Table 8. Materials to be Used for the Protection of Exhaust Systems Against Corrosion[a]

Type of Fume Conveyed	Protective Material to be Used
Chlorine	Rubber lining or chrome-nickel alloys
Hydrogen sulphide	Aluminum coated iron, aluminum, high chrome-nickel alloys
Ammonia	Iron or steel
Sulphurous gases	High chrome-nickel alloys
Hydrochloric acid	Rubber lining, chrome-nickel alloys
Nitrous gases	Nickel-chrome alloys

[a]Condensed from data given by Chilton and Huey (*Industrial and Engineering Chemistry*, Vol. 24, 1932).

chemical corrosion. A list of the materials which may be used to resist the action of certain fumes is given in Table 8. 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.

PROBLEMS IN PRACTICE

1 ● What determines the efficiency of an exhaust system?

It is dependent upon its effectiveness in reducing the concentration of dust, fumes, vapors and gases below the safe or threshold limit.

2 ● Are state regulatory requirements as to *suction* applicable to all sorts of dust collecting installations?

As a rule the regulations refer only to grinding wheel and buffing wheel systems.

3 ● What is the most common method of reducing total air volumes handled in cases employing large hoods over apparatus covering a large area?

The use of the petticoats on large hoods which permits a comparatively high air velocity at the rim of the hood and controllably small velocities in the center.

4 ● What other types of collectors are available for use in the place of cyclones and filters when chemical and physical conditions obviate the possibility of the use of them?

Devices such as scrubbers and contactors, using water or other contacting liquids, and electrical precipitators.

5 ● What is the most frequent error made in dust collector system design?

The omission of some means of putting into the workroom air having the proper characteristics to replace that which has been exhausted.

6 ● Are there available means for testing the performance of dust collecting systems when they are required to meet high industrial hygienic standards?

Yes. Such means are set up by the United States Public Health Service and by the Standard Code for Testing and Rating Air Cleaning Devices Used in General Ventilation Work. (Chapter 44).

7 ● Why is it not permissible to connect up emery wheels and buffing wheels to the same exhaust system?

Emery wheels and buffing wheels should be handled by separate systems because of the fire hazard, as it is possible for sparks from the emery wheels to ignite the lint and dust from the buffing wheels when both are carried through the same system.

8 ● Give an important characteristic of centrifugal type dust collectors which should be given consideration when applying this type of collector to installations requiring high separating efficiencies.

The separating action of a cyclone or centrifugal type collector depends largely on centrifugal force. Reducing the radius of air flow increases the centrifugal force for a given velocity of flow. Accordingly, the smaller size units usually give higher separating factors, and better results can sometimes be obtained by using a number of small collectors instead of one large unit.

9 ● Mention some general suggestions relating to the design of efficient industrial exhaust systems.

a. Endeavor to obtain a maximum degree of effectiveness with a minimum volume of air, by the use of well designed hoods closing in the sources of fumes or material to be removed so located as to take advantage of the natural direction taken by the fumes or materials when leaving their source.

b. Give particular care to the velocity of flow. The duct velocities for material conveying systems must be high enough to properly carry the material, but they should not be higher than necessary because excessive velocities increase the pressure requirements and result in a waste of power.

c. Select the type of fan best suited to the job. For installations where stringy material is handled do not use a fan wheel which has a shroud.

d. When handling the refuse from various machines, study the grouping and operating cycles of the machines. Connecting a large number of machines into one system is frequently very uneconomical.

e. Avoid unnecessary distances and bends in laying out the piping system.

10 ● The static pressure measured at the throat of a buffing wheel hood is 2 in. and the velocity head measured with a Pitot tube is 1.6 in. Calculate the restriction coefficient f.

From Equation 2, $V = 4005 f \sqrt{h_t}$.

From the theory of air flow, $V = 4005 \sqrt{h_v}$.

Hence, $\sqrt{h_v} = f \sqrt{h_t}$.

or

$$f = \sqrt{\frac{h_v}{h_t}} = \sqrt{\frac{1.6}{2.0}} = 0.89$$

11 ● A tank, 4 ft by 8 ft, contains a fluid which gives off injurious vapors. A large hood is located 30 in. above the top of the tank and extends slightly over its edges. Assuming that a velocity of 60 fpm is required to adequately control the vapors near the edges of the tank, calculate the air flow required.

Using Equation 4, $P = 2 \times 4 + 2 \times 8 = 24$ ft; $D = 30$ inches $= 2.5$ ft; $V = 60$ fpm.

Hence, $Q = 1.4 \times 24 \times 2.5 \times 60 = 5040$ cfm.

12 ● Silica dust with a specific gravity of 2.65 is being conveyed in a duct system. The velocity measured in a vertical portion of the system is found to be 2700 fpm. What is the maximum diameter particle transported at this velocity?

Using Equation 5a, $2700 = 13{,}300 \times \frac{2.65}{3.65} \times d^{0.670}$

from which

$$d = (0.28)^{1.75} = 0.11 \text{ in.}$$