MAXIMUM DEMANDS AND LOAD FACTORS

In one form of district heating rates, a portion of the charge is based upon the maximum demand of the building. The maximum demand may be measured in several different ways. It may be taken as the instantaneous peak or as the rate of use during any specified interval. One method is to take the average of the three highest hours during the winter. These figures are available for a number of buildings in Detroit, as shown in Table 9.

These maximum demands were measured by an attachment on the condensation meter and therefore represent the amounts of condensation passed through the meter in the highest hours, rather than the true rate at which steam is supplied. There might be slight differences in these two quantities due to time lag and to storage of condensate in the system, but wherever this has been investigated it has been found to be negligible.

The load factor of a building is the ratio of the average load to the maximum load and is an index of the utilization habits. Thus, in Table 9, the theatres, operating for short hours, have a load factor of 0.126 as compared with the figure of 0.318 for clubs and lodges.

SEASONAL EFFICIENCY

The task of predicting fuel consumption within reasonably accurate limits is a simple one where sufficient experience data are available for the fuel in question. Such data can be analyzed to the point where average unit factors can be determined and expressed in such terms as, for example, average gallons of oil actually burned per square foot of calculated steam radiator surface per degree-day. The unit U can be inserted directly in Equation 3 without reference to efficiency. Such experience factors are available for gas (see Table 4) and for district steam (Table 8), but not for coal or oil.

Since values of U are not available for oil or coal, an assumed seasonal efficiency E must be used. Selection of a value for this E must be made with caution for its use implies a meaning not commonly associated with the word efficiency and consequently is frequently misleading.

The input of heat to a building consists not only of the energy in the fuel but that from occupants, the sun, appliances, processes, and all other sources. In many cases these make up, over a period, an important percentage of the total heat required, and if they are not taken into account a calculation of *efficiency* can show a figure over 100 per cent.

For this and other reasons the actual seasonal efficiency is a difficult thing to determine. Published data are widely scattered and insufficient. From the available published material it is found that the seasonal efficiency varies over a wide range, depending on the fuel used, and it varies widely even for a given fuel. For example, in a recent survey of 30 houses in one locality there was found a variation of from 45 to 75 per cent in the utilization efficiency depending on the fuel[5].

[5]Heat Losses and Efficiencies of Fuels in Residential Heating, by R. A. Sherman and R. C. Cross, (A.S.H.V.E. TRANSACTIONS, Vol. 43, 1937, p. 185).

Chapter 13

HEATING BOILERS

Cast-Iron Boilers, Steel Boilers, Special Heating Boilers, Gas-Fired Boilers, Hot Water Supply Boilers, Furnace Design, Heating Surface, Testing and Rating Codes, Output Efficiency, Selection of Boilers, Connections and Fittings, Erection, Operation and Maintenance, Boiler Insulation

STEAM and hot water boilers for low pressure heating work are built in a wide variety of types, many of which are illustrated in the *Catalog Data Section*, and are classified as (1) cast-iron sectional, (2) steel fire tube, (3) steel water tube, and (4) special.

CAST-IRON BOILERS

Cast-iron boilers usually fall into one of two general classifications (1) rectangular pattern with vertical sections and rectangular grate commonly known as sectional boilers, (2) round pattern with horizontal pancake sections and circular grates commonly known as round boilers. A few boilers of the sectional type use outside header construction where each section is independent of the other and the water and steam connections are made externally through these headers. The majority of boilers, however, both sectional and round, are assembled with push nipples and tie rods at the top and bottom of the sections in which case water and steam connections are internal. The present trend in design of sectional boilers is to use a large top push nipple so that in a steam boiler the water line may be carried through the top push nipple thereby permitting circulation of water between adjacent sections at both the top and bottom of the water content of the boiler. The primary purpose of this construction is to eliminate the necessity of connecting the sections below the water line with an external header to permit circulation of the water from one section to the other which is necessary in the case of a steam boiler equipped with an indirect water heater for summer-winter hot water supply.

Round and sectional boilers may be increased in size by the addition of sections which in the case of sectional boilers also increases the grate area. The grate area of round boilers remains the same as additional sections are added.

Cast-iron boilers are usually shipped knocked down. This facilitates handling at the place of installation where assembly is made in that separate sections can be taken into or out of basements and other places more or less inaccessible after the building is constructed. This feature