

deg. below 65 F. For any one day, when the mean temperature is less than 65 F, there are as many degree-days as there are degrees difference in temperature between the mean temperature for the day and 65 F. Degree-days may be calculated on other than the 65 F base for use mainly for warehouse and other industrial spaces in which temperatures to be maintained are considerably below the 68 to 72 F range. They are listed in a later section of this chapter.

Studies made by the *National District Heating Association*¹¹ of the metered steam consumption of 163 buildings located in 22 different cities and served with steam from a district heating company, substantiate the approximate correctness of the 65 F base chosen by the gas industry.

Table 2 lists the average number of degree-days which have occurred over a long period of years, by months, and the yearly totals for various cities in the United States and Canada. The number of degree-days for United States cities were calculated by taking the difference between 65 F and the daily mean temperature computed as half the total of the daily maximum and the daily minimum temperatures. The monthly averages were obtained by adding daily degree-days for each month each year and dividing by the number of days in the month; then totaling the respective calendar monthly averages for the number of years indicated and dividing by the number of years. The total or long term yearly average degree-day value is the summation of the 12 monthly averages. Degree days for Canadian cities were supplied by the *Canadian Meteorological Division* of the *Department of Transport*, and were computed from the mean temperature normals on record for the various stations. (See Note c, Table 2.)

Any attempt to apply the degree-day method of estimating fuel consumption for less than one month would be of very little value. It should be noted that this method of calculation is based on a long term average and cannot be expected to coincide with any single year in calculating fuel requirement. Individual yearly degree-day calculations may vary as much as 20 percent above and below the long term average.

If the degree-days occurring each day are totaled for a reasonably long period, the fuel consumption during that period as compared with another period will be in direct proportion to the number of degree-days in the two periods. Consequently, for a given installation, the fuel consumption can be calculated in terms of fuel used per degree-day for any sufficiently long period, and compared with similar ratios for other periods to determine the relative operating efficiencies with the outside temperature variable eliminated.

Computation and Application

The general equation for calculating the probable fuel consumption by the degree-day method is:

$$F = U \times N \times D \times C_t \quad (4)$$

where

F = fuel consumption for the estimate period.

U = unit fuel consumption, or quantity of fuel used per (degree-day) (building load unit).

N = number of building load units (when available use calculated hourly heat loss instead of actual amount of radiation installed).

D = number of degree-days for the estimate period.

C_t = temperature-correction factor from Table 3.

Values of N depend on the particular building for which the estimate is

TABLE 2. AVERAGE MONTHLY AND YEARLY DEGREE-DAYS FOR CITIES IN THE UNITED STATES AND CANADA^{a, b, c} (BASE 65F)

STATE	STATION	YEARS	No. OF YEARS	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	YEARLY TOTAL
Ala.	Anniston.....A			0	0	17	118	438	614	614	485	381	128	25	0	2820
	Birmingham.....A			0	0	13	123	398	593	623	491	378	128	30	0	2780
	Mobile.....C			0	0	0	28	219	376	416	304	222	47	0	0	1612
	Mobile.....A			0	0	0	23	198	357	412	290	209	40	0	0	1529
	Montgomery.....C			0	0	0	69	304	491	517	388	288	80	0	0	2137
Ariz.	Montgomery.....A			0	0	0	55	267	458	483	360	265	68	0	0	1954
	Flagstaff.....A			49	78	243	588	876	1135	1231	1014	949	687	465	212	7625
	Phoenix.....A			0	0	0	22	223	400	474	309	196	74	0	0	1698
	Phoenix.....C			0	0	0	13	182	360	425	275	175	62	0	0	1492
	Yuma.....A			0	0	0	105	259	318	167	88	14	0	0	0	961
Ark.	Bentonville.....A	06/07-40/41	35	1	1	33	216	518	810	879	716	519	247	88	7	4036
	Fort Smith.....A			0	0	9	131	435	698	775	571	418	127	24	0	3188
	Little Rock.....A			0	0	10	110	405	654	719	543	401	122	18	0	2982
Calif.	Eureka.....C			267	248	264	335	411	508	552	465	493	432	375	282	4632
	Fresno.....A			0	0	0	86	345	580	629	400	304	145	43	0	2532
	Independence.....A	98/99-40/41	43	0	0	28	216	512	778	799	619	477	267	120	18	3834
	Los Angeles.....A			81	22	56	87	200	301	378	305	273	185	121	58	2015
	Los Angeles.....C			0	0	17	41	140	253	328	244	212	129	68	19	1451
	Needles.....A	17/18-38/39	22	0	0	19	317	416	447	243	124	36	8	0	0	1495
	Point Reyes.....A	98/99-40/41	43	350	336	263	283	317	425	487	406	437	413	415	393	4474
	Red Bluff.....A			0	0	0	59	319	564	617	423	336	177	51	0	2546
	Sacramento.....A			0	0	22	98	357	595	642	428	348	222	103	7	2922
	Sacramento.....C			0	0	17	75	321	567	614	403	317	196	85	5	2600
	San Diego.....A			11	7	24	52	147	255	317	247	223	151	97	43	1674
	San Francisco.....A			144	136	101	174	318	487	630	398	378	327	264	164	3421
	San Francisco.....C			189	177	110	128	237	406	462	336	317	279	248	180	3069
	San Jose.....C			7	11	28	97	270	450	467	342	308	229	137	41	2410
Colo.	Denver.....A			5	11	120	425	771	1032	1125	924	843	525	286	65	6132
	Denver.....C			5	103	385	711	958	1042	854	797	492	266	60	57	5673
	Durango.....A	04/05-40/41	37	25	37	201	535	861	1204	1271	1002	859	615	394	139	7143
	Grand Junction.....A			0	0	36	333	792	1132	1271	924	738	402	145	23	5796
	Leadville.....A	07/08-40/41	34	280	332	509	841	1139	1413	1470	1255	1245	990	740	434	10769
	Pueblo.....A			0	0	74	383	771	1051	1104	865	775	466	203	27	5709
Conn.	Hartford.....A			0	14	101	334	699	1032	1178	1050	871	528	291	81	6139
	New Haven.....A			0	18	93	365	665	1026	1113	1005	865	547	281	52	6026
D. C.	Washington.....A			0	0	37	237	519	837	893	781	619	323	87	0	4333
	Washington.....C			0	0	32	231	510	831	884	770	606	314	80	0	4258
Fla.	Apalachicola.....C			0	0	0	17	154	304	352	263	184	33	0	0	1307
	Jacksonville.....A			0	0	0	16	148	309	331	247	169	23	0	0	1243
	Jacksonville.....C			0	0	0	11	129	276	303	226	154	14	0	0	1113
	Key West.....A			0	0	0	0	22	34	25	8	0	0	0	0	89
	Key West.....C			0	0	0	0	18	28	24	7	0	0	0	0	77
	Miami.....A			0	0	0	6	52	58	48	12	0	0	0	0	178
	Miami.....C			0	0	0	0	5	48	57	48	15	0	0	0	173
	Pensacola.....A			0	0	0	13	177	334	383	275	203	45	0	0	1435
	Tampa.....C			0	0	0	0	60	163	201	148	102	0	0	0	674
Ga.	Atlanta.....A			0	0	8	110	393	614	632	512	404	133	20	0	2826
	Atlanta.....C			0	0	8	107	387	611	632	515	392	135	24	0	2811
	Augusta.....A			0	0	0	58	282	494	521	412	308	62	0	0	2138
	Macon.....A			0	0	0	63	280	481	497	391	275	62	0	0	2049
	Savannah.....A			0	0	0	38	225	412	424	330	258	43	0	0	1710
	Thomasville.....A	05/06-40/41	36	0	2	48	208	361	559	299	178	52	5	1	1513	
Idaho.	Boise.....A			0	0	135	389	762	1054	1169	858	719	453	249	82	5890
	Lewiston.....A			0	0	133	406	747	961	1060	815	663	408	222	68	5453
	Pocatello.....A			0	0	183	487	873	1184	1333	1022	850	561	317	136	6976
Ill.	Cairo.....C			0	0	28	161	492	784	856	683	523	182	47	0	3756
	Chicago.....A			0	0	90	350	765	1147	1243	1053	868	507	229	58	6310
	Peoria.....A			0	11	86	339	759	1128	1240	1028	828	435	192	41	6087
	Springfield.....A			0	6	83	315	723	1066	1166	958	769	404	171	32	5693
	Springfield.....C			0	0	56	259	606	1017	1116	907	713	350	127	14	5225
Ind.	Evansville.....A			0	59	215	570	871	939	770	589	251	50	6	0	4360
	Fort Wayne.....A			0	17	107	377	759	1122	1200	1036	874	516	226	53	6287
	Indianapolis.....A			0	79	306	705	1051	1122	938	772	432	176	30	0	5611
	Indianapolis.....C			0	59	247	642	986	1051	893	725	375	140	16	13	5134
	Royal Center.....A	18/19-31/32	14	11	19	118	373	740	1104	1239	976	860	502	245	54	6239
	Terre Haute.....A			0	5	77	295	681	1023	1107	913	725	371	145	24	5366
Iowa.	Charles City.....C			17	30	151	444	912	1352	1494	1240	1001	537	256	70	7504
	Davenport.....C			0	7	79	320	756	1147	1262	1044	834	432	175	35	6091
	Des Moines.....A			5	12	99	355	798	1203	1330	1062	868	438	201	45	6446
	Des Moines.....C			0	6	89	346	777	1178	1308	1072	849	429	183	41	6274
	Dubuque.....A			8	28	149	444	882	1290	1414	1187	953	543	267	76	7271
	Keokuk.....A	98/99-41/42	44	1	3	71	303	680	1077	1191	1025	761	397	136	18	5663
	Sioux City.....A			8	17	128	405	885	1290	1423	1170	930	474	228	54	7012

^a Data for United States cities from a publication of the *United States Weather Bureau, Monthly Normal Temperatures, Precipitation and Degree Days*, 1954 are for the period 1921 to 1950 inclusive. Those United States cities for which years are given in Column 3 are not listed in the above publication and the data are those which were computed by the *United States Weather Bureau* in 1946 and 1947 in accordance with the requirements of the *National Joint Committee on Weather Statistics*.

^b Data for airport stations, A, and city stations, C, are both given where available.

^c Data for Canadian cities were computed by the *Meteorological Division, Department of Transport* from normal monthly mean temperatures, adjusted for the summer months by a method described by H. C. S. Thom, *The Rational Relationship between Heating Degree Days and Temperature, Monthly Weather Review*, Vol. 82, No. 1, January, 1954.