

TABLE 7. STEAM CONSUMPTION OF BUILDINGS WITH VARIOUS TYPES OF OCCUPANCY*

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	0.677	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	0.788	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	0.982	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	15.0
Lodge, Gym, Hall or Auditorium.....	12	880	0.390	12.4
Miscellaneous.....	7	1387	0.479	21.4

* 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.

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

TABLE 8. HEAT CONSUMPTION RECORD FOR COMPARISON

	HEATING SEASON	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	
1942-43	Sept.....	337,500	170,500	65	148	1,170	0.675	
	Oct.....	834,200	667,200	53	339	1,968	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	1,984,100	28	1,106	1,775	0.888	
	Mar.....	2,021,900	1,854,900	31	1,032	1,799	0.885	
	Apr.....	1,241,600	1,074,600	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.....	1,825,200	1,341,200	39	812	1,663	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	1,808,200	30	1,111	1,624	0.800	
	Mar.....	1,884,100	1,606,100	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.

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. 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. Values 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 8 may be used if the heat consumption is to be compared on a building volume basis with average values shown in Table 7.