circulated through the precooling coil where the entering air is cooled by the water and the heated water sent back to the reheating coil. The run-around has the advantage of permitting a higher supply air dew-point temperature than would be possible otherwise. This is due to the fact that continual reheating is available which is not a large penalty on the refrigeration plant since it provides precooling at the same time. This reheating at peak load creates an artificial sensible heat gain which increases the ratio of room sensible heat to room total heat and for a given room temperature results in a higher apparatus dew-point. See Equations 2, 3 and 4. Thus, while the volume of supply air is increased, the low side temperature level of the refrigeration plant is raised and this may effect savings in initial and operating costs. This system has the disadvantage of providing a decreasing amount of heat for reheating as the demand for reheating increases.

RELATION TO BUILDING TYPE

Few buildings or spaces are physically identical and those that are similar in this respect may have marked differences in internal loading, zoning requirements, and economic limitations. Consequently it is virtually impossible to establish fixed rules governing the type of system to be used. Each case must be considered on its own merits with due regard to all engineering and economic factors. However, some generalizations are possible.

In small single spaces the use of an elaborate system is undesirable from an initial cost standpoint. Zoning may be often eliminated. This also applies to large single spaces except that in very large spaces the necessity of providing adequate zoning is encountered more frequently. If the spaces are extremely large, physical and economic limitations such as the size of equipment, size and length of ducts, may require the division of the space into sections. Whether these sections are to be made according to zones or whether each section is to be zoned will depend on the particular case.

Where groups of spaces or small buildings are encountered, simple systems still prove the most economical. A single central station with zoning by means of volume control and reheat combined may be entirely satisfactory. If the perimeter of the building is large with regard to the area, induction units of the low or high pressure type may be employed, particularly if it is a multi-room application. Occasionally the dual duct system may be considered, but is infrequently used due to its complications.

Low buildings with large floor areas, such as large department stores and large general offices, may have to be divided into sections for treatment. In the case of large department stores it may be possible to provide a single conditioner with a fan delivering the conditioned air to recirculating fans which supply the various departments or spaces. This application is limited by practicability of running the large conditioned air ducts to the various recirculating fans. In some cases the use of separate systems for each section will be indicated with the added necessity of dividing into horizontal as well as vertical sections. If the latter is required, each vertical section may be handled by a separate system consisting of a single conditioner and fan delivering conditioned air to recirculating fans supplying the horizontal sections. Zoning is obtained by proper allocation of the recirculating fans or other conventional methods used in conjunction with the recirculating fans. For general offices in particular, or types of buildings having a large perimeter, the use of one of the induction type units for perimeter treatment, combined with a conventional system for the treatment of the interior portions, offers possibilities.

High buildings having large floor areas may be successfully handled in many ways. Horizontal or vertical sectionalizing or both may be required, as determined by economic factors and physical limitations. Where vertical sections only are required, the use of a single conditioner and fan for each section delivering conditioned air to zone fans at various floors may be used. These zone fans can be so arranged that one recirculating fan can handle similar zones on several floors, thus reducing the number of fans required and providing a degree of vertical zoning. Where vertical sectionalizing is not indicated, the building may be divided into horizontal groups, each group handled by a central system and adequately zoned. In some extremely large buildings apparatus rooms for the systems may be located in the basement and in the attic and on intermediate floors.

In high buildings having small floor areas the treatment required may be the same as for that of a vertical section of one having a large floor area. A single conditioner and fan can be used to deliver conditioned air to recirculating fans located at various floors.

In all cases of high buildings the necessity for horizontal sectionalizing is indicated by the economical size of air supply and return risers and by the extent to which they encroach upon usable space. In all buildings the necessity for vertical sectionalizing is indicated by the economical size of horizontal supply and return ducts and the space requirements of these ducts.

Usually the most simple systems are best adapted to theatres, auditoriums, and similar applications. Zoning is seldom required other than in connection with auxiliary spaces served by the same system. A conventional central system with by-pass control possibly augmented by reheat usually will suffice. The auxiliary spaces may be supplied with air from the same system controlled by volume reduction and reheat. Balconies and large lobbies frequently justify the use of separate zoning fans.

The foregoing are merely generalizations and suggestions. It is the responsibility of the engineer to explore thoroughly the possibilities of all types of systems and employ that best suited to the purpose from a standpoint of maintained economy, maintenance, life, operation and physical applicability.

EQUIPMENT SELECTION

Other chapters cover in detail most of the items of equipment used in a central system. Each item must be selected not only on its own merits, but in relation to all the other items that go to make up the complete central system. Each item should be considered from the standpoint of both initial cost and operating costs. Consideration must be given to performance at partial loads since most systems operate at full load but