high water temperatures are desired. This is due to the fact that higher water outlet temperatures result in lower coefficients of performance.

For coefficients of performance of 4 or higher, the heat pump water heater may be more economical to operate than a conventional water heater.

Although the first cost of domestic hot water heat pumps is somewhat high, they have the advantages of eliminating products of combustion, odors and soot, and not needing a chimney. A further advantage is that they may be used for cooling purposes. With a coefficient of performance of 2½ to 3, water temperatures of 140 to 150 F may be obtained.[5]

REFERENCES

[1] Water Distributing Systems for Buildings, by R. B. Hunter (*National Bureau of Standards*, Report BMS79, p. 6-9). (Charts extended to flow of 0.39 gpm).

[2] Private communication from Howard E. Degler.

[3] Enough Hot Water—Hot Enough, by J. Stanford Setchell (*American Gas Association*, 1950).

[4] Plumbing Practice and Design, by Svend Plum (John Wiley and Sons, Inc., 1943).

[5] Progress Report on a Heat Pump Water Heater, by P. Sporn and E. R. Ambrose (*Heating and Ventilating*, February, 1949, Vol. 46, p. 78).

BIBLIOGRAPHY

Laundry, Kitchen and Hospital Equipment, by H. C. Russell (A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929, p. 45).

Water Consumption, Cost and Savings, by G. C. St. Laurent (*American Hotel Association, Hotel Engineering*, Vol. 1, 1940).

Water-Supply Piping for the Plumbing System, by F. M. Dawson and A. A. Kalinske (Technical Bulletin No. 3, *National Association of Master Plumbers*).

Use of Solar Energy for Heating Water, by F. A. Brooks, *Smithsonian Institution*, Washington, D. C.

Methods of Estimating Loads in Plumbing Systems, by R. B. Hunter (*National Bureau of Standards*, Report BMS65, 1940). Plumbing Manual, Report of the Subcommittee on Plumbing, Central Housing Committee on Research, Design and Construction (*National Bureau of Standards*, Report BMS66, 1940). Water-Distributing Systems for Buildings, by R. B. Hunter (*National Bureau of Standards*, Report BMS79, 1941).

Hot Water Requirements, by M. B. Mackay (*Modern Sanitation*, August, 1949, Vol. 1, p. 30).

Urban Domestic Water Consumption, by M. A. Pond (*Journal of the American Water Works Association*, Vol. 31, No. 12, 1939, p. 2003).

CHAPTER 50

RESIDENTIAL SUMMER AIR CONDITIONING

Equipment Capacity Selection, Types of Equipment, Types of Application, Room Air Conditioners, Central Systems for Summer, Central Systems for Heating and Cooling, Location of Cooling Equipment, Noise, Air Distribution Methods, Operating Costs, Effects on Future House Design

IN RECENT years, summer air conditioning in residences has developed to the stage where it has become a major factor in the air conditioning field and has created a heavy interest among home-owners, builders, architects and business men. Residential cooling, particularly for the small home, received its initial impetus when equipment specifically designed for such purposes became available in the 1930's. Recently it has caught the public fancy resulting in a tremendous increase in the number of sales and installations.

The first installations were made by using the commercial and industrial methods as the estimating basis and did not prove as satisfactory as the installer or designer desired. Actually, the difference between estimating the residential summer air conditioning and commercial summer air conditioning loads is in the design temperature differences used, the type of internal load in the conditioned area, and the method of calculating equipment size.

EQUIPMENT CAPACITY SELECTION

With cooling, as with heating, the proper equipment capacity selection is that which, when properly installed, maintained, and operated, will satisfy the customer. Although at present an indoor design temperature of 75 F is used only on deluxe installations, it is felt that eventually this temperature will be used as the basis for design for both heating and cooling systems. At the present time, however, most summer air conditioning installations are designed on the basis of an 80 F indoor temperature. The outdoor design conditions commonly used in each locality are those listed in Chapter 13.

In calculating residential cooling loads, internal loads are not taken into consideration as much in domestic summer air conditioning as in commercial or industrial summer air conditioning. Lighting, electrical appliances, and so on, are not considered except in the cases where unusual loads are added to the conditioned area by means of certain types of appliances. These appliances, such as clothes dryers, and water heaters, should be vented to the atmosphere in order to limit their effect on the summer cooling load.

Although the methods of calculating the cooling load which are presented in Chapter 13 may be used for calculating residential cooling load, it has been found[1] that the load so calculated is much greater than that which is actually experienced in most residences. This is objectionable from at least two viewpoints: (1) it increases the capacity and consequently the