طرح سیستم های تهویه مطبوع

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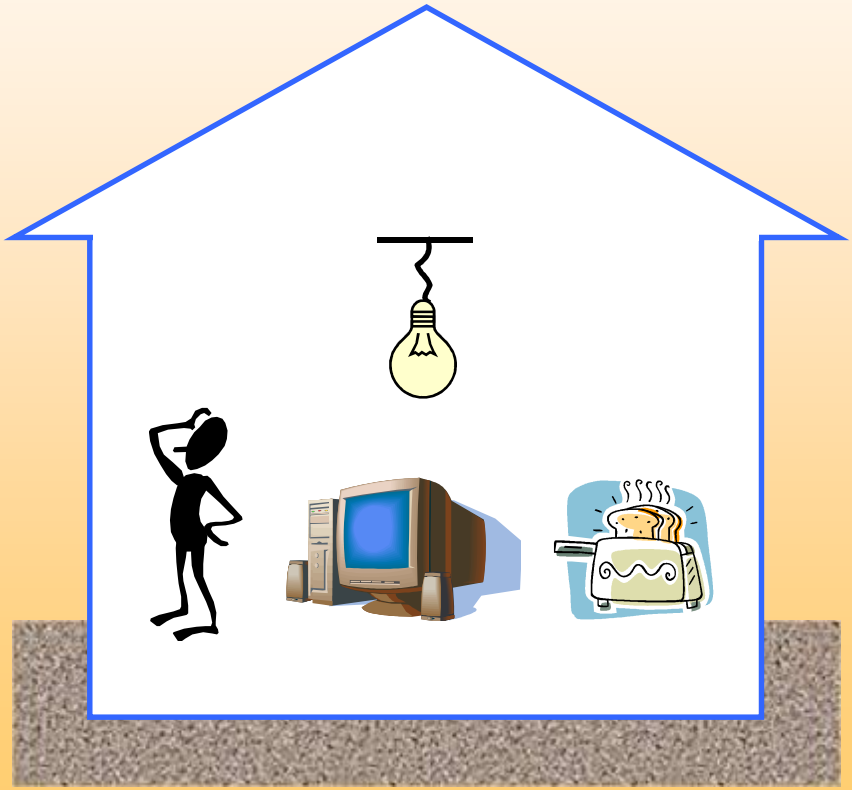
نیمسال دوم 92-93

محاسبات بار سرمایشی

2 بارهای داخلی



بارهای داخلی ساختمان عبارت است از:

- بار روشنایی
- بار افراد
- بار وسایل آشپزخانه
- بار موتورهای الکتریکی
- بار لوله‌های آب گرم و سرد
- بار مخازن آب
- بار سیستم تهویه مطبوع

همان طور که پیش از ذکر شد، اصلی‌ترین تفاوت محاسبات بار سرمایشی با گرمایشی در نظر گرفتن اثرات ذخیره‌سازی حرارتی ساختمان است. برای بارهای داخلی این اثرات به صورت ضرایب ذخیره مطرح می‌گردد.

بار روشنایی

	EQUIP. OPER-ATION Hours	WEIGHT§ (lb per sq ft of floor area)	NUMBER OF HOURS AFTER LIGHTS ARE TURNED ON																					
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Fluorescent Lights Exposed	24	150 & over	.37	.67	.71	.74	.76	.79	.81	.83	.84	.86	.87	.29	.26	.23	.20	.19	.17	.15	.14	.12	.11	.10	.09	.08
		100	.31	.67	.72	.76	.79	.81	.83	.85	.87	.88	.90	.30	.26	.22	.19	.16	.15	.13	.12	.10	.09	.08	.07	.06
		30	.25	.74	.83	.88	.91	.94	.96	.96	.98	.98	.99	.26	.17	.12	.08	.05	.04	.03	.02	.01	.01	.01	0	0
	16	150 & over	.60	.82	.83	.84	.84	.84	.85	.85	.86	.88	.90	.32	.28	.25	.23	.19								
		100	.46	.79	.84	.86	.87	.88	.88	.89	.89	.90	.90	.30	.26	.22	.19	.16								
		30	.29	.77	.85	.89	.92	.95	.96	.96	.98	.98	.99	.26	.17	.12	.08	.05								
	12	150 & over	.63	.90	.91	.93	.93	.94	.95	.95	.95	.96	.96	.37												
		100	.57	.89	.91	.92	.94	.94	.95	.95	.96	.96	.97	.36												
		30	.42	.86	.91	.93	.95	.97	.98	.98	.99	.99	.99	.26												
Fluorescent Lights Recessed in Susp. Ceiling or Exposed Incandescent Lights.	24	150 & over	.34	.55	.61	.65	.68	.71	.74	.77	.79	.81	.83	.39	.35	.31	.28	.25	.23	.20	.18	.16	.15	.14	.12	.11
		100	.24	.56	.63	.68	.72	.75	.78	.80	.82	.84	.86	.40	.34	.29	.25	.20	.18	.17	.15	.14	.12	.10	.09	.08
		30	.17	.65	.77	.84	.88	.92	.94	.95	.97	.98	.98	.35	.23	.16	.11	.07	.05	.04	.03	.02	.01	.01	0	0
	16	150 & over	.58	.75	.79	.80	.80	.81	.82	.83	.84	.86	.87	.39	.35	.31	.28	.25								
		100	.46	.73	.78	.82	.82	.82	.83	.84	.85	.87	.88	.40	.34	.29	.25	.20								
		30	.22	.69	.80	.86	.89	.93	.94	.95	.97	.98	.98	.35	.23	.16	.11	.07								
	12	150 & over	.69	.86	.89	.90	.91	.91	.92	.93	.94	.95	.95	.50												
		100	.58	.85	.88	.88	.90	.92	.93	.94	.94	.94	.95	.48												
		30	.40	.81	.88	.91	.93	.96	.97	.97	.98	.99	.99	.35												
Fluorescent or Incandescent Lights Recessed in Susp. Ceiling and Ceiling Plenum Return System.	24	150 & over	.23	.33	.41	.47	.52	.57	.61	.66	.69	.72	.74	.59	.52	.46	.42	.37	.34	.31	.27	.25	.23	.21	.18	.16
		100	.17	.33	.44	.52	.56	.61	.66	.69	.74	.77	.79	.60	.51	.44	.37	.32	.30	.27	.23	.20	.18	.16	.14	.12
		30	0	.48	.66	.76	.82	.87	.91	.93	.95	.97	.98	.52	.34	.24	.16	.11	.07	.05	.04	.02	.02	.01	0	0
	16	150 & over	.57	.64	.68	.72	.73	.73	.74	.74	.75	.76	.78	.59	.52	.46	.42	.37								
		100	.47	.60	.67	.72	.74	.77	.78	.79	.80	.81	.82	.60	.51	.44	.37	.32								
		30	.07	.53	.70	.78	.84	.88	.91	.93	.95	.97	.98	.52	.34	.24	.16	.11								
	12	150 & over	.75	.79	.83	.84	.86	.88	.89	.91	.91	.93	.93	.75												
		100	.68	.77	.81	.84	.86	.88	.89	.89	.92	.93	.93	.72												
		30	.34	.78	.82	.87	.89	.92	.95	.95	.97	.98	.98	.52												

$$Q = LHG \times F_S$$

Q: بار روشنایی، Btu/hr

L: بار اکتسابی از سیستم روشنایی

F_S: ضریب ذخیره سازی ساختمان

1 Watt = 3.4 Btu/hr

برای لامپهای فلورسنت، ضریب 25/1 برای در نظر گرفتن اتلاف از Ballast لامپ در نظر گرفته می‌شود.

بار افراد

DEGREE OF ACTIVITY	TYPICAL APPLICATION	Metabolic Rate (Adult Male) Btu/hr	Average Adjusted Metabolic Rate* Btu/hr	ROOM DRY-BULB TEMPERATURE									
				82 F		80 F		78 F		75 F		70 F	
				Btu/hr		Btu/hr		Btu/hr		Btu/hr		Btu/hr	
				Sensible	Latent	Sensible	Latent	Sensible	Latent	Sensible	Latent	Sensible	Latent
Seated at rest	Theater, Grade School	390	350	175	175	195	155	210	140	230	120	260	90
Seated, very light work	High School	450	400	180	220	195	205	215	185	240	160	275	125
Office worker	Offices, Hotels, Apts., College	475	450	180	270	200	250	215	235	245	205	285	165
Standing, walking slowly	Dept., Retail, or Variety Store	550											
Walking, seated	Drug Store	550	500	180	320	200	300	220	280	255	245	290	210
Standing, walking slowly	Bank	550											
Sedentary work	Restaurant†	500	550	190	360	220	330	240	310	280	270	320	230
Light bench work	Factory, light work	800	750	190	560	220	530	245	505	295	455	365	385
Moderate dancing	Dance Hall	900	850	220	630	245	605	275	575	325	525	400	450
Walking, 3 mph	Factory, fairly heavy work	1000	1000	270	730	300	700	330	670	380	620	460	540
Heavy work	Bowling Alley‡, Factory	1500	1450	450	1000	465	985	485	965	525	925	605	845

Adjusted Metabolic Rate is the metabolic rate to be applied to a mixed group of people with a typical percent composition based on the following factors:

Metabolic rate, adult female = Metabolic rate, adult male × 0.85
Metabolic rate, children = Metabolic rate, adult male × 0.75

†Restaurant—Values for this application include 60 Btu per hr for food per individual (30 Btu sensible and 30 Btu latent heat per hr).

‡Bowling—Assume one person per alley actually bowling and all others sitting, metabolic rate 400 Btu per hr; or standing, 550 Btu per hr.

بار وسایل آشپزخانه (الکتریکی)

ELECTRIC RESTURANT APP.

APPLIANCE	OVERALL DIMENSIONS Less Legs and Handles (In.)	TYPE OF CON-TROL	MISCELLANEOUS DATA	MFR MAX RATING Btu/hr	MAIN-TAIN-ING RATE Btu/hr	RECOM HEAT GAIN FOR AVG USE		
						Sensible Heat Btu/hr	Latent Heat Btu/hr	Total Heat Btu/hr
Coffee Brewer—½ gal Warmer—½ gal		Man. Man.		2240 306	306 306	900 230	220 90	1120 320
4 Coffee Brewing Units with 4½ gal Tank	20 x 30 x 26H	Auto.	Water heater—2000 watts Brewers—2960 watts	16900		4800	1200	6000
Coffee Urn—3 gal —3 gal —5 gal	15 Dia x 34H 12 x 23 oval x 21H 18 Dia x 37H	Man. Auto. Auto.	Black finish Nickel plated Nickel plated	11900 15300 17000	3000 2600 3600	2600 2200 3400	1700 1500 2300	4300 3700 5700
Doughnut Machine	22 x 22 x 57H	Auto.	Exhaust system to outdoors—½ hp motor	16000		5000		5000
Egg Boiler	10 x 13 x 25H	Man.	Med. ht.—550 watts Low ht—275 watts	3740		1200	800	2000
Food Warmer with Plate Warmer, per sq ft top surface		Auto.	Insulated, separate heating unit for each pot. Plate warmer in base	1350	500	350	350	700
Food Warmer without Plate Warmer, per sq ft top surface		Auto.	Ditto, without plate warmer	1020	400	200	350	550
Fry Kettle—11½ lb fat	12 Dia x 14H	Auto.		8840	1100	1600	2400	4000
Fry Kettle—25 lb fat	16 x 18 x 12H	Auto.	Frying area 12" x 14"	23800	2000	3800	5700	9500
Griddle, Frying	18 x 18 x 8H	Auto.	Frying top 18" x 14"	8000	2800	3100	1700	4800
Grills, Meat	14 x 14 x 10H	Auto.	Cooking area 10" x 12"	10200	1900	3900	2100	6000
Grills, Sandwich	13 x 14 x 10H	Auto.	Grill area 12" x 12"	5600	1900	2700	700	3400
Roll Warmer	26 x 17 x 13H	Auto.	One drawer	1500	400	1100	100	1200
Toaster, Continuous	15 x 15 x 28H	Auto.	2 Slices wide—360 slices/hr	7500	5000	5100	1300	6400
Toaster, Continuous	20 x 15 x 28H	Auto.	4 Slices wide—720 slices/hr	10200	6000	6100	2600	8700
Toaster, Pop-Up	6 x 11 x 9H	Auto.	2 Slices	4150	1000	2450	450	2900
Waffle Iron	12 x 13 x 10H	Auto.	One waffle 7" dia	2480	600	1100	750	1850
Waffle Iron for Ice Cream Sandwich	14 x 13 x 10H	Auto.	12 Cakes, each 2½" x 3¾"	7500	1500	3100	2100	5200

If properly designed positive exhaust hood is used, multiply recommended value by .50.

بار وسایل آشپزخانه (گازسوز)

GAS RESTURANT APP.

APPLIANCE	OVERALL DIMENSIONS Less Legs and Handles (In.)	TYPE OF CONTROL	MISCELLANEOUS DATA	MFR MAX RATING Btu/hr	MAINTAINING RATE Btu/hr	RECOM HEAT GAIN FOR AVG USE		
						Sensible Heat Btu/hr	Latent Heat Btu/hr	Total Heat Btu/hr
GAS BURNING								
Coffee Brewer—½ gal Warmer—½ gal		Man. Man.	Combination brewer and warmer	3400 500	500	1350 400	350 100	1700 500
Coffee Brewer Unit with Tank	19 x 30 x 26H		4 Brewers and 4½ gal tank			7200	1800	9000
Coffee Urn—3 gal	15" Dia x 34H	Auto.	Black finish	3200	3900	2900	2900	5800
Coffee Urn—3 gal	12 x 23 oval x 21H	Auto.	Nickel plated		3400	2500	2500	5000
Coffee Urn—5 gal	18 Dia x 37H	Auto.	Nickel plated		4700	3900	3900	7800
Food Warmer, Values per sq ft top surface		Man.	Water bath type	2000	900	850	450	1300
Fry Kettle—15 lb fat	12 x 20 x 18H	Auto.	Frying area 10 x 10	14250	3000	4200	2800	7000
Fry Kettle—28 lb fat	15 x 35 x 11H	Auto.	Frying area 11 x 15	24000	4500	7200	4800	12000
Grill—Broil-O-Grill Top Burner Bottom Burner	22 x 14 x 17H (1.4 sq ft grill surface)	Man.	Insulated 22,000 Btu/hr 15,000 Btu/hr	37000		14400	3600	18000
Stoves, Short Order—Open Top. Values per sq ft top surface		Man.	Ring type burners 12000 to 22000 Btu/sq	14000		4200	4200	8400
Stoves, Short Order—Closed Top. Values per sq ft top surface		Man.	Ring type burners 10000 to 12000 Btu/sq	11000		3300	3300	6600
Toaster, Continuous	15 x 15 x 28H	Auto.	2 Slices wide—360 slices/hr	12000	10000	7700	3300	11000
STEAM HEATED								
Coffee Urn—3 gal —3 gal —5 gal	15 Dia x 34H 12 x 23 oval x 21H 18 Dia x 37H	Auto. Auto. Auto.	Black finish Nickel plated Nickel plated			2900 2400 3400	1900 1600 2300	4800 4000 5700
Coffee Urn—3 gal —3 gal —5 gal	15 Dia x 34H 12 x 23 oval x 21H 18 Dia x 37H	Man. Man. Man.	Black finish Nickel plated Nickel plated			3100 2600 3700	3100 2600 3700	6200 5200 7400
Food Warmer, per sq ft top surface		Auto.				400	500	900
Food Warmer, per sq ft top surface		Man.				450	1150	1500

If properly designed positive exhaust hood is used, multiply recommended value by .50.

بار موتورهای الکتریکی

ELECTRIC MOTORS

NAMEPLATE† OR BRAKE HORSEPOWER	FULL LOAD MOTOR EFFICIENCY PERCENT	LOCATION OF EQUIPMENT WITH RESPECT TO CONDITIONED SPACE OR AIR STREAM‡		
		Motor In - Driven Machine in HP × 2545 / % Eff	Motor Out - Driven Machine in HP × 2545	Motor In - Driven Machine out HP × 2545 (1 − % Eff) / % Eff
		Btu per Hour		
1/20	40	320	130	190
1/12	49	430	210	220
1/8	55	580	320	260
1/6	60	710	430	280
1/4	64	1,000	640	360
1/3	66	1,290	850	440
1/2	70	1,820	1,280	540
3/4	72	2,680	1,930	750
1	79	3,220	2,540	680
1 1/2	80	4,770	3,820	950
2	80	6,380	5,100	1,280
3	81	9,450	7,650	1,800
5	82	15,600	12,800	2,800
7 1/2	85	22,500	19,100	3,400
10	85	30,000	25,500	4,500
15	86	44,500	38,200	6,300
20	87	58,500	51,000	7,500
25	88	72,400	63,600	8,800
30	89	85,800	76,400	9,400
40	89	115,000	102,000	13,000
50	89	143,000	127,000	16,000
60	89	172,000	153,000	19,000
75	90	212,000	191,000	21,000
100	90	284,000	255,000	29,000
125	90	354,000	318,000	36,000
150	91	420,000	382,000	38,000
200	91	560,000	510,000	50,000
250	91	700,000	636,000	64,000

For intermittent operation, an appropriate usage factor should be used, preferably measured.

†If motors are overloaded and amount of overloading is unknown, multiply the above heat gain factors by the following maximum service factors:

Maximum Service Factors

Horsepower	1/20-1/8	1/6-1/3	1/2-3/4	1	1 1/2-2	3-250
AC Open Type	1.4	1.35	1.25	1.25	1.20	1.15
DC Open Type	—	—	—	1.15	1.15	1.15

No overload is allowable with enclosed motors.

‡For a fan or pump in air conditioned space, exhausting air and pumping fluid to outside of space, use values in last column.

بار لوله‌های آب گرم و سرد

ضریب انتقال حرارت برای لوله‌های گرم بدون عایق (Btu/hr.ft.DT)

NOMINAL PIPE SIZE (in.)	HOT WATER				STEAM		
	120 F	150 F	180 F	210 F	5 psig 227 F	50 psig 300 F	100 psig 338 F
	TEMPERATURE DIFFERENCE*						
	50 F	80 F	110 F	140 F	157 F	230 F	268 F
½	0.46	0.50	0.55	0.58	0.61	0.71	0.76
¾	0.56	0.61	0.67	0.72	0.75	0.87	0.93
1	0.68	0.74	0.82	0.88	0.92	1.07	1.15
1¼	0.85	0.92	1.01	1.09	1.14	1.32	1.43
1½	0.96	1.04	1.15	1.23	1.29	1.49	1.63
2	1.18	1.28	1.41	1.51	1.58	1.84	1.99
2½	1.40	1.53	1.68	1.80	1.88	2.19	2.36
3	1.68	1.83	2.01	2.15	2.26	2.63	2.84
3½	1.90	2.06	2.22	2.43	2.55	2.97	3.22
4	2.12	2.30	2.53	2.72	2.85	3.32	3.59
5	2.58	2.80	3.08	3.30	3.47	4.05	4.39
6	3.04	3.29	3.63	3.89	4.07	4.77	5.16
8	3.88	4.22	4.64	4.96	5.21	6.10	6.61
10	4.76	5.18	5.68	6.09	6.41	7.49	8.12
12	5.59	6.07	6.67	7.15	7.50	8.80	9.53

*At 70 F db room temperature

بار لوله‌های آب گرم و سرد

ضریب انتقال حرارت برای لوله‌های سرد عایق شده (Btu/hr.ft.DT)

IRON PIPE SIZE (in.)	ICE WATER		BRINE		HEAVY BRINE	
	Actual Thickness of Insulation (In.)	Coefficient	Actual Thickness of Insulation (In.)	Coefficient	Actual Thickness of Insulation (In.)	Coefficient
½	1.5	0.11	2.0	0.10	2.8	0.09
¾	1.6	0.12	2.0	0.11	2.9	0.09
1	1.6	0.14	2.0	0.12	3.0	0.10
1¼	1.6	0.16	2.4	0.13	3.1	0.11
1½	1.5	0.17	2.5	0.13	3.2	0.12
2	1.5	0.20	2.5	0.15	3.3	0.13
2½	1.5	0.23	2.6	0.17	3.3	0.15
3	1.5	0.27	2.7	0.19	3.4	0.16
3½	1.5	0.29	2.9	0.19	3.5	0.18
4	1.7	0.30	2.9	0.21	3.7	0.18
5	1.7	0.35	3.0	0.24	3.9	0.20
6	1.7	0.40	3.0	0.26	4.0	0.23
8	1.9	0.46	3.0	0.32	4.0	0.26
10	1.9	0.56	3.0	0.38	4.0	0.31
12	1.9	0.65	3.0	0.44	4.0	0.36

No allowance for fittings. This table applies only to straight runs of pipe. When numerous fittings exist, a suitable safety factor must be included. This added heat gain at the fittings may be as much as 10%. Generally this table can be used without adding this safety factor.

Insulation material. Values in this table are based on a material having a conductivity k=0.30. However, a 15% safety factor was added to this k value to compensate for seams and imperfect workmanship. The table applies to either cork covering (k=0.29), or mineral wool board (k=0.32). The thickness given above is for molded mineral wool board which is usually some 5 to 10% greater than molded cork board.

بار لوله‌های آب گرم و سرد

ضریب انتقال حرارت برای لوله‌های گرم عایق شده (Btu/hr.ft.DT)

IRON PIPE SIZE (in.)	85 PERCENT MAGNESIA INSULATION†		
	1 In. Thick	1½ In. Thick	2 In. Thick
½	0.16	0.14	0.12
¾	0.18	0.15	0.13
1	0.20	0.17	0.15
1¼	0.24	0.20	0.17
1½	0.26	0.21	0.18
2	0.30	0.24	0.21
2½	0.35	0.27	0.24
3	0.40	0.32	0.27
3½	0.45	0.35	0.30
4	0.49	0.38	0.32
5	0.59	0.45	0.38
6	0.68	0.52	0.43
8	0.85	0.65	0.53
10	1.04	0.78	0.64
12	1.22	0.90	0.73

No allowance for fittings. This table applies only to straight runs of pipe. When numerous fittings exist, a suitable safety factor must be included. This added heat gain at the fittings may be as much as 10%. Generally this table can be used without adding this safety factor.

†Other insulation. If other types of insulation are used, multiply the above values by the factors shown in the following table:

MATERIAL	PIPE COVERING FACTORS
Corrugated Asbestos (Air Cell)	
4 Ply per inch	1.36
6 Ply per inch	1.23
8 Ply per inch	1.19
Laminated Asbestos (Sponge Felt)	0.98
Mineral Wool	1.00
Diatomaceous Silica (Super-X)	1.36
Brown Asbestos Fiber (Wool Felt)	0.88

بار انتقال حرارت از مخازن

ضریب انتقال حرارت برای مخازن بدون عایق ($Btu/hr.ft^2.DT$)

CONSTRUCTION	METAL								WOOD 2½ in. Thick				CONCRETE 6 in. Thick			
	Painted				Bright (Nickel)				Painted or Bare				Painted or Bare			
	Temp Diff				Temp Diff				Temp Diff				Temp Diff			
	50 F	100 F	150 F	200 F	50 F	100 F	150 F	200 F	50 F	100 F	150 F	200 F	50 F	100 F	150 F	200 F
Vertical(Sides)	1.8	2.0	2.3	2.6	1.3	1.7	1.6	1.7	.37	.37	.37	.37	.91	.93	.96	.97
Top	2.1	2.4	2.7	2.9	1.6	1.4	1.9	2.1	.38	.38	.38	.38	.99	1.0	1.0	1.1
Bottom	1.5	1.7	2.0	2.2	0.97	1.1	1.3	1.4	.35	.36	.36	.36	.83	.86	.88	.90

تبخیر از سطح مخازن رو باز ($Btu/hr.ft^2$)

STILL AIR, ROOM AT 75 F db, 50% RH

WATER TEMP	75 F	100 F	125 F	150 F	175 F	200 F
Btu/(hr)(sq ft)	42	140	330	680	1260	2190

بار سیستم تهویه مطبوع

AIR CONDITIONING SYSTEM

	FAN TOTAL PRESSURE† (In. of Water)	CENTRAL STATION SYSTEMS‡					APPLIED OR UNITARY SYSTEM**				
		Temp Diff Room to Supply Air					Temp Diff Room to Supply Air				
		10 F	15 F	20 F	25 F	30 F	10 F	15 F	20 F	25 F	30 F
		PERCENT OF ROOM SENSIBLE HEAT*									
Fan Motor Not in Conditioned Space or Air Stream	0.50	1.2	0.8	0.6	0.5	0.4	2.2	1.5	1.1	0.9	0.7
	0.75	1.9	1.3	1.0	0.8	0.6	3.5	2.4	1.8	1.4	1.2
	1.00	2.7	1.8	1.4	1.1	0.9	4.8	3.2	2.4	1.9	1.6
	1.25	3.9	2.6	1.9	1.6	1.3	6.5	4.3	3.2	2.6	2.2
	1.50	4.6	3.1	2.3	1.9	1.6	7.8	5.2	3.9	3.1	2.6
	1.75	5.4	3.6	2.7	2.2	1.8	9.1	6.1	4.6	3.6	3.0
	2.00	6.2	4.1	3.1	2.5	2.1	10.4	6.9	5.2	4.2	3.5
	3.00	10.4	6.9	5.2	4.2	3.5	16.7	11.2	8.4	6.7	5.6
	4.00	15.3	10.2	7.7	6.1	5.1					
	5.00	19.2	12.8	9.6	7.7	6.4					
	6.00	24.4	16.3	12.2	9.9	8.2					
	8.00	38.0	25.4	19.0	15.2	12.7					
Fan Motor†† in Conditioned Space or Air Stream	0.50	1.6	1.1	0.8	0.6	0.5	2.7	1.8	1.4	1.1	0.9
	0.75	2.6	1.8	1.3	1.1	0.9	4.2	2.8	2.1	1.7	1.4
	1.00	3.6	2.4	1.8	1.5	1.2	5.8	3.8	2.9	2.3	1.9
	1.25	5.0	3.4	2.5	2.0	1.7	7.6	5.1	3.8	3.1	2.6
	1.50	6.0	4.0	3.0	2.4	2.0	9.2	6.1	4.6	3.7	3.1
	1.75	7.0	4.7	3.5	2.8	2.4	10.7	7.2	5.4	4.3	3.6
	2.00	8.0	5.4	4.0	3.2	2.7	12.2	8.2	6.1	4.9	4.1
	3.00	13.2	8.8	6.6	5.3	4.4	19.5	13.1	9.8	7.8	6.5
	4.00	19.0	12.7	9.5	7.6	6.4					
	5.00	23.8	15.9	11.9	9.5	8.0					
	6.00	30.0	20.0	15.0	12.0	10.0					
	8.00	45.5	30.3	22.8	18.2	15.2					

*Excludes from heat gain, typical values for bearing losses, etc. which are dissipated in apparatus room.

†Fan Total Pressure equals fan static pressure plus velocity pressure at fan discharge. Below 1200 fpm the fan total pressure is approximately equal to the fan static. Above 1200 fpm the total pressure should be figured.

‡70% fan efficiency assumed.

**50% fan efficiency assumed.

††80% motor and drive efficiency assumed.

‡‡For draw-thru systems, this heat is an addition to the supply air heat gain and is added to the room sensible heat. For blow-thru systems this fan heat is added to the grand total heat; use the RSH times the percent listed and add to the GTH.