

Estimating Steam Consumption

In estimating steam consumption the efficiency is generally assumed at 100 per cent. If for low pressure steam an average heating value of 1000 Btu per pound of steam is used no correction is necessary. In comparing values from different cities, correction should be made for design temperature (see Table 6) when the unit figures are in terms of square foot of radiator or 1000 Btu per hour calculated heat loss, but not when the values are in terms of building volume or floor space.

Consideration has been given to the difference in steam utilization of different types of buildings and Table 7 shows actual average units for

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	0.577	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

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

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 hot water 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 4749 degree-days per normal year. Inserting in Equation 4:

$$F = 0.624 \times 250 \times 4749 = 740,000 \text{ lb of steam.}$$

Degree-Day as an Operating Unit

The use of the degree-day as a fuel *predicting* unit, explained in the foregoing, is perhaps the lesser of its two most used applications. It is also widely used as a unit for eliminating the weather (temperature) variable for existing plants from month to month or year to year. The degree-days given in Table 2 are *normals* or averages. For operating data

TABLE 8. 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	.....	.....	.....	.....	.....

HEATING SEASON 1943-44

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.....	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
Apr.....	.....	.....	.....	.....	.....	.....
May.....	.....	.....	.....	.....	.....	.....
June.....	.....	.....	.....	.....	.....	.....
July.....	.....	.....	.....	.....	.....	.....
Aug.....	.....	.....	.....	.....	.....	.....
Total.....	.....	.....	.....	.....	.....	.....

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.

the actual number occurring for a given month and year in a city under consideration is recorded. 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 figure, 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