TABLE 10. CORROSION RESISTING MATERIALS FOR EXHAUST SYSTEMS[a]

MATERIAL	ACID[b]															
	ACETIC		CHROMIC		HYDRO-CHLORIC		HYDRO-FLUORIC		NITRIC		PHOS-PHORIC		SUL-PHUROUS		SUL-PHURIC	
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		Poor	
Magnesium and Alloys	No Data		Good	Poor	No Data		Poor	Good	No Data		No Data		No Data		No Data	
Lead and Lead-Coated	Poor		Good		Poor		Poor		Poor		Poor		Good		Good	Poor
Moly Alloy (60 Ni—20 Mo—20 Fe)	Good		No Data		Fair		No Data		Poor		Poor		No Data		Good	
Monel Metal	Fair		Poor		Fair	Poor	Good[d]		Fair	Poor	Fair		Poor		Good[e]	Poor
Bronze	Poor												Good			
Silicon Iron	Fair	Good	No Data		Fair		Poor		Good		Good		No Data		Good	
Stainless Steel[c] (18 Cr-8 Ni)	Good		Good		Poor		No Data		Good		Poor		Good		Poor	Good[e]
Enameled Steel	No Data		No Data		Good		Poor		Good		Poor		No Data		Good	
MISCELLANEOUS																
Asbestos Comp.					Good except against strong acids and alkalies											
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.															

[a]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 H_3PO_4.
[d]Under most conditions.
[e]At room temperatures.

venturi ejectors, centrifugal exhaust fans, disc or propeller fans, and axial flow fans[16].

Manufacturers generally provide special fans for the collection of various industrial wastes. These are available for the collection of coal dust, wood shavings, wool, cotton and many other substances. When substances having an abrasive character are conveyed, the fan blades and housing should be protected from wear. This may be accomplished by placing a collector on the negative side of the fan or by lining the housing and blades with rubber.

PROTECTION AGAINST CORROSION

The removal of gases and fumes in many chemical plants requires that metals used in the construction of the exhaust system be resistant to chemical corrosion. A list of the materials which may be used to resist the action of certain fumes is given in Table 10. Hoods and ducts, when short, may frequently be constructed of wood and be quite effective. Rubberized paints are available and may be applied as protective coatings in handling such gases and fumes as chlorine and hydrochloric acid.

[16]The Axial Flow Fan and Its Place in Ventilation, by W. R. Heath and A. E. Criqui (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, February, 1944, p. 107).

CHAPTER 41

Drying Systems

Drying Methods, Radiant-Heat Drying, Conduction or Direct Contact Drying, Convection or Air Drying, Mechanism of Drying, Omissions in the Cycle, General Rules for Drying, Humidity Chart, Dryer Calculations, Design, Estimating Methods

DRYING, in its broader sense, refers to the removal of water, or other volatile liquid from either a gaseous, liquid, or solid material. In practice, the process of direct drying gaseous material is referred to generally as dehumidifying, or condensing, and in some cases chemicals are used in the adsorption or absorption of moisture. The subject of dehumidification is treated in Chapter 23. Drying a liquid is called evaporation or distillation. The common usage of the word *drying* refers to the removal of water or other liquid, such as a solvent, by evaporation from a solid material.

When the solid to be dried contains large amounts of free water, the actual drying process is frequently preceded by the removal of part of the water by some mechanical means, such as filtration, settling, pressing or centrifuging. Removal of as much water as possible by such methods is usually advisable, as the cost of these operations, per pound of water removed, is generally much less than by evaporation. In some drying processes the evaporation of the liquid is accompanied by a chemical change, as in the drying of paint and varnish.

DRYING METHODS

Heat must be supplied in order to dry a solid by evaporation. Since this latent heat is large compared with the specific heat of the materials, drying becomes largely a problem in heat transfer. Hence drying methods are often classified according to the method of heat transfer used, as follows:

1. Radiant-heat drying.
2. Drying by direct contact, and conduction.
3. Convection or air drying.

Radiant-Heat Drying

Drying by sun heat is still practiced where danger of rain is slight, atmospheric pollution is negligible and sufficient time can be allowed.

Radiating surfaces, (heated by steam, electricity or other means), afford a good method of heat distribution and control. Radiant heating sets up convection currents, and in low-temperature dryers only about one-third to one-half of the total heat for evaporation is actually supplied to the material by radiation. At high temperatures the radiation output increases rapidly, according to the *fourth-power law*. The total radiation may be computed by the equations and tables given in Chapter 3. In general, fins and irregular surfaces do not increase radiation, hence the area to be used in calculations is the area of a smooth-surface envelope enclosing the radiating elements.

A certain amount of air circulation is required through a radiant dryer, in order to carry off the vapor.