Slant/Fin Hydronic Fitters' Guide

A simple and accurate method
for calculating heat losses
and selecting the boiler
and heat distributors for
residential hydronic heating systems.

Based upon the methods recommended
by The Hydronics Institute (I = B = R) in their
Installation and Calculation Guides.

Member of

- The Hydronics Institute
- Better Heating Cooling Council

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HOW TO USE THE HYDRONIC FITTERS' GUIDE

The line numbers referred to in the following Steps apply to the Heat Loss Calculation Sheet, Form No. I502, (see sample form in lower right corner). For full details refer to I = B = R Guide H-21 (Heat Loss Calculation) and Guide 200 (Design and installation of Hydronic Heating systems), obtainable from The Hydronics Institute.

CALCULATION OF RESIDENTIAL HEAT LOSS

Fill in all data in the heading of the Heat Loss Calculation Sheet, Form No. I502. Identify each room on Line 1, using as many columns as necessary. Measure or take off the linear dimensions of each room and enter on Line 2. For rooms having bays, dormers or irregular shapes divide room into two or more easily figured portions using two columns if necessary. Figure length of exposed walls and enter on Line 3.

STEP 1 — Determine the areas, and enter in left half of column for each room:

(a) Gross Wall Area (Exposed), including closet walls. Walls of different construction should be figured and entered separately. Enter on Line 4.

(b) Window and Door Areas (Glass Area): Enter on Line 5.

(c) Net Wall Area: Subtract Line 5 from Line 4 and enter on Line 6.

(d) Ceiling Area: Enter on Line 7.

(e) Floor Area: Disregard unless concrete floor on ground or fill.

(f) Room Volume: Enter on Line 9.

STEP 2 — From table of "Heat Loss Factors" (over), determine factor for each type of construction, and enter on Lines 5, 6, 7, 8, and 9, in spaces provided. (Note Line 9 has space for three different window constructions and exposures.)

STEP 3 — Refer to table of "Btu/Hr. Requirements for Areas and Volumes." Find column headed by heat loss factor applying to area or volume under consideration. Follow down this column until the nearest value to the given area or volume is found. Follow across on this line to column headed "Btu/Hr. Required." The amount given here is the Btu/Hr. required for the area at 70 F temperature difference. Enter this in "Btu/Hr. Required" column for each room. Do this for each factor for each room.

STEP 4 — Add Btu/Hr. required for all areas and volumes in each room and enter on Line 10. This sum is the Btu/Hr. required to heat each room at 70 F temperature difference. Increase bathroom heat loss 20%.

STEP 5 — If the inside or outside (or both) design temperatures are different from 0 F outside and 70 F inside, refer to table of "Correction Factors" (over) and select correct factor. Multiply Total Btu/Hr. for each room, Line 10, by this factor and enter on Line 11. This amount is the Btu/Hr. required to heat the room at the design temperature difference.

STEP 6 — Enter either Line 10 or 11 (whichever applies) in column "Room Totals" from Line 11 at right side of Calculation Sheet. Add all these totals. This will be the total Building Heat Loss in Btu/Hr. at the design temperature difference.

SELECTION OF BOILER—Refer to I = B = R Guide 200

STEP 7 — The boiler rating shown in Slant/Fin catalogs show Net I = B = R Ratings. These published ratings include allowance for piping loss and pick-up load, for normal installations. A boiler equipped with a domestic hot water heater has sufficient capacity to supply average domestic hot water requirements when selected on the basis of the building heat loss determined in Step 6. No additional Btu/Hr. allowance for domestic hot water requirements is necessary, unless daily usage exceeds 75 gallons or if there are more than two bathrooms. The boiler selected should have a Btu/Hr. Net Rating equal to the required heating load. If the boiler catalog rating is smaller than this load, the next larger size should be selected. Consult your Slant/Fin representative for any questions you may have.

SIZING OF ROOM HEAT DISTRIBUTORS

STEP 8 — The heat output of room heat distributors varies with the temperature of the water flowing through them. The higher the average water temperature (AWT) the higher the heat output. It is necessary to decide upon an AWT for design purposes prior to selecting the heat distributors. This decision is a matter of the designer's personal preference. However, since the AWT has a direct bearing on the size of the heat distributors required, the following points should be considered:

(a) If 215 F AWT is selected, the heat distributors will be about 60% as large as those required if 170 F AWT is used. This will result in a substantial reduction in cost.

(b) The use of high AWT has no appreciable effect on fuel consumption.

(c) The AWT selected to satisfy the heat loss at the design temperature difference is required only during those brief periods when the outside temperature drops to the extreme design condition. In most localities this occurs during less than 3% of the heating season.

Note: Boiler water temperature is limited to 250 F by the A.S.M.E. Code for Low-Pressure Heating Boilers.

STEP 9 — Refer to Slant/Fin catalogs and select room heat distributors of sufficient capacity to satisfy the heat loss of each room, as found in Step 5. Enter size and type of required heat distributing units on Line 12.

EXAMPLE OF CALCULATION OF RESIDENTIAL HEAT LOSS

In the following steps, we show how to determine heat loss, size of boiler, and size and rating of room heat distributors for the residence described on the sample Heat Loss Calculation Sheet (shown in lower right corner). Steps 1 to 5 below apply to Bedroom No. 1, Col. C, but the same method should be used for each room. (For full details, including dimensional floor plans, refer to I = B = R Guide H21.)

Bedroom No. 1, Col. B is 8'0" High, 12'6" Long, 12'0" Wide. Enter these dimensions on Line 2. Length of Exposed Walls is 24'6" – enter on Line 3.

STEP 1 — Determine areas, and enter in left half of Col. G.

(a) Gross Wall Area (Exposed): 24'6" x 8' = 196 sq. ft. Enter on Line 4.

(b) Glass Area: Two windows, 9'+ 8'= 17 sq. ft. Enter on Line 5.

(c) Net Wall Area: Line 4 minus Line 5, 196 sq. ft.-17 sq. ft. = 179 sq. ft. Enter on Line 6.

(d) Ceiling Area: 12' x 12'6" = 150 sq. ft. Enter on Line 7.

(e) Floor Area: No heat loss in this case. Line 8 is left blank.

(f) Room Volume: 150 sq. ft. (ceiling area) x 8' = 1200 cu. ft. Enter on Line 9. (See sample sheet.)

STEP 2 — Select factors from table of "Heat Loss Factors" (over) and enter in Column A.

Windows, with storm sash. Factor is No. 1 (b), 0.56 — enter on Line 5.

Exposed Walls, construction is wood siding, building paper, wood sheathing, 3-5/8" rockwool, studs, ½" drywall. Factor is No. 3 (e), 0.07 — enter on Line 6.

Ceiling construction, ½" drywall, insulated with 6" rockwool, no floor above, attic space above. Factor is No. 14 (h), 0.07 — enter on Line 7.

Infiltration, for rooms with windows on two sides, with storm sash. Factor is No. 21 (b), 0.018 — enter on Line 9. (Infiltration factors for other rooms should also be entered on Line 9.) (See sample sheet.)

STEP 3 — Determine Heat Losses for Areas and Volumes at 70 F temperature difference from table "Btu/Hr. Requirements for Areas and Volumes" (over).

Glass Area: Under factor 0.56 in the section "Window and Door Areas," read down to 18 sq. ft. (area nearest the Glass Area of 17 sq. ft. Line 5). Btu/Hr. required, 700, is found in left hand column. Enter 700 on Line 5, right half of Col. G.

Net Wall Area: Under factor 0.07 in the section "Wall, Ceiling and Floor Areas," read down to 184 sq. ft. (area nearest the Wall Area of 179 sq. ft., Line 6). Btu/Hr. required, 900, is entered on Line 6, right half of Col. G.

Ceiling Area: Under factor 0.05 in the Section "Wall, Ceiling and Floor Areas," read down to 143 sq. ft. (area nearest the ceiling area of 150 sq. ft., Line 7). Btu/Hr. required, 500, is entered on Line 7, right half of Col. G.

Infiltration: Under factor 0.018 in the section "Infiltration," read down to 1190 cu. ft. (nearest volume to 1200 cu. ft., Line 9). Btu/Hr. required, 1500 is entered on Line 9, right half of Col. G.

STEP 4 — Determine Room Heat Loss at 70 F temperature difference by adding the "Btu/Hr. Required," found in right half of Col. G. This totals 3600 Btu/Hr. — enter on Line 10.

STEP 5 — From Table of "Correction Factors," select correction factor for a temperature difference of – 10 F outside to 70 F inside, which is 1.14. Multiply room heat loss at 70 F temperature difference (Line 10) by this factor: 3600 x 1.14 = 4100. Enter on Line 11.

Follow these five steps for each room, and enter in column at right of sheet "Room Totals from Line 11," and total this column. This sum (31,500) gives the total building heat loss at the design temperature difference.

EXAMPLE OF SELECTION OF BOILER

The boiler for this house, in addition to taking care of the building heat loss, is also to supply domestic hot water through a tankless heater attached to it. Inasmuch as there are only 1½ bathrooms in this house, no allowance is necessary for the tankless heater.

The boiler picked for this job should have a Net Rating equal to the 31,500 Btu/Hr. as listed in the catalog under the heading "Net I=B=R Rating." If the catalog Net Boiler Rating is less than the 31,500 Btu/Hr. required, the next larger size boiler should be selected. The boiler size and rating should be entered on the first line of the Estimate Sheet on back of the Heat Loss Calculation Sheet.

EXAMPLE OF SIZING OF ROOM HEAT DISTRIBUTORS

At a flow rate of 1 gpm, the I=B=R Rating of Custom Baseboard at 215 F AWT is 810 Btu/Hr. per lineal ft. Divide the room heat loss, 4100 Btu/Hr. for Bedroom No. 1, by 810. The required amount of baseboard is 5.07 lineal feet, which will easily fit along either outside wall of Bedroom No. 1.

Repeat this procedure for each room. In some houses there are rooms with insufficient wall length. In this case Slant/Fin high capacity baseboard or convectors may be used.

HEAT LOSS CALCULATION SHEET

Plumbing — Heating — Air Conditioning Group

OWNER JOHN DOE ADDRESS BILLINGS, MONTANA DATE 3-10-88

TYPE OF BUILDING RANCH HOUSE CONSTRUCTION WALLS: WOOD SIDING, PAPER, WOOD SHEATHING, STUDS, ½" DRYWALL, 3½" ROCKWOOL INS. CEILINGS: ATTIC ABOVE, NO FLOOR, 6" ROCKWOOL INS. ½" DRY WALL

DESIGN TEMPERATURE DIFFERENCE 80 F. WINDOWS: STORM SASH & STORM DOORS. FULL BASEMENT BELOW.

COL. A			COL. B		COL. C		COL. D		COL. E		COL. F +5'	
1 ROOM			BEDROOM 1		BATHROOM 1		BATHROOM 2		FAMILY ROOM		KITCHEN	
			H L W		H L W		H L W		H L W		H L W	
2 ROOM DIMENSIONS. FT.			8 12½ 12		8 10½ 4½		8 7 7		8 17½ 12		8 14 12	
3 LENGTH EXPOSED WALLS. FT.			24½	BTUH REQUIRED	10½	BTUH REQUIRED	—	BTUH REQUIRED	17½	BTUH REQUIRED	19	BTUH REQUIRED
4 GROSS WALL AREA. SQ. FT.			196		84		—		140		152	
5 GLASS AREA. SQ. FT.	FACTORS	1(b) .56	17	700	8	300	—	—	36	1400	25	1000
6 NET WALL AREA. SQ. FT.		3(e) .07	179	900	76	400	—	—	104	500	127	600
7 CEILING AREA. SQ. FT.		14(h) .05	150	500	47	200	49	200	210	700	168	600
8 FLOOR AREA. SQ. FT. †		—	—	—	—	—	—	—	—	—	—	—
9 ROOM VOLUME FOR INFILTRATION CU. FT.		VOLUME FACTOR	1200 .018	1500	360 .012	300 (1200)	—	—	1680 .012	1400	1360 .018	1700
10 TOTAL BTUH AT 70F TEMP. DIFFERENCE*				3600		1400		200		4000		3900
11 TOTAL BTUH AT DESIGN TEMP. DIFFERENCE				4100		1600		200		4600		4500
12 HEAT DISTRIBUTING UNITS												

COL. A			COL. G		COL. H		COL. I		COL. J		COL. K	
1 ROOM			DINING ROOM		LIVING ROOM		ENTRY		BEDROOM 3		BEDROOM 2	
			H L W		H L W		H L W		H L W		H L W	
2 ROOM DIMENSIONS. FT.			8 10 13		8 16 13		8 5 13		8 13 9½		8 10 13	
3 LENGTH EXPOSED WALLS. FT.			23	BTUH REQUIRED	16	BTUH REQUIRED	5	BTUH REQUIRED	13	BTUH REQUIRED	23	BTUH REQUIRED
4 GROSS WALL AREA. SQ. FT.			184		128		40		104		184	
5 GLASS AREA. SQ. FT.	FACTORS	1(b) .56	13	500	32	1300	22	900	13	500	22	900
6 NET WALL AREA. SQ. FT.		3(e) .07	171	800	96	500	18	100	91	400	162	800
7 CEILING AREA. SQ. FT.		14(h) .05	130	500	208	700	65	200	124	400	130	500
8 FLOOR AREA. SQ. FT. †		—	—	—	—	—	—	—	—	—	—	—
9 ROOM VOLUME FOR INFILTRATION CU. FT.		VOLUME FACTOR	1040 .012	900	1680 .012	1400	520 .027	1000	1000 .012	800	1040 .018	1300
10 TOTAL BTUH AT 70F TEMP. DIFFERENCE*				2700		3900		2200		2100		3500
11 TOTAL BTUH AT DESIGN TEMP. DIFFERENCE				3100		4500		2500		2400		4000
12 HEAT DISTRIBUTING UNITS												

ROOM TOTALS FROM LINE 11	
B	4100
C	1600
D	200
E	4600
F	4500
G	3100
H	4500
I	2500
J	2400
K	4000
	31500

TOTAL BTUH OF BUILDING AT DESIGN TEMP. DIFFERENCE

*INCREASE BATHROOM TOTAL 20%

†FOR CONCRETE FLOOR ON GROUND OR FILL AT GRADE LEVEL, USE LINEAR FEET OF EXPOSED EDGE

This form is available from The Hydronics Institute (Formerly The Institute of Boiler and Radiator Manufacturers) 35 Russo Place, Berkeley Heights, N. J. 07922

FORM 1502

HYDRONIC FITTERS' GUIDE

Btu/Hr. REQUIREMENTS FOR AREAS AND VOLUMES

Based on 70 F Temperature Difference
(0 F Outside and 70 F Inside Temperatures)

Btu/Hr. Required	WINDOW AND DOOR AREAS Sq. Ft. FACTORS				INFILTRATION Room Volume Cu. Ft. FACTORS							WALL, CEILING AND FLOOR AREAS* Sq. Ft. FACTORS																																			Btu/Hr. Required
	.36	.56	.65	1.13	0.012	0.018	0.027	0.036	0.045	0.054	0.068	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.14	0.15	0.18	0.19	0.20	0.21	0.22	0.23	0.25	0.27	0.29	0.30	0.31	0.33	0.34	0.35	0.38	0.39	0.47	0.49	0.52	0.56	0.60	0.67	0.69*	
100	4	3	2	1	119	79	53	40	32	26	21	36	29	24	20	18	16	14	13	10	10	8	8	7	7	6	6	6	5	5	5	5	4	4	4	4	4	3	3	3	3	2	2	2	100
200	8	5	4	3	238	159	106	79	63	53	42	71	57	48	41	36	32	29	26	20	19	16	15	14	14	13	12	11	11	10	10	9	9	8	8	8	7	6	6	5	5	5	4	4	200
300	12	8	7	4	357	238	159	119	95	79	63	107	86	71	61	54	48	43	39	31	29	24	23	21	20	19	19	17	16	15	14	14	13	13	12	11	11	9	9	8	8	7	6	6	300
400	16	10	9	5	476	317	212	159	127	106	84	143	114	95	82	71	63	57	52	41	38	32	30	29	27	26	25	23	21	20	19	18	17	17	16	15	15	12	12	11	10	10	9	8	400
500	20	13	11	6	595	397	265	198	159	132	105	179	143	119	102	89	79	71	65	51	48	40	38	36	34	32	31	29	26	25	24	23	22	21	20	19	18	15	15	14	13	12	11	10	500
600	24	15	13	8	714	476	317	238	190	159	126	214	171	143	122	107	95	86	78	61	57	48	45	43	41	39	37	34	32	30	29	28	26	25	24	23	22	18	17	16	15	14	13	12	600
700	28	18	15	9	833	556	370	278	222	185	147	250	200	167	143	125	111	100	91	71	67	56	53	50	48	45	43	40	37	34	33	32	30	29	29	26	26	21	20	19	18	17	15	14	700
800	32	20	18	10	952	635	423	317	254	212	168	286	229	190	163	143	127	114	104	82	76	63	60	57	54	52	50	46	42	39	38	37	35	34	33	30	29	24	23	22	20	19	17	17	800
900	36	23	20	11	1071	714	476	357	286	238	189	321	257	214	184	161	143	129	117	92	86	71	68	64	61	58	56	51	48	44	43	41	39	38	37	34	33	27	26	25	23	21	19	19	900
1000	40	26	22	13	1190	794	529	397	317	265	210	357	286	238	204	179	159	143	130	102	95	79	75	71	68	65	62	57	53	49	48	46	43	42	41	38	37	30	29	27	26	24	21	21	1000
1100	44	28	24	14	1310	873	582	437	349	291	231	393	314	262	224	196	175	157	143	112	105	87	83	79	75	71	68	63	58	54	52	51	48	46	45	41	40	33	32	30	28	26	23	23	1100
1200	48	31	26	15	1429	952	635	476	381	317	252	429	343	286	245	214	190	171	156	122	114	95	90	86	82	78	75	69	63	59	57	55	52	50	49	45	44	36	35	33	31	29	26	25	1200
1300	52	33	29	16	1548	1032	688	516	413	344	273	464	371	310	265	232	206	186	169	133	124	103	98	93	88	84	81	74	69	64	62	60	56	55	53	49	48	40	38	36	33	31	28	27	1300
1400	56	36	31	18	1667	1111	741	556	444	370	294	500	400	333	286	250	222	200	182	143	133	111	105	100	95	91	87	80	74	69	67	65	61	59	57	53	51	43	41	38	36	33	30	29	1400
1500	60	38	33	19	1786	1190	794	595	476	397	315	536	429	357	306	268	238	214	195	153	143	119	113	107	102	97	93	86	79	74	71	69	65	63	61	56	55	46	44	41	38	36	32	31	1500
1600	63	41	35	20	1905	1270	847	635	508	423	336	571	457	381	327	286	254	229	208	163	152	127	120	114	109	104	99	91	85	79	76	74	69	67	65	60	59	49	47	44	41	38	34	33	1600
1700	67	43	37	21	2024	1349	899	675	540	450	357	607	486	405	347	304	270	243	221	173	162	135	128	121	116	110	106	97	90	84	81	78	74	71	69	64	62	52	50	47	43	41	36	35	1700
1800	71	46	40	23	2143	1429	952	714	571	476	378	643	514	429	367	321	286	257	234	184	171	143	135	129	122	117	112	103	95	89	86	83	78	76	73	68	66	55	52	49	46	43	38	37	1800
1900	75	48	42	24	2262	1508	1005	754	603	503	399	679	543	452	388	339	302	271	247	194	181	151	143	136	129	123	118	109	101	94	90	88	82	80	78	71	70	58	55	52	48	45	41	39	1900
2000	79	51	44	25	2381	1587	1058	794	635	529	420	714	571	476	408	357	317	286	260	204	190	159	150	143	136	130	124	114	106	99	95	92	87	84	82	75	73	61	58	55	51	48	43	41	2000
2100	83	54	46	27	2500	1667	1111	833	667	556	441	750	600	500	429	375	333	300	273	214	200	167	158	150	143	136	130	120	111	103	100	97	91	88	86	79	77	64	61	58	54	50	45	43	2100
2200	87	56	48	28	2619	1746	1164	873	698	582	462	786	629	524	449	393	349	314	286	224	210	175	165	157	150	143	137	126	116	108	105	101	95	92	90	83	81	67	64	60	56	52	47	46	2200
2300	91	59	51	29	2738	1825	1217	913	730	608	483	821	657	548	469	411	365	329	299	235	219	183	173	164	156	149	143	131	122	113	110	106	100	97	94	86	84	70	67	63	59	55	49	48	2300
2400	95	61	53	30	2857	1905	1270	952	762	635	504	857	686	571	490	429	381	343	312	245	229	190	180	171	163	156	149	137	127	118	114	111	104	101	98	90	88	73	70	66	61	57	51	50	2400
2500	99	64	55	32	2976	1984	1323	992	794	661	525	893	714	595	510	446	397	357	325	255	238	198	188	179	170	162	155	143	132	123	119	115	108	105	102	94	92	76	73	69	64	60	53	52	2500
2600	103	66	57	33	3095	2063	1376	1032	825	688	546	929	743	619	531	464	413	371	338	265	248	206	195	186	177	169	161	149	138	128	124	120	113	109	106	98	95	79	76	71	66	62	55	54	2600
2700	107	69	59	34	3214	2143	1429	1071	857	714	567	964	771	643	551	482	429	386	351	276	257	214	203	193	184	175	168	154	143	133	129	124	117	113	110	102	99	82	79	74	69	64	58	56	2700
2800	111	71	62	35	3333	2222	1481	1111	889	741	588	1000	800	667	571	500	444	400	364	286	267	222	211	200	190	182	174	160	148	138	133	129	121	118	114	105	103	85	82	77	71	67	60	58	2800
2900	115	74	64	37	3452	2302	1534	1151	921	767	609	1036	829	690	592	518	460	414	377	296	276	230	218	207	197	188	180	166	153	143	138	134	126	122	118	109	106	88	85	80	74	69	62	60	2900
3000	119	77	66	38	3571	2381	1587	1190	952	794	630	1071	857	714	612	536	476	429	390	306	286	238	226	214	204	195	186	171	159	148	143	138	130	126	122	113	110	91	87	82	77	71	64	62	3000
3100	123	79	68	39	3690	2460	1640	1230	984	820	651	1107	886	738	633	554	492	443	403	316	295	246	233	221	211	201	193	177	164	153	148	143	134	130	127	117	114	94	90	85	79	74	66	64	3100
3200	127	82	70	40	3810	2540	1693	1270	1016	847	672	1143	914	762	653	571	508	457	416	327	305	254	241	229	218	208	199	183	169	158	152	147	139	134	131	120	117	97	93	88	82	76	68	66	3200
3300	131	84	73	42	3929	2619	1746	1310	1048	873	693	1179	943	786	673	589	524	471	429	337	314	262	248	236	224	214	205	189	175	163	157	152	143	139	135	124	121	100	96	91	84	79	70	68	3300
3400	135	87	75	43	4048	2698	1799	1349	1079	899	714	1214	971	810	694	607	540	486	442	347	324	270	256	243	231	221	211	194	180	167	162	157	147	143	139	128	125	103	99	93	87	81	72	70	3400
3500	139	89	77	44	4167	2778	1852	1389	1111	926	735	1250	1000	833	714	625	556	500	455	357	333	278	263	250	238	227	217	200	185	172	167	161	152	147	143	132	128	106	102	96	89	83	75	72	3500
3600	143	92	79	46	4286	2857	1905	1429	1143	952	756	1286	1029	857	735	643	571	514	468	367	343	286	271	257	245	234	224	206	190	177	171	166	156	151	147	135	132	109	105	99	92	86	77	75	3600
3700	147	94	81	47	4405	2937	1958	1468	1175	979	777	1321	1057	881	755	661	587	529	481	378	352	294	278	264	252	240	230	211	196	182	176	171	160	155	151	139	136	112	108	102	94	88	79	77	3700
3800	151	97	83	48	4524	3016	2011	1508	1206	1005	798	1357	1086	905	776	679	603	543	494	388	362	302	286	271	259	247	236	217	201	187	181	175	165	160	155	143	139	116	111	104	97	91	81	79	3800
3900	155	100	86	49	4643	3095	2063	1548	1238	1032	819	1393	1114	929	796	696	619	557	506	398	371	310	293	279	265	253	242	223	206	192	186	180	169	164	159	147	143	119	114	107	99	93	83	81	3900
4000	159	102	88	51	4762	3175	2116	1587	1270	1058	840	1429	1143	952	816	714	635	571	519	408	381	317	301	286	272	260	248	229	212	197	190	184	173	168	163	150	147	122	117	110	102	95	85	83	4000
4100	163	105	90	52	4881	3254	2169	1627	1302	1085	861	1464	1171	976	837	732	651	586	532	418	390	325	308	293	279	266	255	234	217	202	195	189	177	172	167	154	150	125	120	113	105	98	87	85	4100
4200	167	107	92	53	5000	3333	2222	1667	1333	1111	882	1500	1200	1000	857	750	667	600	545	429	400	333	316	300	286	273	261	240	222	207	200	194	182	176	171	158	154	128	122	115	107	100	90	87	4200
4300	171	110	94	54	5119	3413	2275	1706	1365	1138	903	1536	1229	1024	878	768	683	614	558	439	410	341	323	307	293	279	267	246	228	212	205	198	186	181	176	162	158	131	125	118	110	102	92	89	4300
4400	175	112	97	56	5238	3492	2328	1746	1397	1164	924	1571	1257	1048	898	786	698	629	571	449	419	349	331	314	299	286	273	251	233	217	210	203	190	185	180	165	161	134	128	121	112	105	94	91	4400
4500	179	115	99	57	5357	3571	2381	1786	1429	1190	945	1607	1286	1071	918	804	714	643	584	459	429	357	338	321	306	292	280	257	238	222	214	207	195	189	184	169	165	137	131	124	115	107	96	93	4500
4600	183	117	101	58	5476	3651	2434	1825	1460	1217	966	1643	1314	1095	939	821	730	657	597	469	438	365	346	329	313	299	286	263	243	227	219	212	199	193	188	173	168	140	134	126	117	110	98	95	4600
4700	187	120	103	59	5595	3730	2487	1865	1492	1243	987	1679	1343	1119	959	839	746	671	610	480	448	373	353	336	320	305	292	269	249	232	224	217	203	197	192	177	172	143	137	129	120	112	100	97	4700
4800	191	122	105	61	5714	3810	2540	1905	1524	1270	1008	1714	1371	1143	980	857	762	686	623	490	457	381	361	343	327	312	298	274	254	236	228	222	208	202	196	180	176	146	140	132	122	114	102	99	4800
4900	195	125	108	62	5833	3889	2593	1944	1556	1296	1029	1750	1400	1167	1000	875	778	700	636	500	467	389	368	350	333	318	304	280	259	241	233	226	212	206	200	184	179	149	143	135	125	117	104	101	4900
5000	199	128	110	63	5952	3968	2646	1984	1587	1323	1050	1786	1429	1190	1020	893	794	714	649	510	476	397	376	357	340	325	311	286	265	246	238	230	216	210	204	188	183	152	146	137	128	119	107	104	5000
5100	203	130	112	64	6071	4048	2698	2024	1619	1349	1071	1821	1457	1214	1041	911	810	729	662	520	486	405	383	364	347	331	317	291	270	251	243	235	221	214	208	192	187	155	149	140	130	121	109	106	5100
	.36	.56	.65	1.13	0.012	0.018	0.027	0.036	0.045	0.054	0.068	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.14	0.15	0.18	0.19	0.20	0.21	0.22	0.23	0.25	0.27	0.29	0.30	0.31	0.33	0.34	0.35	0.38	0.39	0.47	0.49	0.52	0.56	0.60	0.67	0.69*	

*When calculating the heal loss of a house where the floor corresponds to item 20(a) in the table of Heat Loss Factors the figures used under the factor of 0.69 represent linear feet of exposed edge—NOT the square feet of floor area. This applies to concrete floors on ground or fill only.

HEAT LOSS FACTORS

EXTERIOR DOORS

With or without glass, treated the same as Windows.

Item	Description	Factor

WINDOWS (GLASS)

No. 1. Windows

(a)	Single (no storm sash)	1.13
(b)	With storm sash	0.56
(c)	Double glazed with 1/4" air space	0.65
(d)	Triple glazed with two 1/2" air spaces	0.36

EXPOSED WALLS

The factor for lath and plaster is the same as for 1/2" dry wall (gypsum board).

No. 2. Frame, Not Insulated

(a)	Clapboards or wood siding, studs, 1/2" dry wall (gypsum board) (no sheathing)	0.33†
(b)	Asbestos-cement siding over wood siding, paper, studs, 1/2" dry wall (gypsum board) (no sheathing)	0.30
(c)	Wood siding, paper, wood sheathing, studs, 1/2" dry wall (gypsum board)	0.25
(d)	Asbestos-cement siding over wood siding, paper, wood sheathing, studs, 1/2" dry wall (gypsum board)	0.23
(e)	Asbestos-cement shingles, paper, wood sheathing, studs, 1/2" dry wall (gypsum board)	0.29

No. 3. Frame, Insulated

(a)	Wood siding, paper, wood sheathing, studs, 1/2" insulating board, plaster	0.19
(b)	Wood siding, 25/32" insulating board, studs, 1/2" dry wall (gypsum board)	0.22
(c)	Wood siding, paper, wood sheathing, 1/2" flexible insulation in contact with sheathing, studs, 1/2" dry wall (gypsum board)	0.18
(d)	Wood siding, paper, wood sheathing, 1/2" flexible insulation with an air space on both sides of insulation, studs, 1/2" dry wall (gypsum board)	0.15
(e)	Wood siding, paper, wood sheathing, 3-5/8" rockwool or equivalent, studs, 1/2" dry wall (gypsum board)	0.07
(f)	Wood siding, paper, wood sheathing, 2" rockwool or equivalent, studs, 1/2" dry wall (gypsum board)	0.10
(g)	Wood siding, 1" styrofoam board sheathing, 3-5/8" rockwool insulation or equivalent, studs, 1/2" dry wall (gypsum board)	0.06
(h)	3/4" x 10" wood siding, wood sheathing, 2" x 6" studs on 24" centers, 5-1/2" rockwool or equivalent insulation, vapor seal, 1/2" dry wall (gypsum board)	0.05
(i)	3/4" x 10" wood siding, 1" styrofoam sheathing, 2" x 6" studs on 24" centers, 5-1/2" rockwool or equivalent insulation, vapor seal, 1/2" dry wall (gypsum board)	0.04
(j)	Wood foundation above grade. 5/8" treated plywood, 2" x 6" studs on 24" centers, 5-1/2" rockwool or equivalent insulation, 1/2" dry wall (gypsum board)	0.06
(k)	Wood foundation below grade. 5/8" treated plywood, 2" x 6" studs on 24" centers, 5-1/2" rockwool or equivalent insulation, 1/2" dry wall (gypsum board)	0.03

No. 4. Frame, Insulated, Asbestos-Cement Shingles (or siding)

(a)	Asbestos-cement shingles, paper, wood sheathing, studs, 1/2" insulating board, plaster	0.21
(b)	Asbestos-cement shingles, 25/32" insulating board, studs, 1/2" dry wall (gypsum board)	0.25
(c)	Asbestos-cement shingles, paper, wood sheathing, 1/2" flexible insulation in contact with sheathing, studs, 1/2" dry wall (gypsum board)	0.20
(d)	Asbestos-cement shingles, paper, wood sheathing, 1/2" flexible insulation with an air space on both sides of insulation, studs, 1/2" dry wall (gypsum board)	0.16
(e)	Asbestos-cement shingles, paper, wood sheathing, 3 5/8" rockwool or equivalent, studs, 1/2" dry wall (gypsum board)	0.07
(f)	Asbestos-cement shingles, paper, wood sheathing, 2" rockwool or equivalent, studs, 1/2" dry wall (gypsum board)	0.11
(g)	Asbestos-cement shingles, 1" styrofoam board sheathing, 3 5/8" rockwool insulation or equivalent, studs, 1/2" dry wall (gypsum board)	0.06
(h)	Asbestos-cement shingles, wood sheathing, 2" x 6" studs on 24" centers, 5 1/2" rockwool or equivalent insulation, vapor seal, 1/2" dry wall (gypsum board)	0.05
(i)	Asbestos-cement shingles, 1" styrofoam sheathing, 2" x 6" studs on 24" centers, 5 1/2" rockwool or equivalent insulation, vapor seal, 1/2" dry wall (gypsum board)	0.04

No. 5. Brick, Not Insulated

(a)	8" brick, 1/2" plaster one side	0.47
(b)	8" brick, furred, lath and plaster one side	0.31
(c)	12" brick, 1/2" plaster one side	0.33
(d)	12" brick, furred, lath and plaster one side	0.25
(e)	4" brick, 8" hollow tile, 1/2" plaster one side	0.31
(f)	4" brick, 8" hollow tile, furred, 1/2" dry wall (gypsum board)	0.23
(g)	4" brick, paper, wood sheathing, studs, 1/2" dry wall (gypsum board)	0.29
(h)	4" brick, 4" light weight aggregate block, furred, 1/2" dry wall (gypsum board)	0.25

No. 6. Brick, Insulated

(a)	8" brick, furred, 1/2" insulating board, 1/2" plaster one side	0.22
(b)	12" brick, furred, 1/2" insulating board, 1/2" plaster one side	0.20
(c)	4" brick, 8" hollow tile, 1/2" insulating board, 1/2" plaster one side	0.18
(d)	4" brick, 4" light weight aggregate block, 1/2" insulating board, 1/2" plaster one side	0.19
(e)	4" brick, paper, wood sheathing, studs, 1/2" insulating board, 1/2" plaster	0.22
(f)	4" brick, 25/32" insulating board, studs, 1/2" dry wall (gypsum board)	0.23
(g)	4" brick, paper, wood sheathing, 3-5/8" rockwool or equivalent, studs, 1/2" dry wall (gypsum board)	0.08
(h)	4" brick, paper, wood sheathing, 2" rockwool or equivalent, studs, 1/2" dry wall (gypsum board)	0.09

HEAT LOSS FACTORS

Item	Description	Factor

EXPOSED WALLS

The factor for lath and plaster is the same as for 1/2" dry wall (gypsum board)

No. 7. Hollow Tile

(a)	8" tile, 3/4" stucco exterior, furred, 1/2" dry wall (gypsum board)	0.25
(b)	8" tile, 3/4" stucco exterior, furred, 1/2" insulating board, 1/2" plaster	0.19

No. 8. Hollow Concrete Block, Gravel Aggregate

(a)	8" block, plain, above grade	0.53†
(b)	8" block, above grade, 1/2" plaster one side	0.49
(c)	8" block, above grade, furred, 1/2" dry wall (gypsum board)	0.33
(d)	8" block, above grade, furred, 1/2" insulating board and 1/2" plaster	0.23
(e)	8" block, plain, basement wall below grade	0.06
(f)	12" block, plain, above grade	0.47†
(g)	12" block, plain, basement wall below grade	0.06

No. 9. Hollow Concrete Block, Cinder Aggregate

(a)	8" block, plain	0.39†
(b)	8" block, 1/2" plaster one side	0.38
(c)	8" block, furred, 1/2" dry wall (gypsum board)	0.27
(d)	8" block, furred, 1/2" insulating board, 1/2" plaster	0.20

No. 10. Hollow Concrete Block, Light Weight Aggretate

(a)	8" block, no interior finish	0.35†
(b)	8" block, 1/2" plaster one side	0.34
(c)	8" block, furred, 1/2" dry wall (gypsum board)	0.25
(d)	8" block, furred, 1/2" insulating board, 1/2" plaster	0.19
(e)	8" block, furred, 1" insulating blanket, 1/2" dry wall (gypsum board)	0.15

No. 11. Poured Concrete

(a)	8" wall, above grade	0.67
(b)	8" wall, below grade	0.06
(c)	12" wall, above grade	0.56
(d)	12" wall, below grade	0.06

No. 12. Limestone or Sandstone

(a)	8" stone, furred, 1/2" dry wall (gypsum board)	0.39
(b)	8" stone, furred, 1/2" insulating board, 1/2" plaster	0.25
(c)	12" stone, furred, 1/2" dry wall (gypsum board)	0.34
(d)	12" stone, furred, 1/2" insulating board, 1/2" plaster	0.23
(e)	12" stone, below grade	0.06
(f)	16" stone, below grade	0.06

No. 13. Glass Block

(a)	5-3/4 x 5-3/4 x 3-7/8 inches thick	0.61
(b)	7-3/4 x 7-3/4 x 3-7/8 inches thick	0.56
(c)	11-3/4 x 11-3/4 x 3-7/8 inches thick	0.53
(d)	7-3/4 x 7-3/4 x 3-7/8 inches thick with glass fiber screen dividing the cavity	0.49

COLD PARTITIONS (Exposed to unheated spaces)

The factor for lath and plaster is the same as for 1/2" dry wall (gypsum board)

No. 14. Frame

(a)	Studs, lath and plaster on one side only	0.33
(b)	Studs, 1/2" insulating board, 1/2" plaster on one side only	0.22
(c)	1/2" insulating board on exposed side, studs, 1/2" dry wall (gypsum board)	0.18
(d)	Studs, lath and plaster on both sides	0.23
(e)	Studs, 1/2" insulating board, 1/2" plaster on both sides	0.15
(f)	Studs, lath and plaster on both sides, 3-5/8" rockwool or equivalent	0.08
(g)	Studs, lath and plaster on both sides, 2" rockwool or equivalent	0.10

CEILINGS

The factor for lath and plaster is the same as for 1/2" dry wall (gypsum board)

No. 15. Attic Space Above

(a)	1/2" dry wall (gypsum board), no floor above	0.30
(b)	1/2" dry wall (gypsum board), tight floor above	0.18
(c)	1/2" insulating board, 1/2" plaster, no floor above	0.22
(d)	1/2" insulating board, 1/2" plaster, tight floor above	0.14
(e)	1/2" dry wall (gypsum board) with 1/2" insulating board on top of joists	0.18
(f)	1/2" dry wall (gypsum board), 3-5/8" rockwool or equivalent, with or without a floor above	0.07
(g)	1/2" dry wall (gypsum board), 2" rockwool or equivalent, with or without a floor above	0.11
(h)	1/2" dry wall (gypsum board), 6" rockwool or equivalent, with or without a floor above	0.05
(i)	1/2" dry wall (gypsum board), 8" rockwool or equivalent insulation with or without a floor above	0.03
(j)	1/2" dry wall (gypsum board), 10" rockwool or equivalent insulation with or without a floor above	0.03
(k)	1/2" dry wall (gypsum board), 12" rockwool or equivalent insulation with or without a floor above	0.02

No. 16. Part of Asphalt Shingled Roof — No Attic Space

(a)	1/2" dry wall (gypsum board), rafters, wood sheathing, shingles	0.29
(b)	1/2" insulating board, 1/2" plaster, rafters, wood sheathing, shingles	0.22
(c)	1/2" dry wall (gypsum board), rafters, 3-5/8" rockwool or equivalent, wood sheathing, shingles	0.06
(d)	1/2" dry wall (gypsum board), rafters, 2" rockwool or equivalent, wood sheathing, shingles	0.09
(e)	1/2" dry wall (gypsum board), rafters, 6" rockwool or equivalent, wood sheathing, shingles	0.04

No. 17. Part of Built-up Roof — No Attic Space

(a)	1/2" dry wall (gypsum board), rafters, wood sheathing, 3/8" built-up roofing	0.27

HEAT LOSS FACTORS

Item	Description	Factor

(b)	1/2" insulating board, 1/2" plaster, rafters, wood sheathing, 3/8" built-up roofing	0.22
(c)	1/2" dry wall (gypsum board), rafters, 3-5/8" rockwool or equivalent, wood sheathing, 3/8" built-up roofing	0.06
(d)	1/2" dry wall (gypsum board), rafters, 2" rockwool or equivalent, wood sheathing, 3/8" built-up roofing	0.09
(e)	1/2" dry wall (gypsum board), rafters, 6" rockwool or equivalent, wood sheathing, 3/8" built-up roofing	0.04

FLOORS

No. 18. Wood, over ENCLOSED, UNHEATED SPACE

(a)	Finish flooring (maple or oak), pine sub-floor on joists	0.15
(b)	Finish flooring (maple or oak), pine sub-floor on joists, with 1/2" insulating board on bottom of joists	0.09
(c)	Finish flooring (maple or oak), pine sub-floor on joists, with 2" rockwool or equivalent between joists	0.05
(d)	Finish flooring (maple or oak), pine sub-floor on joists, with 3-5/8" rockwool or equivalent between joists	0.04
(e)	Finish flooring (maple or oak), 5/8" plywood sub-floor, 6" rockwool or equivalent insulation	0.03
(f)	Finish flooring (maple or oak), 5/8" plywood sub-floor, 10" rockwool or equivalent insulation	0.02
(g)	Carpet and fibrous pad, 5/8" plywood floor, 5/8" plywood sub-floor, 6" rockwool or equivalent insulation	0.02

No. 19. Wood, over EXPOSED SPACE

(a)	Finish flooring (maple or oak), pine sub-floor on joists	0.35
(b)	Finish flooring (maple or oak), pine sub-floor on joists, with 1/2" insulating board on bottom of joists	0.20
(c)	Finish flooring (maple or oak), pine sub-floor on joists, with 2" rockwool or equivalent between joists	0.09
(d)	Finish flooring (maple or oak), pine sub-floor on joists, with 3-5/8" rockwool or equivalent between joists	0.06
(e)	Finish flooring (maple or oak), 5/8" plywood sub-floor, 6" rockwool or equivalent insulation	0.05
(f)	Finish flooring (maple or oak), 5/8" plywood sub-floor, 10" rockwool or equivalent insulation	0.03

No. 20. Concrete

(a)	On ground or fill, with 1" edge insulation — per linear foot of exposed edge, NOT per square foot	0.69
(b)	Floor on ground below grade — per square foot of area only, NOT edge loss	0.04

INFILTRATION

Based on volume of room in cubic feet

†NOTE: For constructions covered by Item Nos. 2(a), 8(a), 8(f), 9(a), and 10(a), use Item No. 23 (NOT Item Nos. 21 or 22) for figuring Infiltration.

No. 21. Windows and Doors NOT Weatherstripped and WITHOUT Storm Sash

(a)	Rooms with windows or exterior doors on one side only	0.018
(b)	Rooms with windows or exterior doors on two sides	0.027
(c)	Rooms with windows or exterior doors on three sides	0.036
(d)	Entrance halls	0.036
(e)	Sun rooms with many windows on three sides	0.054

No. 22. Windows and Doors Weatherstripped OR with Storm Sash

(a)	Rooms with windows or exterior doors on one side only	0.012
(b)	Rooms with windows or exterior doors on two sides	0.018
(c)	Rooms with windows or exterior doors on three sides	0.027
(d)	Entrance halls	0.027
(e)	Sun rooms with many windows on three sides	0.036

No. 23. Wall Construction Items 2(a), 8(a), 8(f), 9(a), and 10(a)

(a)	Rooms with one outside wall	0.027
(b)	Rooms with two outside walls	0.045
(c)	Rooms with three outside walls	0.068
(d)	Rooms with four outside walls	0.068

NOTE: The above infiltration factors are based upon:

.012 = 2/3 air change per hour
.018 = 1 air change per hour
.027 = 1-1/2 air changes per hour
.036 = 2 air changes per hour

CORRECTION FACTORS

For a Temperature Difference Other Than 0 F to 70 F, Multiply Heat Loss by Factors Shown Below

Outside Temperature, °F.	Inside Temperature, °F.						
	50	55	60	65	70	75	80
30	.29	.36	.43	.50	.57	.64	.71
20	.43	.50	.57	.64	.71	.79	.86
10	.57	.64	.71	.79	.86	.93	1.00
0	.71	.79	.86	.93	1.00	1.07	1.14
−10	.86	.93	1.00	1.07	1.14	1.21	1.30
−20	1.00	1.07	1.14	1.21	1.30	1.36	1.43
−30	1.14	1.21	1.30	1.36	1.43	1.50	1.56