

of water, disc or propeller fans are generally used instead of the blower 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 lowering the inside air temperatures¹⁰.

Types

Open attic fans are units in which the fan is installed in a gable or dormer of the attic and one or more grilles are provided in the floor of the attic, permitting air to flow from the hall below. Outdoor air, which enters the house through open windows, is drawn into the attic through the grilles, and is discharged outside 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.

Another version of the attic fan is the *window fan* for use when attic application is not feasible or no attic is available. Supplied with a perforated or expanded metal enclosure and mounted in either the upper or lower window section, this fan is easy to install or move to another location.

The locations of the fan, the outlet openings, and grilles should be selected after consideration of the room and attic arrangements 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 as in the case of the boxed-in fan, 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.

The window fan may be located in a hall or an unused bedroom. Noise of operation is more of a problem with the window fan than with the attic type, although care should be taken to locate either type of fan so that possible complaints are not forthcoming.

These fans range in capacity from 3000 to 30,000 cfm. The window type usually does not exceed 8000 cfm, while the most generally used attic type ranges from 8000 to 16,000 cfm. Power consumption is under 50 watts an hour per 1000 cfm of rated output for the 8000 cfm fan and larger while the watts input for smaller fans is greater than this figure. Improved results can be secured with the window fan by closing off parts of the house where ventilation is not desired.

¹⁰Comfort Cooling with Attic Ventilating Fans, by G. B. Helmrich and G. H. Tuttle (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 155). A.S.H.V.E. RESEARCH REPORT No. 979—Study of Summer Cooling in the Research Residence for the Summer of 1933, by A. P. Kratz and S. Konzo (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 167). A.S.H.V.E. RESEARCH PAPER—The Effect of Attic Fan Operation on the Cooling of a Structure, by W. A. Hinton and A. F. Poor (A.S.H.V.E. JOURNAL SECTION, Heating, Piping and Air Conditioning, April, 1942, p. 244). The Installation and Use of Attic Fans, by W. H. Badgett (Agricultural and Mechanical College of Texas, Bulletin, No. 52, 1940).

Chapter 24

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).