

Because the low static pressures involved are usually less than $\frac{1}{8}$ in. of water, disc or propeller fans are generally used instead of the blower or housed types. The fans should have quiet operating characteristics, and they should be capable of giving about 20 to 30 air changes per hour in northern areas. In the South the usual specification requires one air change per minute which provides appreciable air movement in addition to the cooling effect.

Types

Open attic fans are units in which the fan is installed in a gable or dormer and one or more grilles are provided in the ceilings of the rooms below. Outdoor air, which enters the house through open windows, is drawn into the attic through the grilles, and is discharged out-of-doors by the fan. An attic stairway may be used in place of the grilles. It is essential that the roof and the attic walls be free from air leaks.

Boxed-in fans are units in which the fan is installed within the attic in a box or housing directly over a central ceiling grille, or in a bulkhead enclosing an attic stair. The fan may be connected by a duct system to the grilles in individual rooms. Outdoor air entering through the windows of the rooms below is discharged into the attic space and escapes to the outside through louvers, dormer windows, or screened openings under the eaves.

Location

The locations of the fan, the outlet openings, and the grilles should be selected after consideration of the room and attic arrangement in order to give uniform air distribution in the individual rooms served. If the outlet for the air is not on the side away from the direction of the prevailing wind, openings should be provided on all sides. Kitchens should be separately ventilated because of the fire hazard, and to prevent the spread of cooking odors.

Costs

The capacity of attic fans is from 3,000 to 30,000 cfm with the trend toward units in the range of capacity from 7,000 to 15,000 cfm.

Some typical data on an attic fan installation in an average six room house of frame construction containing 14,000 cu ft and located in the southern part of this country are:

Installed cost.....	\$100 to \$400, average \$200
Fan data.....	12,000 cfm average, 500 watts input
Operating period.....	April 15 to October 15, intermittently as weather conditions demand
Power consumption.....	500 kwhr per year for 8 months' operation

In northern climates the figures would be considerably reduced. A smaller capacity fan can be effectively used and the cost of an installation ranges from \$60.00 upwards.

Chapter 23

COOLING, DEHUMIDIFICATION AND DEHYDRATION

Definitions and Methods, Adsorbents, Absorbents, Nature of Processes, Temperature—Pressure—Concentration Relations, Dehydration Methods, Auxiliaries, Controls, Performance, Economics

THE addition or abstraction of heat to or from air, whether sensible or latent, requires (a) a medium held at the necessary temperature or vapor pressure to produce a flow of heat or moisture and (b) sufficient contact between the air and the medium to achieve the desired final condition. The medium may be solid or liquid. It may be used (a) directly, as in a water or brine spray, or (b) indirectly, as with a steam radiator or direct expansion cooling coil.

The contact is obtained through the use of exposed surface, to which the molecules of air are brought into direct physical proximity, thereby producing the heat interchange. These molecules then re-mix with uncontacted molecules in the air stream. The completeness of the interchange is a function of the number of such successive contacts, and is a measure of the efficiency of the surface¹. The contacting surface may be that of the medium directly, such as a finely atomized spray or the bed of a solid dehydrating agent; or a chilled or warmed metal surface, as a coil; or a combination of medium and surface, such as a packed tower, where the medium produces the interchange and the surface provides the necessary contact area.

DEFINITIONS AND METHODS

There are several basic methods of producing the necessary difference in temperature or vapor pressure between air and the medium employed to achieve cooling or dehumidification, or both simultaneously:

Cooling of air involves its reduction in temperature due to the abstraction of sensible heat. It is always a result of contact with a medium held at a temperature lower than that of the air. Cooling may be accompanied by moisture addition (evaporation), by moisture extraction (dehumidification), or by no change of moisture content whatever. Such moisture change, if present, is considered as a secondary or by-product effect. As

¹The Contact Mixture Analogy Applied to Heat Transfer with Mixtures of Air and Water Vapor, by W. H. Carrier (A.S.M.E. Transactions, Vol. 59, 1937).