



F = Depth of Finish Coat—Assumed as 3/4 in. of concrete. Finish Coat may be asphalt but then cover slab should be reduced from 3 in. Depth of slab should always keep thermal resistance equal to 3 in. of concrete.
S = Depth required by structural design (should be a minimum of 2 in. of concrete).

Fig. 1.....Detail of Snow Melting Panel

trace quantities about twice as often as there are for measurable quantities of 0.01 in. or more. It is assumed that these light falls can be handled by the *idling* load.

The remaining columns of Table 1 represent the frequency distribution of required heat output. This distribution is based on the solution to the basic equation for two values of the free area ratio, *A_f*. This distribution represents the basis of the analysis and is also the basis for Tables 3 and 4.

For specific conditions, or for cities other than those given in Table 1, the solutions to Equation 2 are given in Table 2.

Table 2.....Heat Output and Fluid Temperature for Snow-Melting System

Rate of Snowfall	<i>A_f</i>		<i>t_a</i> = 0 F			<i>t_a</i> = 10 F			<i>t_a</i> = 20 F			<i>t_a</i> = 30 F			
			Speed <i>v</i>			Speed <i>v</i>			Speed <i>v</i>			Speed <i>v</i>			
			5	10	15	5	10	15	5	10	15	5	10	15	
0.08	1.0	<i>q_s</i>	151	205	260	127	168	209	102	128	154	75	84	94	
		<i>t_m</i>	108	135	162	97	117	138	85	97	110	70	75	79	
	0.0	<i>q_s</i>	66	66	66	64	64	64	62	62	62	60	60	60	
		<i>t_m</i>	66	66	66	65	65	65	64	64	64	63	63	63	
-0.16	1.0	<i>q_s</i>	218	273	327	193	233	274	165	191	217	135	144	154	
		<i>t_m</i>	142	169	198	129	149	170	117	129	142	100	105	109	
	0.0	<i>q_s</i>	133	133	133	129	129	129	125	125	125	121	121	121	
		<i>t_m</i>	99	99	99	97	97	97	95	95	95	93	93	93	
0.25	1.0	<i>q_s</i>	292	347	401	265	305	346	235	261	287	203	212	221	
		<i>t_m</i>	179	206	234	165	186	206	161	163	176	134	139	144	
	0.0	<i>q_s</i>	208	208	208	202	202	202	195	195	195	188	188	188	
		<i>t_m</i>	137	137	137	134	134	134	131	131	131	127	127	127	

Note: This table is based on a relative humidity of 80 percent for all air temperatures.

q_s = rate of snowfall, inches of water equivalent per hour.

A_f = free area ratio.

t_m = slab output, Btu per (hour) (square foot).

t_a = air temperature, Fahrenheit.

v = fluid temperature, Fahrenheit. Based on construction as shown in Fig. 1.

w = wind speed, miles per hour.

Table 3.....Design Data for Three Classes of Snow-Melting System*

City	Design Output, Btu per (hr) (Sq Ft)		
	Class I system ¹	Class II system ²	Class III system ³
Albuquerque, N. M.	71	82	167
Amarillo, Tex.	98	143	241
Boston, Mass.	107	231	255
Buffalo-Niagara Falls, N. Y.	80	192	307
Burlington, Vt.	90	142	244
Caribou-Limestone, Me.	89 (93)	138	307
Cheyenne, Wyo.	83	129	425
Chicago, Ill.	89	165	350
Colorado Springs, Colo.	49 (63)	63	293
Columbus, Ohio	52	72	253
Detroit, Mich.	69	140	255
Duluth, Minn.	83 (114)	206	374
Falmouth, Mass.	93	144	165
Great Falls, Mont.	84 (112)	138	372
Hartford, Conn.	115	254	260
Lincoln, Neb.	64 (87)	202	246
Memphis, Tenn.	134	144	212
Minneapolis-St. Paul, Minn.	63 (95)	155	254
Mt. Home, Idaho	50	90	140
New York, N. Y.	121	298	342
Ogden, Utah	98	216	217
Oklahoma City, Okla.	66	81	350
Philadelphia, Pa.	97	229	263
Pittsburgh, Pa.	89	157	275
Portland, Ore.	86	97	111
Rapid City, S. D.	58 (86)	102	447
Reno, Nev.	98	154	155
St. Louis, Mo.	122	152	198
Salina, Kan.	85	120	228
Sault Ste. Marie, Mich.	52 (78)	144	213
Seattle-Tacoma, Wash.	92	128	133
Spokane, Wash.	87	127	189
Washington, D. C.	117	121	144

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* Where idling rate is greater than Class I design rate, idling rate is given in parenthesis and should be used as Class I design output.

¹ For Class I (residential) Systems, the design output is set at that required heat output (see Table 1) when *A_f* = 0 at the 98th percentile of the frequency distribution; that is where 98% of the hours have this output or less.

² For Class II (commercial) Systems, the design output is the maximum output when *A_f* = 0 in Table 1 (last column).

³ For Class III (industrial) Systems, the design output is determined by the following four requirements: (1) Output is never exceeded for two consecutive hours; (2) Output for *A_f* = 1; Table 1, is at least 1 Btu per hour per sq ft greater than maximum output for *A_f* = 0; (3) *A_f* is greater than or equal to 0.6 maximum requirement shown in Table 1 for *A_f* = 1. That is, *q_s* = *q_s* + *q_s* + 0.6 (*q_s* + *q_s*) for the conditions where *q_s* = *q_s* + *q_s* + *q_s* are a maximum; (4) The free area ratio *A_f* is only for at least 80% of the hours listed in Table 1.

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Table 4.....Yearly Operating Data

City	Idling			Melting			City	Idling			Melting		
	Time, ¹ hr per year	Rate, ² Btu per (hr) (sq ft)	Output, ³ Btu per (year) (sq ft)	Time, ⁴ hr per year	Class ⁵	Output, ⁶ Btu per (year) (sq ft)		Time, ⁴ hr per year	Rate, ² Btu per (hr) (sq ft)	Output, ³ Btu per (year) (sq ft)	Time, ⁴ hr per year	Class ⁵	Output, ⁶ Btu per (year) (sq ft)
Albuquerque, N. M.	897	32.5	29100	22	I	903	Mt. Home, Idaho	1546	41.9	64800	40	I	1260
Amarillo, Tex.	944	51.1	48200	33	II	969	New York, N. Y.	1532	50.7	77700	76	II	1530
Boston, Mass.	1140	52.1	59400	145	III	1150	Ogden, Utah	1655	44.6	73800	160	III	4180
Buffalo-Niagara Falls, N. Y.	1702	50.2	85500	240	I	2150	Oklahoma City, Okla.	719	56.2	40400	44	I	4690
Burlington, Vt.	1978	76.9	152000	236	II	2770	Philadelphia, Pa.	820	31.4	25700	58	II	4710
Caribou-Limestone, Me.	2563	93.0	238000	290	III	3000	Pittsburgh, Pa.	1445	49.5	71500	182	III	7050
Cheyenne, Wyo.	1808	77.7	140000	138	I	9080	Portland, Ore.	221	17.4	3840	36	I	7370
Chicago, Ill.	1848	67.8	125000	134	II	9100	Rapid City, S. D.	1873	86.4	162000	116	II	7370
Colorado Springs, Colo.	1583	63.4	100000	76	III	11800	Reno, Nev.	1510	36.9	55700	87	III	2380
Columbus, Ohio	1383	45.0	62200	105	I	14600	St. Louis, Mo.	1104	44.8	4950	33	I	5400
Detroit, Mich.	1790	49.0	87600	134	II	14900	Seattle-Tacoma, Wash.	1398	53.9	75400	54	II	2710
Duluth, Minn.	2922	113.8	332000	250	III	18800	Sault Ste. Marie, Mich.	2512	77.7	195000	345	III	3100
Falmouth, Mass.	1071	44.2	47400	73	I	17300	Seattle-Tacoma, Wash.	392	17.2	6750	44	I	3110
Great Falls, Mont.	1677	111.6	187000	174	II	20200	Spokane, Wash.	1873	39.1	65500	196	II	9650
Hartford, Conn.	1412	41.9	59200	171	III	23500	Washington, D. C.	770	30.6	23600	33	III	1690
Lincoln, Neb.	1906	67.2	128000	91	I	27300							
Memphis, Tenn.	454	32.0	14500	11	II	3590							
Minneapolis-St. Paul, Minn.	2570	95.1	244000	203	III	4180							

Air Conditioning, Heating and Ventilating, August 1957, p. 94.

Notice that these solutions are for a relative humidity of 80 percent. For other values of relative humidity, corrections can be obtained by using Equations 8 and 9 as follows:

$$\frac{dq_s}{dp_{rH}} = -A_s(0.0201v + 0.055)h_p \quad (8)$$

Snow-melting installations are classified in Table 3 according to types as Class I, II, or III. These classes have been discussed thoroughly in Reference 3, and are defined in

$$\frac{dq_s}{dp_{rH}} = \frac{-A_s}{2} (0.0201v + 0.055)h_p \quad (9)$$