Table 5 .... Exhaust Requirements[28] for Grinding, Polishing, Buffing, Scratch Brushing Abrasive Cut-Off Wheels, Grinding and Polishing Belts

(Air Volume: 4500 fpm in all branches.) (2-in. water suction at average hood.)

Grinding or Cut-off Wheels				Buffing, Polishing, and Scratch Brushing			
Wheel (dia), In.	Max. Width[a] In.	Branch (dia) In.	Cfm	Wheel (dia), In.	Max Width[a] In.	Branch (dia), In.	Cfm
–9	1½	3	225	–9	2	3½	300
10–16	2	4	390	10–16	3	4½	500
17–19	3	4½	500	17–19	4	5	610
20–24	4	5	610	20–24	5	5½	740
25–30	5	6	880	25–30	6	6½	1040
31–36	6	7	1200				

Horizontal Single Spindle Disc Grinders			Horizontal Double Spindle Disc Grinders			Vertical Single Spindle Disc Grinders		
Wheel (dia) In.	Branch (dia) In.	Cfm	Wheel (dia) In.	Branch (dia) In.	Cfm	Wheel (dia) In.	Branch (dia) In.	Cfm
–12	3	225	–19	1–5	610	–20	1–4½	500
13–19	4	390	20–25	1–6	880	21–30	2–4	780
20–30	5	610	26–30	1–7	1200	31–53	2–6	1760
31–36	6	880	31–53	2–6	1760	54–72	2–8	3120
			54–72	4–8	6240			

GRINDING OR POLISHING BELTS:
To 3 in. wide—3 in. branch, add ½ in. to branch diameter for each 2 in. or fraction increase in belt width over 3 in.

[a] Increase branch diameter 0.3 in., but not less than ½ in., for each 1 in. increase in width over dimension noted.

the air flow. For conveying of solid particles, velocities shown in Table 8 include a reasonable factor of safety and, consequently, design velocities may therefore be adjusted as required to permit use of commercial pipe sizes that are available generally in ½-in. diameter steps through 6-in. diameter, 1-in. steps through 16-in. diameter or larger, and 2-in. diameter steps for large diameters. For contaminants other than solids, conveying velocities are based on a consideration of the higher resistance and lower first cost of smaller diameter ducts against higher first cost and lower resistance of larger diameter ducts.

Main ducts connecting two or more branches are sized by the same procedure as for branches. The main should be designed for the total exhaust volume to be handled through all branch ducts.

Where exhaust systems handling solids are to provide for a substantial increase of future capacity, required conveying velocities can be maintained by:

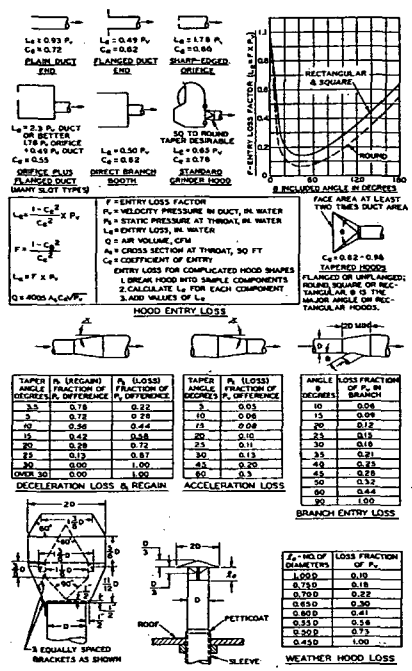
1. Providing open end stub branches in the main through which air will be admitted into system until future connection is made. The volume admitted into the main can be adjusted to required air flow rate (cfm) by use of a blast gate or orifice plate in such stub branch.

2. Arranging the system layout so that exhaust from future points can be picked up by a separate main that will run directly to the fan or air cleaning equipment inlet.

CALCULATION OF SYSTEM PRESSURE LOSS

The pressure loss of the system includes entrance loss[46] as air is accelerated through the hood to a branch duct connection, resistance losses of ducts,[46] elbows, and junctions, and acceleration or deceleration losses from velocity changes within the system. Chapter 21 includes data on duct resistance and on resistance of elbows, and provides sample calculations. In exhaust systems, either the equal friction method (illustrated in Chapter 21) or the use of blast gates in the branches to equalize pressure loss of all runs is employed.[8, 21, 25, 29]

Data on losses for hood entrance, branch entry, transitions, and weather hoods are given in Fig. 2. The static pressure in branch ducts close to the hood connection is frequently referred to as *hood suction*. It is the sum of the branch velocity pressure and the hood entrance loss.



Tapered hood data from Reference 43. Weather hood data from Reference 44

Fig. 2 .... Exhaust System Design Data[15]

CONSTRUCTION SPECIFICATIONS FOR LOCAL EXHAUST SYSTEMS

Correct design and competent installation of sheet steel ducts and hoods, are necessary for the proper functioning of any exhaust system. The following specifications are those recommended in the *Industrial Ventilation Manual*.[18]

General

All exhaust systems shall be constructed with the materials recommended herewith and shall be installed in a permanent and workmanlike manner. The interior of all ducts shall be smooth and free from obstructions; with joints either welded, flanged, or soldered airtight.

Materials

1. Ducts shall be constructed of block iron welded or of galvanized sheet steel riveted and soldered unless the presence of corrosive gases, vapors, and mists or other conditions make use of such material impracticable. Galvanized construction is not recommended for temperatures exceeding 400 F. Welding of black iron of 18 gage and lighter is not recommended for field fabrication.

2. For average exhaust systems on non-corrosive applications the following metal thickness shall be supplied:

Diameter of Straight Ducts (Inches)	U. S. Standard Gage for Steel Duct		
	Class I	Class II	Class III
Up to 8	24	22	20
Over 8 to 18	22	20	18
Over 18 to 30	20	18	16
Over 30	18	16	14

Table 6 ....Ventilation Rates for Open Surface Tanks[26, 27]

Process	Minimum Ventilation Rate Cfm Per Sq Ft Hood Opening: Enclosing Hood: One Open Side	Enclosing Hood: Two Open Sides	Canopy Hood: Three Open Sides	Canopy Hood: Four Open Sides	Minimum Ventilation Rate Cfm Per Sq Ft Tank Area Lateral Exhaust (Note 1) W/L = Tank Width / Tank Length RATIO: W/L 0–0.24 A	W/L 0–0.24 B	W/L 0.25–0.49 A	W/L 0.25–0.49 B	W/L 0.50–1.0 A	W/L 0.50–1.0 B
Plating										
Chromium (Chromic Acid Mist)	75	100	125	175	125	175	150	200	175	225
Arsenic (Arsine)	65	90	100	150	90	130	110	150	130	170
Hydrogen Cyanide	75	100	125	175	125	175	150	200	175	225
Cadmium	75	100	125	175	125	175	150	200	175	225
Anodizing	75	100	125	175	125	175	150	200	175	225
Metal Cleaning (Pickling)										
Cold Acid	65	90	100	150	90	130	110	150	130	170
Hot Acid	75	100	125	175	125	175	150	200	175	225
Nitric and Sulfuric Acid	75	100	125	175	125	175	150	200	175	225
Nitric and Hydrofluoric Acid	75	100	125	175	125	175	150	200	175	225
Metal Cleaning (Degreasing) See Note 2 and Ref. 38 and 39										
Metal Cleaning (Caustic or Electrolytic)										
Not Boiling	65	90	100	150	90	130	110	150	130	170
Boiling	75	100	125	175	125	175	150	200	175	225
Bright Dip (Nitric Acid)	75	100	125	175	125	175	150	200	175	225
Stripping										
Concentrated Nitric Acid	75	100	125	175	125	175	150	200	175	225
Stripping										
Conc. Nitric and Sulfuric Acid	75	100	125	175	125	175	150	200	175	225
Salt Baths (Molten Salt)	50	75	75	125	60	90	75	100	90	110
Salt Solution (Parkerize, Bonderize, etc.)										
Not Boiling	90	90	100	150	90	130	110	150	130	170
Boiling	75	100	125	175	125	175	150	200	175	225
Hot Water (if vent. desired)										
Not Boiling	50	75	75	125	60	90	75	100	90	110
Boiling	75	100	125	175	125	175	150	200	175	225

Note 1—Column *A* refers to tank with hood along one side or two parallel sides when one hood is against a wall or a baffle running length of tank and as high as tank is wide; also to tanks with exhaust manifold along center line with $\frac{W}{2}$ becoming tank width in *W/L* Ratio.

Column *B* refers to free standing tank with hood along one side or two parallel sides.

Note 2—Complete control of the vapors and mist from degreasing operations requires the same ventilation rates as recommended for pickling. However, the solvents employed in degreasing operations are relatively volatile, and the solvent loss caused by evaporation increases rapidly as the exhaust rate at the tank increases. For this reason perfect control is usually sacrificed in favor of lower solvent evaporation rates. Where solvent loss does not present an important cost or operating problem, the exhaust rates given for pickling should be adhered to, but where solvent loss must be kept at a minimum, an exhaust rate of 50 cfm per sq ft of tank area is commonly employed. Where this rate is used, control will be adequate only if the tank is located in an area free of drafts and if the degreasing operations are carried out in accordance with a rigid schedule.[39]

Class I. Includes non-abrasive applications such as paint spray, woodworking, pharmaceutical and food product, and discharge ducts from dust collectors.

Class II. Includes applications for non-abrasive material in high concentration (low-pressure pneumatic conveying); moderately abrasive material; and highly abrasive materials in light concentrations. Typical applications are conveying of chemicals and wood dust; exhaust of foundry shakeouts and sand handling systems, grain dusts; coal crushing and screening; exhaust of grit blast cabinets; and grinding, buffing, and polishing.

Class III. Includes applications for all highly abrasive materials in moderate to heavy concentrations and moderately abrasive materials in heavy concentrations such as low-pressure conveying of tobacco; exhaust systems from sand and grit blasting and abrasive cleaning operations, from rock and ore screening and crushing, from dryers and kilns, and fly ash removal from boiler stacks.

Where aluminum duct is indicated, the following equivalent B & S gage thickness of sheets should be used:

Steel—U. S. Standard Gage	26	24	22	20	18	16	14
Aluminum—B & S Gage	24	22	20	18	16	14	12

3. For exhaust systems on corrosive applications, consideration should be given to non-corrosive materials or coatings.

(Continued on p. 711)