ular requirements of each installation. For some small plants the evaporator may be placed in the air stream, when type of refrigerant and nature of occupancy permit. In many cases, chilled water coils are required by considerations of safety. Where low temperature and relative humidity are necessary, brine, often of calcium chloride, may be indicated.

Condensing requirements must have economic analysis. Wells, public water service, cooling towers and evaporative condensers present possibilities for consideration. Condenser water may have a secondary use for roof sprays in hot weather, and is usually suitable for lawn sprinkling. Most health department rules in cities prohibit any connection from refrigerant condensers that might permit the water to be used for drinking or lavatory purposes.

Practically without exception, air cleaners should be provided for both outside and recirculated air.

Control of temperature and of relative humidity by automatic means is vital, if comfort and economical operation of air conditioning equipment are to be attained.

The insulation of ductwork is not merely a matter of economics, but sometimes is a necessity from the standpoint of limiting the temperature change of the air between the conditioning apparatus and the point of final delivery. Such temperature change of the air should be taken into account when apportioning the air and sizing the ducts. When computing heating or cooling loads, due allowance must be made for the effect of any hot or cold ducts or pipes contained in the space under consideration, and insulation must be incorporated where necessary or justified. Consideration must also be given to the possibilities of condensation of moisture on either the inside or outside surfaces of pipes, ducts, housings, fan encasements, etc., and insulation should be applied to prevent corrosion and water damage and to conserve refrigeration.

The location of the apparatus room often is determined by building construction or available space. The closer the apparatus room is to the conditioned space, the less expensive are the ducts. If the equipment is noisy, it should be located at some distance from the occupied spaces or be provided with adequate sound and vibration treatment. The scattering of wet apparatus throughout a building is to be avoided unless suitable precautions are taken. It must be remembered that encroachment on spaces that are otherwise usable should be charged against the system as an operating cost.

In general, the apparatus should be arranged to have a straight-line air flow. Each change in direction increases air resistance and, in addition, elbows and offsets may cause eddy currents resulting in stratification. The usual order of equipment location, beginning at the outside air intake, is: weather hood of louvers, outside air dampers, return air connection, filters, tempering coils, cooling coils or sprays, by-pass connection with or without reheaters, reheaters, fan and distributing ducts.

Screens at the intake prevent the entry of large foreign matter, birds, etc. A hood or louver at the outside air intake prevents the entry of rain and snow. Since in most climates there are many days during which use of 100 percent outside air unheated or uncooled may be economical, the areas of all air-passing and treating apparatus should be large enough for such a volume, and the exhaust or spent air equipment should be capable of discharging out of doors, all of the air admitted.

The by-pass connection normally connects the return air duct system with the apparatus casing between the conditioner and the supply fan.

Usually the by-pass opening is sized to handle about 50 percent of the fan capacity where a variable by-pass is used though extreme load variations may require a larger size. It is at times good design to locate a reheating coil in the by-pass connection to permit using some by-pass air when heating is required. Since the relatively high resistance of the cooling coil or spray is to be balanced by the heating coil and by-pass connection, enough heating surface can be provided to raise the temperature of the by-pass air to the point where the mixture of by-passed air and conditioned air will have the required temperature. When a variable by-pass is used, a damper working in opposition to the by-pass damper should be placed across the face of the dehumidifier, for unless the resistances of the two are carefully balanced at all operating points, the proper mixtures of air will not be obtained. Outside air that has not been dehumidified should not be by-passed around a cooling coil or spray dehumidifier if accurate control of the delivered relative humidity is desired. Where the by-pass is made a part of the dehumidifier or conditioner and is located on the top or side of it, the return air connection should be arranged so that stratification of return air is insured, baffles being provided to accomplish this purpose if necessary. When return air and by-pass air connections are taken off a return duct system, it may be necessary to install a back-draft damper between the return air connection and the by-pass connection. When the by-pass damper is at maximum opening it may be much easier for outside air to pass through the return damper, into the return duct connection and through the by-pass, than for return air to pass through the by-pass connection into the fan. Air tends to take the path of least resistance and, if the dehumidifier resistance is high, and if the return duct resistances are low, this situation is apt to occur. A recirculating air fan, instead of a back-draft damper, may be required for this case, if the failure of return air to reach the dehumidifier or conditioner is a serious matter under reduced load conditions.

LOCATION OF APPARATUS

In general, the outside air intake, preheaters, and return air connections precede the conditioner, while the by-pass, reheaters and fan follow it. In the case of a blow-through system, where the fan is located ahead of the conditioner, the leakage of air at the conditioner is outward, instead of inward, and may be accompanied by water leakage.

The location of the complete apparatus assembly, including the dehumidifier, will be dependent on the type of building, spaces available, structural characteristics, etc. The type of conditioner used may limit the location under certain conditions. Where cooling coils employing chilled water or brine as the cooling agent are used, there are few limitations with regard to location other than those of pumping power, working pressures, piping costs, etc. Where spray dehumidifiers are used, very definite limitations present themselves, and these may require certain extraneous equipment to make the system workable. If several spray type dehumidifiers are located on different levels, thus involving different water pressures, a surge or storage tank, to which the return water from each dehumidifier can be taken, is required. Should the water level in the pan of the dehumidifiers be low in relation to that of the surge tank, return water pumps will be required, and these pumps will have to be operated until the water supply lines are drained in order to prevent flooding of the lower dehumidifiers. Where spray dehumidifiers are on the same level, equalizing lines between the pans may be required if a storage tank is not provided. It is exceedingly important that water-tight drained floors be provided under all