

supplied with steam or hot water from an external source. Electric strip heaters may also be considered, where installation and operating costs justify their use. They are often used in special control applications. Reverse cycle heating as described in Chapter 39 has been developed as a feature in some unit air conditioning equipment, but this form of heating has not yet been generally adopted.

Humidifying

Adding moisture to the air involves the absorption of heat, by the humidifying water, for conversion to water vapor. Heat may be supplied by heating the humidifying water, or supplied from the air to be humidified. In the latter case the air may be warmed or the water finely divided to present a large evaporating surface to the existing air. The source of heat may be from electricity, steam or hot water coils, or from a heat transfer surface as in a direct-fired unit. Occasionally vapor is added directly by means of steam jets but this is usually confined to industrial applications because of the presence of some odor from the steam. Methods and types of humidifying apparatus are dealt with in detail in Chapter 37.

For unit application, some of the available methods are the spray nozzle, or the atomizing nozzle, the impact-jet, the drip screen and the evaporating pan. The first method is usually employed where humidification on a large scale is desired, as with large remote industrial units. Eliminator plates are necessary and the water supply may be recirculated by a pump or wasted to the drain. The drip screen, impact-jet, evaporator pan or small atomizing jets are used when humidification is desired in the smaller remote and self-contained units.

Wetted surfaces exposed to the air stream and utilizing the capillary action of water on porous substances such as fabrics and ceramics, are used for adding moisture to air. Frequent cleaning or replacement is necessary to avoid closing of the pores and to maintain freedom from odors or growths on the humidifying element.

Cooling and Dehumidifying

These two functions of air conditioning are usually performed simultaneously, although both may be done separately. For example, air may be dehumidified or dehydrated without sensible cooling by the process of adsorption. Sensible cooling of air may be accomplished without dehumidifying by maintaining the cooling surface temperature above the dew-point temperature of the air to be treated. Chapter 7 explains these fundamentals in detail.

Unit equipment commonly utilizes heat transfer surface such as pipes or coils, through which a cooling medium such as water or a refrigerant, is circulated. Types and methods of generating cooling mediums are covered in Chapter 39. Brine or water sprays may be used if desirable, either separately or in combination with coil or pipe surface. However, these methods find their best application in the larger, remote type units. Surface temperature and area of the coil or pipe, air volume and velocity, and spray temperature and volume are some of the controlling factors in unit air conditioner design and application. Ice as a cooling medium is practical but is seldom used in connection with units.

Filtering

Cleaning of outside or recirculated air discharged to the conditioned area is one of the important functions of air conditioning, and air filters

should be included on all units which condition air for comfort. Protection is also afforded the cooling and heating coils as well as the condenser coil in the case of the air cooled type.

Means of filtering may vary from the lint screen to the electrostatic filter, with the degree of efficiency covering a wide range. Inexpensive throw-away type filters lend themselves well to the compact design of the unit conditioner. Air cleaning devices form the subject of Chapter 33.

Ventilating

Provision for the introduction of outside air should be an essential part of unit conditioner design. Odors and air vitiation are avoided and better load control is possible when a positive means of introducing outside air is available.

On the small, air cooled room units, it has been found practicable to control the air in such a way as to permit variation from all recirculated air to 100 per cent outside air. An added feature is a dampering arrangement whereby it is possible to exhaust air from the room to remove smoke and generally ventilate the space.

A code⁴ sponsored by a Joint Committee of the A.S.H.V.E. and the *American Society of Refrigerating Engineers* may be consulted, although it should be realized that individual applications may often show a need for ventilation in excess of these minimum requirements.

Types of Units

Unit air conditioners fall into two general classifications, depending on the location of the refrigeration source. Those units having the condensing unit completely enclosed in the same cabinet as the evaporator are known as self-contained types, while those units having the condensing unit remotely located from the evaporator and requiring piping of refrigerant from the condensing unit to the evaporator and return are known as remote types.

Self-contained units are further divided into two groups in accordance with their condensing mediums, being either air-cooled or water-cooled. Evaporative cooled types are included in this latter class.

The air-cooled types are small in capacity, ranging from $\frac{1}{8}$ to $1\frac{1}{2}$ hp. Their principal application is for conditioning such spaces as hotel rooms, offices and residential living quarters. A duct connection between the unit and an outside window or ventilated air shaft is required to permit disposal of the heat extracted from the conditioned area. The unit may stand in front of the window or be mounted on the window sill. Various styles and types of windows are encountered which increase the difficulty of making the window connections. The evaporation of condensate on the condenser coils, as a means of disposing of this moisture, tends to increase the condensing capacity and reduce the operating head pressure. Some units add supplementary water so that increased capacity may be obtained from constantly wetted condenser coil surface. Connections to an electrical outlet may be by means of a conventional cord and plug or a permanent electrical connection, depending on local code rulings pertaining to the installation of small motors. The exterior finish of the unit in metal, wood or fabric is decorated to harmonize with office or bedroom furnishings.

A unit of the air-cooled condenser type for floor mounting is shown in Fig. 1. Of the two fans shown, the lower one acts as condenser air fan, and in some units this fan is arranged with slingers for discharging condensate on the condenser coil while the upper fan discharges air into the