

TABLE 6. STEAM CONSUMPTION OF BUILDINGS WITH VARIOUS TYPES OF OCCUPANCY^a

TYPE OF BUILDING	No. BLDGS.	AVERAGE VOLUME HEATED SPACE 1000 Cu Ft	STEAM FOR HEATING	AVERAGE HOURS OF OCCUPANCY
			Lb per DD per 1000 Cu Ft	
Office.....	334	2160	0.685	12.1
Office and Bank.....	49	3000	0.577	13.1
Office and Printing.....	8	1895	1.230	17.7
Office and Theater.....	7	4950	0.412	12.9
Office and Stores or Shops.....	26	1615	0.617	13.2
Bank.....	16	806	0.786	11.7
Department Store.....	63	3400	0.385	11.1
Stores.....	73	310	0.624	10.4
Loft.....	63	865	0.588	10.0
Warehouse.....	24	2230	0.459	9.4
Hotel and Club.....	73	1795	0.990	22.3
Apartment or Residence.....	51	1425	0.962	21.8
Theater.....	22	1240	0.482	12.9
Garage.....	13	1540	0.202	21.4
Manufacturing.....	19	1350	0.808	9.5
Church.....	9	656	0.532	7.9
Hospital.....	4	3306	1.194	22.0
School.....	8	1115	0.592	11.5
Municipal or Federal.....	15	3215	0.587	15.6
Lodge, Gym, Hall or Auditorium.....	12	880	0.390	12.4
Miscellaneous.....	7	1387	0.479	21.4
Total or Average.....	896	1890	0.651	13.4

^aPrinciples of Economical Heating, National Association of Building Owners and Managers.

variable, indicates whether the operating efficiency of the plant is above or below the previous month or year.

The figures in Table 7 illustrate a typical example of a method of using the degree-day for making heating comparisons for one building for two consecutive heating seasons. The heat quantity figures inserted are pounds of steam, but a similar comparison could be made using pounds of coal, gallons of oil, or cubic feet of gas.

For such a comparison, a two-year record is often used, as shown in Table 7. The year under consideration may then be compared, month by month, with the previous year. Column 3, Consumption for Heating, would be used if the same fuel is used for heating and process steam. Some reasonable figure must be assumed for the process requirement and should be deducted from the amount shown in column 2. This would leave in column 3 only the fuel chargeable to heating. The degree-day values in column 5 are obtainable from the local Weather Bureau. Figures in column 6 are obtained by dividing corresponding values in column 3 by the degree days in column 5. The heating index in column 6 is, then, a figure of heat consumption, corrected for outdoor temperature, and should be relatively constant month by month. Column 7 in Table 7 may be used if the heat consumption is to be compared on a building volume basis with average values shown in Table 6.

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

TABLE 7. HEAT CONSUMPTION RECORD FOR COMPARISON

HEATING SEASON	1942-43	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7
			TOTAL CONSUMPTION	CONSUMPTION FOR HEATING	AVG. MEAN TEMP.	DEG DAYS 65 F BASE	Lb/DEG DAY	Lb/DEG DAY/ M CU FT
		Sept.....	337,500	170,500	65	146	1,170	0.575
		Oct.....	834,200	667,200	53	339	1,966	0.970
		Nov.....	1,446,600	1,279,600	44	641	1,990	0.982
		Dec.....	2,176,400	2,009,400	25	1,233	1,630	0.804
		Jan.....	2,332,200	2,165,200	22	1,297	1,670	0.822
		Feb.....	2,131,100	1,964,100	28	1,106	1,775	0.888
		Mar.....	2,021,900	1,854,900	31	1,032	1,799	0.885
		Apr.....	1,241,500	1,074,500	43	647	1,660	0.818
May.....	672,500	505,500	55	303	1,670	0.822		
June.....	258,600	91,600	-----	50	1,830	0.905		
July.....	188,400	-----	-----	-----	-----	-----		
Aug.....	180,100	-----	-----	-----	-----	-----		
	Total.....	13,821,000	-----	-----	-----	-----	-----	
1943-44	Sept.....	330,200	146,200	61	167	875	0.431	
	Oct.....	887,100	703,100	52	410	1,718	0.845	
	Nov.....	1,525,200	1,341,200	39	812	1,653	0.815	
	Dec.....	2,045,500	1,861,500	28	1,120	1,660	0.817	
	Jan.....	1,933,400	1,749,400	30	1,044	1,670	0.825	
	Feb.....	1,990,200	1,806,200	30	1,111	1,624	0.800	
	Mar.....	1,984,100	1,800,100	31	1,021	1,760	0.868	

If, for example, the heat consumption in March, 1943, is compared with that in March, 1944, it will be found that in the latter the steam consumption is 1799 - 1760 = 39 lb less which is a decrease of 2.2 per cent.

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 8⁶.

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. Thus, in Table 8, the theaters, 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 2 without reference to efficiency. Such experience factors are available for gas (see Table 2) and for district steam (Table 6), 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