TABLE 7. 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: Lb per DD per 1000 Cu Ft	AVERAGE HOURS OF OCCUPANCY
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

[a] Principles of Economical Heating, *National Association of Building Owners and Managers.*

than approximately 70 F is to be used, the number of degree-days should be obtained for the new base.

Example 7: An eight-story building in Pittsburgh is operated with a daytime temperature of 70 F. The calculated heat loss is 10,500 Btu per (hr) (*degree temperature difference*). What is the estimated average yearly steam consumption for building heating?

Solution: Since the average inside temperature is approximately 70 F, the degree-days from Table 2, based on 70 F may be used. Therefore, from Table 2, Pittsburgh has 5430 degree-days per normal season. Inserting in Equation 5:

$$F = \frac{10{,}500 \times 24 \times 5430}{1000} = 1{,}368{,}000 \text{ lb of steam.}$$

Consideration has been given to the difference in steam utilization of different types of buildings, and Table 7 shows actual average units for these various types. These figures were obtained from operating results in 896 buildings located in all sections of the United States. Being averages, and for small groups in each type, the figures may need considerable modification to allow for local variations. It should be especially noted that the steam used for heating water for service is not included in the values given in Table 7.

Example 8: A store in Philadelphia with a heating system designed to maintain 70 F inside in 0 F weather has 250,000 cu ft of heated space. What would be the estimated average yearly steam consumption of purchased steam for heating?

Solution: According to Table 7, a store would use 0.624 lb of steam per degree-day per 1000 cu ft heated space. From Table 2, Philadelphia has 4739 degree-days per normal year. Inserting in Equation 4:

$$F = 0.624 \times 250 \times 4739 = 739{,}000 \text{ lb of steam.}$$

Degree-Day as an Operating Unit

The degree-day is also widely used as a means of comparing the efficiency of the fuel consumption of one period with another *for the same building.*

TABLE 8. HEAT CONSUMPTION RECORD FOR COMPARISON

HEATING SEASON		COL. 1	COL. 2 TOTAL CONSUMPTION	COL. 3 CONSUMPTION FOR HEATING	COL. 4 AVG MEAN TEMP.	COL. 5 DEG DAYS 65 F BASE	COL. 6 LB/DEG DAY	COL. 7 LB/DEG DAY/M CU FT
	1942–43	Sept.	337,500	170,500	65	146	1,170	0.575
		Oct.	834,200	667,200	53	339	1,966	0.970
		Nov.	1,445,600	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 percent.

Since the fuel consumption is proportional to the weather (degree-days), and since the periods to be compared may not have the same weather conditions, the comparison can be made only after the fuel consumptions have been computed on a comparable weather basis, that is, upon the actual number of degree-days occurring for a given month and year in the city under consideration. Since fuel consumption is proportional to the number of degree-days, plant operators frequently compute each month the fuel burned per degree-day by the heating plant. The resulting unit value, by eliminating the outside temperature variable, indicates whether the operating efficiency of the plant is above or below the previous month or year.

The figures in Table 8 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, as shown in Table 8, is often used

TABLE 9. BUILDING LOAD FACTORS AND DEMANDS OF SOME DETROIT BUILDINGS

BUILDING CLASSIFICATION	LOAD FACTOR	LB OF DEMAND PER (HOUR) (SQ FT OF EQUIVALENT INSTALLED RADIATOR SURFACE)
Clubs and Lodges	0.318	0.184
Hotels	0.316	0.207
Printing	0.287	0.217
Offices	0.263	0.209
Apartments	0.255	0.225
Retail Stores	0.238	0.182
Auto Sales and Service	0.223	0.248
Banks	0.203	0.158
Churches	0.158	0.152
Department Stores	0.138	0.145
Theaters	0.126	0.151