

Every pipe should be kept open and unobstructed throughout its entire length, and no fixed screen should be placed in it, although the use of a trap at the junction of the hood and branch pipe is permissible, provided it is not allowed to fill up completely. The passing of pipes through firewalls should be avoided wherever possible, and floor sweep connections should be so arranged that foreign material cannot be easily introduced into them.

At the point of entrance of a branch pipe into the main duct, there should be an increase in the latter equal to their sum. Some state codes specify that the combined area be increased by 25 percent. While this is not always good practice, and is frequently done at the expense of a reduced air velocity, it is often done where future expansion of the exhaust system is contemplated.

Duct Resistance

The resistance to flow in round galvanized duct, riveted and soldered at the joints, may be obtained from Figs. 1 or 2, Chapter 31. The pressure drop through elbows depends upon the radius of the bend. For elbows

TABLE 6. LOSS THROUGH 90-DEG ELBOWS

RATIO OF ELBOW CENTER LINE RADIUS TO PIPE DIAMETER OR DEPTH	APPROXIMATE LOSS IN PERCENT OF VELOCITY HEAD
1	80
1½	31
2	22
2½	19

whose centerline radii vary from 100 to 250 percent of pipe diameter, the loss may be estimated from Table 6.

RESISTANCE OF SYSTEM

The resistance of the exhaust system is composed of three factors: (1) loss through the hoods, (2) collector drop, and (3) friction drop in the duct system.

The loss through the hoods is usually assumed to be equal to one-half the suction at the hoods. Where possible the resistance of the particular collector to be used should be obtained from the manufacturer.

Friction drop in the pipes must be computed for each section where there is a change in area or in velocity. The velocities should be found in each section of pipe, starting with the branch most remote from the fan. The friction drop for these sections can be determined by reference to Table 6 in this chapter, and Figs. 1 or 2, Chapter 31. Total friction loss in the piping system is the friction drop in the most remote branch, plus the drop in the various sections of the main, plus the drop in the discharge pipe.

EFFICIENCY OF EXHAUST SYSTEMS

The efficiency of an exhaust system depends upon its effectiveness in reducing the concentration of dusts, fumes, vapors, and gases below the safe or threshold limits.¹⁸

Too much emphasis cannot be placed on the necessity of testing exhaust systems frequently by determining the concentration of atmospheric contamination at the worker's breathing level.¹⁹ Commonly accepted

values of threshold limits for usual atmospheric contaminants will be found in Tables 3, 4 and 5, Chapter 8.

AIR FLOW PRODUCING EQUIPMENT

In any type of exhaust system, some form of air flow producing equipment is required to create the pressure necessary to cause the air to flow through the system to the discharge stack. The principal types of air moving equipment are centrifugal exhaust fans, disc or propeller fans, axial flow fans and venturi ejectors.

TABLE 7. CORROSION RESISTING MATERIALS FOR EXHAUST SYSTEMS*

MATERIAL	ACID ^b															
	ACETIC		CHROMIC		HYDRO- CHLORIC		HYDRO- FLUORIC		NITRIC		PHOS- PHORIC		SUL- FURIC		SUL- FURIC	
METALS	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.
Aluminum	Good		Fair		Poor		No Data		Poor		Good		Poor		Poor	
Magnesium and Alloys	No Data		Good		Poor		No Data		Poor		Good		No Data		No Data	
Lead and Lead-Coated	Poor		Good		Poor		Poor		Poor		Poor		Good		Good	
Moly Alloy (60 Ni-20Mo-20 Fe)	Good		No Data		Fair		No Data		Poor		Poor		No Data		Good	
Monel Metal	Fair		Poor		Fair		Poor		Good		Fair		Poor		Good	
Bronze	Poor												Good			
Silicon Iron	Fair		Good		No Data		Fair		Poor		Good		Good		No Data	
Stainless Steel ^c (18 Cr-8 Ni)	Good		Good		Poor		No Data		Good		Poor		Good		Poor	
Enamel Steel	No Data		No Data		Good		Poor		Good		Poor		No Data		Good	
MISCELLANEOUS																
Asbestos Comp.																
Wood	Some woods are decomposed or softened faster than others.															
Rubber									Poor						Poor	
Plastics	In general plastics resist weak acids and are decomposed by concentrated acid.															

* Standard Practice Sheet No. 115 (Division of Industrial Hygiene, New York State Labor Department).
^b Acid mists in air are more corrosive than as liquid in storage tank. Galvanized iron not resistant to acid.

^c Stainless steel of (24 Cr-10 Ni) fairly resistant at low temperature for HCl and H₂PO₄.
^d Under most conditions.
^e At room temperatures.

PROTECTION AGAINST CORROSION AND ABRASION

Manufacturers generally provide special fans for the handling of various industrial wastes. When corrosive or abrasive materials are conveyed, the fan blades and interior of the fan housing should be protected from wear. This may be accomplished by placing the collector on the suction side of the fan. Excellent protection against many corrosive acids may be obtained by lining the interior surfaces of the ducts and fans, including wheels, with rubber.

The removal of gases and fumes in many chemical plants requires that metals used in the construction of the exhaust system be resistant to chem-