

erably not more than 6 ft apart and be rectangular in shape with the long side parallel to the back of the hood. Exhaust openings into range hoods should be designed to maintain a velocity of 1500 to 1800 fpm.

An approved fire damper with fusible link should be (and is required by code in many states) installed in the main exhaust duct or branch adjacent to the range hood. Should there be more than one hood connected to a common duct, then the branch duct to each hood should be provided with a fire damper. Access doors should be provided at the fire damper for purpose of inspection, cleaning or for renewal of fusible link. All exhaust piping to range hoods, commonly called grease ducts, should be provided with tight fitting cleanout doors of adequate size to permit easy removal of grease.

Hoods over steam tables should be of similar construction to range hoods. In determining the necessary amount of air to be exhausted it is considered good practice to design such hoods with a face velocity of 60 to 70 fpm. Hoods over dishwashing machines are usually relatively small and generally 1500 to 2000 cfm per hood is allowed, which is equivalent to a velocity of approximately 100 fpm per square foot of face area. Range hoods in diet kitchens are constructed the same as restaurant range hoods but with less exhaust air per square foot of face area, depending upon the nature of the food cooked.

Hoods are not often used in private residences unless they are quite large and the consideration of expense is not important. For such residences the hoods should be designed on the same basis as diet kitchens. Most all residence kitchens can be effectively and economically ventilated by the installation of a built-in kitchen ventilator, which should be located in an outside wall and in close proximity to the kitchen range. It has been found that the capacity of the built-in kitchen ventilator should be at least 350 cfm regardless of the size of kitchen. This can be justified on the basis that the smaller the kitchen, the more concentrated the heat will be thus requiring a more rapid rate of air change. Standard size built-in kitchen ventilators are generally available in three sizes, namely 350, 500 and 800 cfm. The proper size to use will depend on design conditions and available wall space.

DUCT SYSTEM DESIGN

In designing a duct system it is necessary to recognize a few fundamental principles (see also Chapter 32). Knowing the quantity of air required, the size of the duct may be computed from Equation 5:

$$A = \frac{Q}{V} \quad (5)$$

where

A = cross-section area of duct, square feet.

Q = air quantity to be handled by the duct, cubic feet per minute.

V = velocity of air, feet per minute.

Air Velocities in Ducts

Where it is necessary to transport the particulate material collected in an exhaust system, minimum carrying velocities must be maintained in the

TABLE 5. GAGES OF METALS FOR EXHAUST SYSTEM

DUCT DIAMETER, IN.	GAGE OF METAL	
	Dust	Non-Corrosive Fumes, Vapors and Gases
8 or less.....	20	24
9 to 18.....	18	22
18 to 30.....	16	20
30 or more.....	14	18

ducts preceding the collector. It has been found that good design results when air velocities in horizontal runs are not less than 3000 fpm or not greater than 5000 fpm. When the dust being carried is organic and other than wood flour, or similar material, a velocity of 2500 fpm is adequate. The velocity in vertical piping should be increased 25 per cent over the minimum required for transport in horizontal ducts.

For duct systems wherein the air has no dust or solid load, a lower velocity is desirable, which may range from 1200 to 2000 fpm. In view of the fact that the horsepower required by a system depends directly on the resistance and the resistance is a function of the velocity, economical design requires velocities of this magnitude.

The equal friction method is generally used for designing a duct system as this insures equal resistance to air flow in all branches throughout the system (see Chapter 32). Long main ducts do not generally provide the most economical layout. Where it is necessary to ventilate a large number of machines, or machines which are widely separated, it is desirable to locate the fan at approximately the center of the system. With this arrangement it is possible to choose a fan which will deliver the required air quantity against a lower resistance pressure, and this will generally result in a horsepower saving.

When a system carrying dust is designed with an oversize main duct to allow for future extension, the air velocity may be found to be too low to carry the dust, and serious plugging may occur. In this case it is desirable to install an orifice in the end of the pipe to allow for the lower air quantity.

Construction

The ducts leading from the hoods to the exhaust fan should be constructed of sheet metal not lighter than is shown in Table 5. The piping should be free from dents, fins and projections on which refuse might catch.

All permanent circular joints should be lap-jointed, riveted and soldered, and all longitudinal joints either grooved and locked or riveted and soldered. Circular laps should be in the direction of the flow, and piping installed out-of-doors should not have the longitudinal laps at the bottom. Every change in pipe size should be made with an eccentric taper flat on the bottom, the taper to be at least 4 in. long for each inch change in diameter. All pipes passing through roofs should be equipped with collars so arranged as to prevent water leaking into the building.

The main trunks and branch pipes should be as short and straight as