of the results in Table 9. The values in column F of Table 8 were obtained by multiplying together the figures in columns C, D, and E. The heat losses are calculated to the nearest 10 Btu. See reference notes for Table 7 for further explanation of data.

Attention is called to the summary of heat losses (Table 9) for the uninsulated residence. As storm windows are used in this instance the *glass* and *door* transmission heat losses of 19.8 percent are relatively small. The infiltration losses of 14.0 percent are also comparatively small because the storm windows are equivalent to weatherstripping. In this problem, the wall, ceiling and floor transmission losses comprise 66.2 percent of the total.

*Example 7:* Calculate the heat loss of residence shown in Fig. 2 based on the same conditions as in *Example 6* but having construction improved or insulated to obtain coefficients as follows:

*Walls*, 0.13; *Walls of Dormer over Garage*, 0.12; *Attic Walls*, 0.28; *Walls Adjoining Garage*, 0.18; *Basement Walls (Recreation Room)*, 0.10.

*Roof*, 0.53.

*Ceiling (Second Floor)*, 0.15.

*Windows* (Same as in *Example 6*).

*Floor (Bedroom D)*, 0.18.

*Solution:* The procedure for calculating the heat losses is similar to that for *Example 6*. A summary of the results is given in Table 10.

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## CHAPTER 13

# COOLING LOAD

**Cooling Load Calculations; Design Conditions; Instantaneous Heat Load; Solar Radiation; Periodic Heat Flow; Tables for Calculating Solar Heat Gain Through Walls, Roofs and Glass; Instantaneous Heat Gain vs. Cooling Loads; Load from Interior Partitions, Ceiling and Floors; Load from Outside Air, Ventilation and Infiltration; Effect of Outside Air on Load; Heat Sources Within Conditioned Space; Moisture Transfer Heat Load; Miscellaneous Heat Loads; Apparatus Dew Point and Required Air Quantity Through Conditioning Equipment; Minimum Entering Air Temperature; Example Cooling Load Calculation**

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THE variables affecting cooling-load calculations are numerous, often difficult to define precisely, and always intricately inter-related. Most of the components of the cooling load vary in magnitude over a wide range during a 24-hour period, and as the cyclic changes in load components are not usually in phase with each other, careful analysis is required to establish the resultant maximum cooling load for a building or zone. A zoned system must often handle peak loads in different zones at different hours.

Economic considerations must be of particular influence in the selection of equipment for cooling season operation in comfort air conditioning, and this fact, coupled with present inadequacies in available data and knowledge of the air-conditioning art, places a premium on the experienced judgment essential to successful design or practice. Variations in the weather, building occupancy, and other factors affecting load, necessitate carefully coordinated controls to regulate simultaneously the components and the equipment in order to maintain the desired room conditions.

The calculation procedures presented in this chapter deal with the various instantaneous rates of heat gain, both sensible and latent, in a conditioned space. There may be an appreciable difference between the *net instantaneous rate of heat gain* and the *total cooling load* at any instant. This difference is caused by the storage and subsequent release of heat by the structure and its contents. This thermal-storage effect may be quite important in determining an economical cooling equipment capacity. The lack of any adequate means of treating this storage quantitatively in its entirety for a complete structure, must be recognized in judging the procedures and data presented for calculating individual components of the net rate of instantaneous heat gain.

*Solar heating* calculations involve the same principles as cooling load calculations. Many of the data on solar radiation given in this chapter can be used in calculations for solar heating.

## COOLING LOAD CALCULATIONS

Summer cooling load calculations, whether for industrial or comfort applications, require consideration of the following factors:

A. *Design Conditions:* (1) indoor conditions; (2) outdoor conditions; (3) ventilation rate.

B. *Instantaneous Heat Load, Sensible and Latent:* (1) load from solar radiation,