

8. Where blast gates are used for adjustment of system, place them near connection of branch to main. Provide means of locking after adjustments have been made. Butterfly-type dampers shall not be permitted.

9. Fire dampers, explosion vents, etc., should be installed in accordance with NFPA Codes or local fire ordinances.

10. Rectangular ducts can be used only when clearances prevent the use of round construction. Rectangular ducts must be as nearly square as possible. Weight of metal, lap, and other construction details are to be the equal of round duct construction whose diameter equals the longest side.

11. Where State or local laws conflict with the specifications given, the more stringent regulation shall be followed. Any other deviation must be approved before installation.

AIR FLOW PRODUCING EQUIPMENT

The principal types of air moving equipment are centrifugal fans, axial flow fans, and venturi ejectors. Chapter 22 includes information on fan types, arrangements, and application. Gravity stacks have application for some systems handling higher air temperatures or steam where no air cleaning equipment is installed.

Centrifugal fans are most frequently used for the bulk of exhaust system applications due to the system pressures involved. Where air cleaning equipment is included, fans are usually located on the clean air side. The paddle wheel or modified paddle wheel designs are heavily constructed and have few blades to make them more suitable if wear, corrosion, or accumulations are a factor. The higher efficiency backward-curved blade designs find application where relatively clean, non-corrosive air is handled. Forward-curved blade designs have limited application due to the number, shape, and metal thickness of the short curved blades.

Belt driven fans are recommended by many designers because a change in fan speed is often needed where future changes of the system may be involved, where added pressure losses from air cleaning equipment improvements are anticipated, or where the fan may be used at some later date for another application.

The axial-flow fan is used for systems having low-pressure losses. Propeller or disc designs develop pressures under 1 in., the vane-axial designs develop higher pressures but seldom are used where pressures exceed 3 in.

The venturi ejector[42] is an inefficient method of air movement, but has the advantage of causing air flow without having the exhaust air pass through the air flow producing equipment. It minimizes the explosion or corrosion potentialities in certain types of system.

Fans, motors, and drives should be located so that safe and easy access for periodic inspection, servicing, and maintenance is possible.

AIR CLEANING EQUIPMENT

As discussed in detail in Chapter 24, air cleaning equipment should be considered in all systems where it can prevent property damage, neighborhood pollution, or reentry of polluted air to the working space, or where it can salvage usable material, reduce fire and explosion hazards, or make possible some recirculation of air to the working spaces. The present growing emphasis on air pollution control makes it desirable to remove all contaminants to the greatest practical degree based on reasonable cost and maintenance.

MAKE-UP AIR REQUIREMENTS

A correctly designed exhaust system may be ineffective during periods when windows and doors are closed. This condition should be anticipated and prevented by making provision for an adequate air supply. Poor performance of exhaust hoods is caused by: absence of air supply systems; cold drafts due to high indraft velocities through cracks and openings in building construction especially at windows and doors; reverse air flow through low-pressure systems of roof ventilators or general ventilation systems; downflow through heater vent stacks preventing exhaust of flue gases to the outdoors. Systems for conditioning make-up air do not necessarily increase heating requirements for the space, as cold air due to infiltration