3. The cooling load per degree difference in temperature is not constant but increases as the outdoor temperature increases.

4. The heat lag of the building complicates the estimation of the cooling load under any specified conditions and makes such estimates, based on the usual methods of computation, of doubtful value.

5. The seasonal cooling requirements are extremely variable from year to year, and the ratio between the degree-hours of any two seasons occurring within a 10 year period may be as high as 7.5 to 1. Hence an average value of the degree-hours cooling per season is comparatively meaningless.

6. The duct system in a forced-air heating installation can be successfully converted to a system for conveying cool air for the purpose of cooling the structure. No condensation of moisture was observed when the duct temperatures were not less than 65 F.

7. Cooling by means of water at a temperature of 60 F is not satisfactory unless an indoor temperature of less than 80 F is maintained.

8. In the selection of cooling coils, the frictional resistance of the coil to flow of air must be given careful consideration.

9. Cooling the structure by introducing large quantities of air from outdoors at night tended to reduce the amount of cooling required on the following day and was a practical means of providing more comfortable conditions in those homes where cooling systems were not available.

METHOD OF DESIGNING COOLING SYSTEM

The general procedure for the design of a cooling system in a forced-air installation is as follows:

1. Calculate heat gain for each room or space to be conditioned. (See Chapters 3 and 6.) Allowance for addition of outside air must be included in this calculation.

2. Select a temperature of air leaving supply inlets. In Research Residence tests[7] a value of from 65 to 70 F was found satisfactory.

3. Determine indoor conditions to be maintained. In Research Residence 80 F dry-bulb and 45 per cent relative humidity were found satisfactory.

4. Determine the quantity of air to be introduced into each room. (See Chapter 20.)

5. Estimate heat loss in duct system between cooling unit and supply registers.

6. Calculate the heat to be removed by the cooling unit, in the form of sensible heat and latent heat.

7. Determine size of ducts in duct system and size of registers, as explained in this chapter under the heading of Method of Designing Forced-Air Heating Systems.

8. Determine pressure loss in duct system and select fan as also explained in the same section.

9. Select cooling unit from manufacturer's data. Specify temperature and pressure of available cooling water, voltage and characteristics of electrical supply, and method of control of apparatus.

10. Select cooling coils from manufacturer's data to take care of latent heat load and to give required drop in air temperature with the weight of air flowing. (See Chapter 25.)

11. If system is to be used for both winter heating and summer cooling, duct sizes must be checked to insure that velocities and friction losses are reasonable for both conditions of operation. Adjustable dampers will be necessary to make changes in air distribution for the two seasons. Provision must also be made for changing fan speeds for summer and winter operation.

[7]Loc. Cit. Note 6.

Chapter 20

CENTRAL SYSTEMS FOR COMFORT AIR CONDITIONING

Types of Systems for Heating, Humidifying, Cooling, Dehumidifying with Modifications, Design Details, Load Calculations, Selection of Equipment

THE purpose of this chapter is to offer a summary of the procedure generally followed in the design of central systems for comfort air conditioning. Detailed information for making the various calculations is found elsewhere in THE GUIDE, and reference to the proper chapter follows in this text.

The reader is also referred to the Code of Minimum Requirements[1], which was prepared by a joint Committee of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and the *American Society of Refrigerating Engineers*, and which was adopted by the Society in January 1938. Engineers should also be familiar with any state or municipal codes which may apply to the problem under consideration.

A central system consists of a fan with complete supply and return ducts designed to serve one or more conditioned spaces, together with some or all of the following equipment: heating coils, cooling coils, humidifiers, dehumidifiers, air cleaning devices, and control equipment. These various items of equipment are assembled into a properly balanced system which has for its purpose the control of temperature and humidity within the conditioned space.

The principal types of central systems are illustrated in Figs. 1 to 5, but space does not allow showing all of the modifications to which these types may be subjected by the conditions existing in the building or by the preferences of the designing engineer. Also, a central system need not provide for year-round conditioning, but may be designed only for heating, cooling, or simply for ventilation.

CLASSIFICATION OF SYSTEMS

Central systems in which dehumidification is accomplished by cooling may be classified as follows:

[1]Code of Minimum Requirements for Comfort Air Conditioning (A.S.H.V.E. TRANSACTIONS, Vol. 44; 1938, p. 27). Reprints of this code are available at $.10 a copy.