

ice. Ice is also used to cool water which is circulated through the sprays.

In conditioning units, the use of surface cooling is probably more common than direct spray or other direct transfer means. The type of surface employed may, of course, be cast or fabricated from tubes. In present day practice finned tubes or plate fins through which tubes are passed form the most generally used cooling surface. The detailed fabrication of this surface and the arrangement of the tubes will depend largely upon the type of refrigerant for which it is intended.

The simplest construction is where chilled water or brine is used as the refrigerating medium. With direct expansion refrigerant it is usually necessary to provide a special arrangement of headers so that proper distribution of refrigerant through all the surface is obtained. In some cases, ordinary brine coils can be used when operated as a flooded refrigerant system. In some units a combination of a direct spray and a refrigerant surface is used, the spray being directed against the surface. Such systems claim the advantage of air washing together with the maintenance of a clean and effective cooling coil.

It should be noted that when surface coolers are used, adequate protection in the form of filters or at least lint screens are necessary to prevent fouling of the surface from the air borne dirt. Surface not so protected frequently becomes completely matted with lint, grease, and similar dirt.

The sources of refrigeration used with these surface type conditioning units are discussed in Chapter 24. However, they may be divided into the following groups:

1. Direct expansion refrigerant in which the liquid refrigerant is evaporated within the coils of the unit. The vapor from these coils may be recompressed in centrifugal, rotary, or reciprocating type compressors, and the refrigerant again returned to the evaporator coil.
2. Indirect refrigeration by means of:
 - a. Cold well water.
 - b. Cold city water.
 - c. Artificial refrigerated water provided by direct expansion of refrigerant in a water cooler, direct steam jet refrigeration, or by the melting of ice.

Filtering—Air Cleaning

A variety of methods are employed as a means of controlling air purity. In unit systems where filtering alone is considered satisfactory, the degree of filtering varies widely and in proportion to the actual needs. If the air is chiefly recirculated with but little outside air used for ventilation, filtering requirements are largely limited to keeping the coils in a clean and operable condition. Thus such units are frequently furnished with simple lint screens of low resistance and formed of moderately close meshed wire. Where outside air is used for ventilation, more complete filtering of dust particles is necessary and for this purpose, there are a large number of filters available on the market. Some of these filters are of the so-called *throw-away* type, constructed of inexpensive material so that when they become dirty or clogged they may be thrown away and replaced with new ones. All of these filtering methods are described in detail in Chapter 26.

Ventilation

Inasmuch as air purity is one of the factors that constitute true air conditioning, ventilation or the introduction of outside air is an essential part of any air conditioning unit or system. While a unit that recirculates all its air capacity is still considered an air conditioning unit, the better type system provides for the introduction of a certain proportion of outdoor air. In some instances one of several units may operate entirely on outside air, while in other cases only a portion of the air handled by the unit is drawn from out-of-doors. In such cases a damper is provided either in the unit or in the duct connections for controlling the proportion of outdoor air.

Location of Air Conditioning Units

The characteristics of the conditioned space, the building construction, the type of system employed, the duct connections as well as the source of power, piping and refrigeration influence directly the location of air conditioning units.

Primarily a unit is either of the portable or fixed type. The portable unit is usually a simple self-contained air conditioning or cooling unit either with or without ventilation, but includes the condensing unit. If the condensing unit is of the air-cooled type, the unit must be located adjacent to a window or other source of outside air. On the other hand, if it is of the water-cooled type, its location should be convenient to sources of water and drainage. Portable units are invariably located within the conditioned space.

Non-portable units, or units of fixed location may or may not be located within the occupied space. Naturally units that are located in such spaces must be built with decorative cases in order to harmonize with the surroundings. Such units are normally of comparatively small capacity varying from a fraction of a ton up to as much as five or six tons. Many conditioning units and particularly those of the larger sizes are located externally to the occupied and conditioned space and are connected thereto by means of delivery and return ducts. Such an arrangement permits the location of the conditioning unit convenient to either the sources of refrigeration or outside air. It frequently permits the use of the basement or of space less valuable than that on the level or floor of the occupied zone. Oftentimes the same type of unit may find application in an exposed position for one job and in a concealed location for another. Thus it can be seen that it is not possible to define a unit merely on the basis of its location. Frequently conditioning units are built into the structure or into the architectural design of a room so that they are entirely concealed except for the discharge and return grilles or openings which are designed so as to correspond to the decorative scheme of the room.

Air Distribution

With portable units or units exposed within the conditioned space, the distribution is usually through grilles or louvers built entirely into the equipment. The discharge of the air from this unit, in general, should be