

Heating

The normal air conditioning unit derives its heating function from a heating coil, usually of the non-ferrous finned tube type supplied with either steam or hot water. Steam may be supplied directly from a self-contained and built-in oil or gas fired unit, from a separate domestic steam boiler, or even from an outside source of a central heating plant. Hot water is supplied either from a separate hot water boiler or in rare instances from a domestic water heater.

In domestic or household conditioning units, adapted from a warm-air heater to which humidification is added, or possibly all-year-round conditioning, a direct-fired air interchanger is frequently used. The source of heat in this case may be from the combustion of coal, oil, or gas. A wide variety of designs and structures are used. In such direct-fired systems, the bulk and volume of the heat transfer surface is necessarily large in proportion to the rest of the equipment.

Where electric power is low in cost, electric heat has been furnished for air conditioning units either in the form of encased heaters, or open wire heaters. (See Chapter 40.) Radiant electric heaters are seldom used except as their radiant heat is absorbed by some receiving wall and there transmitted to the air in the form of convected heat.

Another method of applying electric heat is by means of the reversed refrigeration cycle, whereby electric energy is used to compress a refrigerant and to deliver the heat of compression, withdrawn from a lower temperature source, to the conditioned space by locating the condensing coils in the air circulation circuit of the air conditioning unit. While this method of heating has gained wide interest, it is practical only in a limited number of applications.

Humidifying

A variety of methods have been used to furnish humidification in winter to air conditioning units. The oldest and best known is by means of a direct spray which is used in many different ways. The simplest system is where the spray water is furnished from a constant water source, such as city water, and is permitted to run to waste. Under such conditions, the spray may be either of the direct atomizing type where, by means of the nozzles, the water is broken into fine particles, or of the so-called target spray type, where a fine stream of water under pressure is caused to impinge upon a flat surface or target. Such methods are normally rather inefficient in the use of water.

In some units, in order to increase the humidifying capacity and to utilize a greater portion of the spray water, the atomized spray is permitted to impinge against a heated surface thereby forcing its evaporation. While this is practical in some instances, there is danger of scale formation where hard water is employed.

One of the simplest methods of humidification in winter is by means of a direct steam spray. This is seldom used in air conditioning units for comfort applications due to the resulting odors. In industrial applications, however, it finds frequent use. The steam is usually introduced to the air through a perforated tube or through some type of porous material.

If a small atomizing spray is not used in comfort conditioning units, the evaporative pan type of humidifier is usually employed. This consists of a container offering as much water surface as possible and equipped with means of heating the water. This heat may be applied either electrically, by steam, hot water, or by circulation of the water from a heated space through the evaporating pan. Since the humidification is accomplished by surface evaporation only, it is essential that the air stream be directed across the surface and that the evaporating surface be large. While this system eliminates the dusting hazard when hard water is used with a spray system, hard water tends to scale the heating surface and results in loss of capacity and the need for frequent cleaning.

The rate of evaporation per unit surface exposed is low, thus it frequently becomes difficult to provide sufficient surface for adequate capacity. The higher the temperature of the water, the lower the relative humidity of the air; the greater the velocity over the surface, the greater is the rate of humidification. The evaporative pan type of humidification limits the water wastage and is usually supplied with water through a float valve. Due to the collection of salts in this evaporating pan such humidifying systems require occasional drainage and cleaning.

Other methods of humidification attempted in air conditioning units are through the use of wetted fabrics, porous earthenware plates, or other capillary surfaces. These methods rely upon the capillary absorption of the moisture up from the liquid level into the portion exposed to the air. They have a tendency to lose their effectiveness due to the resulting deposit of mineral salts at the evaporating surfaces thereby clogging the pores and reducing the contact of the air with the water. Also they frequently become foul and often support bacterial growth.

Cooling and Dehumidification

Those units that employ recirculated water sprays will undoubtedly use such sprays as their means of cooling and dehumidification by furnishing refrigeration to the water in circulation. Occasionally where an adequate source of cold well water is available, this may be used as a direct spray and run to waste.

Other methods of dehumidification accomplished by direct contact with the transfer medium are by means of the so-called *adsorption* and *absorption* systems. (See Chapter 24.) It must be recognized that these methods of dehumidification do not in themselves provide cooling. The substance removes the water vapor from the air thereby heating it. This highly dehumidified air may then be cooled either by partial rehumidification or by direct contact with a cooling medium of cold water or direct expansion refrigerant. There are now on the market solid adsorbents such as silica gel and activated alumina. Water solutions of the chlorides of various inorganic elements such as calcium and lithium chloride are the absorbents most frequently used.

Finally a common direct means of cooling and dehumidification is through the use of ice. In such units the ice is brought into as intimate contact as possible with the air handled. Provision is made for the removal of the moisture as rapidly as it is formed from the melting of the