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# LAMPIRAN

3.20

## Cooling and Heating Load Calculation Manual

Table 3.9 Wall Construction Group Description

Group No.	Description of Construction	Weight (lb/ft <sup>2</sup> )	U-Value Btu/(hr·ft <sup>2</sup> ·F)	Heat Capacity Btu/(ft <sup>2</sup> ·F)	Code Numbers of Layers (See Table 3.11)
<b>4-in. Face Brick+(Brick)</b>					
C	Air Space+4-in. Face Brick	83	0.358	18.3	A0, A2, B1, A2, E0
D	4-in. Common Brick	90	0.415	18.4	A0, A2, C4, E1, E0
C	1-in. Insulation or Air space+4-in. Common Brick	90	0.174-0.301	18.4	A0, A2, C4, B1/B2, E1, E0
B	2-in. Insulation+4-in. Common Brick	88	0.111	18.5	A0, A2, B3, C4, E1, E0
B	8-in. Common Brick	130	0.302	26.4	A0, A2, C9, E1, E0
A	Insulation or Air space+8-in. Common Brick	130	0.154-0.243	26.4	A0, A2, C9, B1/B2, E1, E0
<b>4-in. Face Brick+(H.W. Concrete)</b>					
C	Air Space+2-in. Concrete	94	0.350	19.7	A0, A2, B1, C5, E1, E0
B	2-in. Insulation+4-in. concrete	97	0.116	19.8	A0, A2, B3, C5, E1, E0
A	Air Space or Insulation+8-in. or more Concrete	143-190	0.110-0.112	29.1-38.4	A0, A2, B1, C10/11, E1, E0
<b>4-in. Face Brick+(L.W. or H.W. Concrete Block)</b>					
E	4-in. Block	62	0.319	12.9	A0, A2, C2, E1, E0
D	Air Space or Insulation+4-in. Block	62	0.153-0.246	12.9	A0, A2, C2, B1/B2, E1, E0
D	8-in. Block	70	0.274	15.1	A0, A2, C7, A6, E0
C	Air Space or 1-in. Insulation+6-in. or 8-in. Block	73-89	0.221-0.275	15.5-18.5	A0, A2, B1, C7/C8, E1, E0
B	2-in. Insulation+8-in. Block	89	0.096-0.107	15.5-18.6	A0, A2, B3, C7/C8, E1, E0
<b>4-in Face Brick+(Clay Tile)</b>					
D	4-in. Tile	71	0.381	15.1	A0, A2, C1, E1, E0
D	Air Space+4-in. Tile	71	0.281	15.1	A0, A2, C1, B1, E1, E0
C	Insulation+4-in. Tile	71	0.169	15.1	A0, A2, C1, B2, E1, E0
C	8-in. Tile	96	0.275	19.7	A0, A2, C6, E1, E0
B	Air Space or 1-in. Insulation+8-in. Tile	96	0.142-0.221	19.7	A0, A2, C6, B1/B2, E1, E0
A	2-in. Insulation+8-in. Tile	97	0.097	19.8	A0, A2, B3, C6, E1, E0
<b>H.W. Concrete Wall+(Finish)</b>					
E	4-in. Concrete	63	0.585	12.5	A0, A1, C5, E1, E0
D	4-in. Concrete+1-in. or 2-in. Insulation	63	0.119-0.200	12.5	A0, A1, C5, B2/B3, E1, E0
C	2-in. Insulation+4-in. Concrete	63	0.119	12.7	A0, A1, B6, C5, E1, E0
C	8-in. Concrete	109	0.490	21.9	A0, A1, C10, E1, E0
B	8-in. Concrete+1-in. or 2-in. Insulation	110	0.115-0.187	22.0	A0, A1, C10, B5/B6, E1, E0
A	2-in. Insulation+8-in. Concrete	110	0.115	21.9	A0, A1, B3, C10, E1, E0
B	12-in. Concrete	156	0.421	31.2	A0, A1, C11, E1, E0
A	12-in. Concrete+Insulation	156	0.113	31.3	A0, C11, B6, A6, E0
<b>L.W. and H.W. Concrete Block+(Finish)</b>					
F	4-in. Block+Air Space/Insulation	29-36	0.161-0.263	5.7-7.2	A0, A1, C2, B1/B2, E1, E0
E	2-in. Insulation+4-in. Block	29-37	0.105-0.114	5.8-7.3	A0, A1, B1, C2/C3, E1, E0
E	8-in. Block	41-57	0.294-0.402	6.3-11.3	A0, A1, C7/C8, E1, E0
D	8-in. Block+Air Space/Insulation	41-57	0.149-0.173	8.3-11.3	A0, A1, C7/C8, B2, E1, E0
<b>Clay Tile+(Finish)</b>					
F	4-in. Tile	39	0.419	7.8	A0, A1, C1, E1, E0
F	4-in. Tile+Air space	39	0.303	7.8	A0, A1, C1, B1, E1, E0
E	4-in. Tile+1-in. Insulation	39	0.175	7.9	A0, A1, C1, B2, E1, E0
D	2-in. Insulation+4-in. Tile	40	0.110	7.9	A0, A1, B3, C1, E1, E0
D	8-in. Tile	63	0.296	12.5	A0, A1, C6, E1, E0
C	8-in. Tile+Air Space/1-in. Insulation	63	0.151-0.231	12.6	A0, A1, C6, B1/B2, E1, E0
B	2-in. Insulation+8-in. Tile	63	0.099	12.6	A0, A1, B3, C6, E1, E0
<b>Metal Curtain Wall</b>					
G	With/without Air Space+1-in./2-in./3-in. Insulation	5.6	0.091-0.230	0.7	A0, A3, B5/B6/B12, A3, E0
<b>Frame Wall</b>					
G	1-in. to 3-in. Insulation	16	0.081-0.178	3.2	A0, A1, B1, B2/B3/B4, E1, E0



**Table 3.11 Thermal Properties and Code Numbers of Layers Used in Calculations of Coefficients for Roof and Wall**

Description	Code Number	Thickness and Thermal Properties						WT	WT × SH
		L	K	D	SH	R			
Outside surface resistance	A0						0.333		
1-in. Stucco (asbestos cement or wood siding plaster, etc.)	A1	0.0833	0.4	116	0.20	0.208	9.66	1.93	
4-in. face brick (dense concrete)	A2	0.333	0.75	130	0.22	0.444	43.3	9.53	
Steel siding (aluminum or other lightweight cladding)	A3	0.005	26.0	480	0.10	0.0002	2.40	0.24	
Finish	A6	0.0417	0.24	78	0.26	0.174	3.25	0.85	
Air space resistance	B1					0.91			
1-in. insulation	B2	0.083	0.025	2.0	0.2	3.32	0.17	0.03	
2-in. insulation	B3	0.167	0.025	2.0	0.2	6.68	0.33	0.07	
3-in. insulation	B4	0.25	0.025	2.0	0.2	10.03	0.50	0.10	
1-in. insulation	B5	0.0833	0.025	5.7	0.2	3.33	0.47	0.10	
2-in. insulation	B6	0.167	0.025	5.7	0.2	6.68	0.95	0.19	
1-in. wood	B7	0.0833	0.07	37.0	0.6	1.19	3.08	1.85	
2.5-in. wood	B8	0.2083	0.07	37.0	0.6	2.98	7.71	4.63	
4-in. wood	B9	0.333	0.07	37.0	0.6	4.76	12.3	7.38	
2-in. wood	B10	0.167	0.07	37.0	0.6	2.39	6.18	3.71	
3-in. wood	B11	0.25	0.07	37.0	0.6	3.58	9.25	5.55	
3-in. insulation	B12	0.25	0.025	5.7	0.2	10.0	1.42	0.28	
4-in. clay tile	C1	0.333	0.33	70.0	0.2	1.01	23.3	4.66	
4-in. l.w. concrete block	C2	0.333	0.22	38.0	0.2	1.51	12.7	2.54	
4-in. h.w. concrete block	C3	0.333	0.47	61.0	0.2	0.71	20.3	4.06	
4-in. common brick	C4	0.333	0.42	120	0.2	0.79	40.0	8.00	
4-in. h.w. concrete	C5	0.333	1.0	140	0.2	0.333	46.6	9.32	
8-in. clay tile	C6	0.667	0.33	70	0.2	2.02	46.7	9.34	
8-in. l.w. concrete block	C7	0.667	0.33	38.0	0.2	2.02	25.4	5.08	
8-in. h.w. concrete block	C8	0.667	0.6	61.0	0.2	1.11	40.7	8.14	
8-in. common brick	C9	0.667	0.42	120	0.2	1.59	80.0	16.00	
8-in. h.w. concrete	C10	0.667	1.0	140	0.2	0.667	93.4	18.68	
12-in. h.w. concrete	C11	1.0	1.0	140	0.2	1.00	140.0	28.00	
2-in. h.w. concrete	C12	0.167	1.0	140	0.2	0.167	23.4	4.68	
6-in. h.w. concrete	C13	0.5	1.0	140	0.2	0.50	70.0	14.00	
4-in. l.w. concrete	C14	0.333	0.1	40	0.2	3.33	13.3	2.66	
6-in. l.w. concrete	C15	0.5	0.1	40	0.2	5.0	20.0	4.00	
8-in. l.w. concrete	C16	0.667	0.1	40	0.2	6.67	26.7	5.34	
Inside surface resistance	E0					0.685			
0.75-in. plaster; 0.75-in. gypsum or other similar finishing layer	E1	0.0625	0.42	100	0.2	0.149	6.25	1.25	
0.5-in. slag or stone	E2	0.0417	0.83	55	0.40	0.050	2.29	0.92	
0.375-in. felt membrane	E3	0.0313	0.11	70	0.40	0.285	2.19	0.88	
Ceiling air space	E4					1.0			
Acoustic tile	E5	0.0625	0.035	30	0.20	1.786	1.88	0.38	

\* Units: L = ft.; SH = Btu/(lb · deg F); K = Btu/(hr · ft · deg F); R = (hr · ft<sup>2</sup> · deg F)/Btu; D = lb/ft<sup>3</sup>; WT = lb/ft<sup>2</sup>; WT SH = Btu/(ft<sup>2</sup> · F)



Table 3.12 CLTD Correction For Latitude and Month Applied to Walls and Roofs, North Latitudes

Lat.	Month	N	NNE NNW	NE NW	ENE WNW	E W	ESE WSW	SE SW	SSE SSW	S	HOR
0	Dec	-3	-5	-5	-5	-2	0	3	6	9	-1
	Jan/Nov	-3	-5	-4	-4	-1	0	2	4	7	-1
	Feb/Oct	-3	-2	-2	-2	-1	-1	0	-1	0	0
	Mar/Sept	-3	0	1	-1	-1	-3	-3	-5	-8	0
	Apr/Aug	5	4	3	0	-2	-5	-6	-8	-8	-2
	May/Jul	10	7	5	0	-3	-7	-8	-9	-8	-4
	Jun	12	9	5	0	-3	-7	-9	-10	-8	-5
8	Dec	-4	-6	-6	-6	-3	0	4	8	12	-5
	Jan/Nov	-3	-5	-6	-5	-2	0	3	6	10	-4
	Feb/Oct	-3	-4	-3	-3	-1	-1	1	2	4	-1
	Mar/Sept	-3	-2	-1	-1	-1	-2	-2	-3	-4	0
	Apr/Aug	2	2	2	0	-1	-4	-5	-7	-7	-1
	May/Jul	7	5	4	0	-2	-5	-7	-9	-7	-2
	Jun	9	6	4	0	-2	-6	-8	-9	-7	-2
16	Dec	-4	-6	-8	-8	-4	-1	4	9	13	-9
	Jan/Nov	-4	-6	-7	-7	-4	-1	4	8	12	-7
	Feb/Oct	-3	-5	-5	-4	-2	0	2	5	7	-4
	Mar/Sept	-3	-3	-2	-2	-1	-1	0	0	0	-1
	Apr/Aug	-1	0	-1	-1	-1	-3	-3	-5	-6	0
	May/Jul	4	3	3	0	-1	-4	-5	-7	-7	0
	Jun	6	4	4	1	-1	-4	-6	-8	-7	0
24	Dec	-5	-7	-9	-10	-7	-3	3	9	13	-13
	Jan/Nov	-4	-6	-8	-9	-6	-3	3	9	13	-11
	Feb/Oct	-4	-5	-6	-6	-3	-1	3	7	10	-7
	Mar/Sept	-3	-4	-3	-3	-1	-1	1	2	4	-3
	Apr/Aug	-2	-1	0	-1	-1	-2	-1	-2	-3	0
	May/Jul	1	2	2	0	0	-3	-3	-5	-6	1
	Jun	3	3	3	1	0	-3	-4	-6	-6	1
32	Dec	-5	-7	-10	-11	-8	-5	2	9	12	-17
	Jan/Nov	-5	-7	-9	-11	-8	-4	2	9	12	-15
	Feb/Oct	-4	-6	-7	-8	-4	-2	4	8	11	-10
	Mar/Sept	-3	-4	-4	-4	-2	-1	3	5	7	-5
	Apr/Aug	-2	-2	-1	-2	0	-1	0	1	1	-1
	May/Jul	1	1	1	0	0	-1	-1	-3	-3	1
	Jun	1	2	2	1	0	-2	-2	-4	-4	2
40	Dec	-6	-8	-10	-13	-10	-7	0	7	10	-21
	Jan/Nov	-5	-7	-10	-12	-9	-6	1	8	11	-19
	Feb/Oct	-5	-7	-8	-9	-6	-3	3	8	12	-14
	Mar/Sept	-4	-5	-5	-6	-3	-1	4	7	10	-8
	Apr/Aug	-2	-3	-2	-2	0	0	2	3	4	-3
	May/Jul	0	0	0	0	0	0	0	0	1	1
	Jun	1	1	1	0	1	0	0	-1	-1	2
48	Dec	-6	-8	-11	-14	-13	-10	-3	2	6	-25
	Jan/Nov	-6	-8	-11	-13	-11	-8	-1	5	8	-24
	Feb/Oct	-5	-7	-10	-11	-8	-5	1	8	11	-18
	Mar/Sept	-4	-6	-6	-7	-4	-1	4	8	11	-11
	Apr/Aug	-3	-3	-3	-3	-1	0	4	6	7	-5
	May/Jul	0	-1	0	0	1	1	3	3	4	0
	Jun	1	1	2	1	2	1	2	2	3	2
56	Dec	-7	-9	-12	-16	-16	-14	-9	-5	-3	-28
	Jan/Nov	-6	-8	-11	-15	-14	-12	-6	-1	2	-27
	Feb/Oct	-6	-8	-10	-12	-10	-7	0	6	9	-22
	Mar/Sept	-5	-6	-7	-8	-5	-2	4	8	12	-15
	Apr/Aug	-3	-4	-4	-4	-1	1	5	7	9	-8
	May/Jul	0	0	0	0	2	2	5	6	7	-2
	Jun	2	1	2	1	3	3	4	5	6	1
64	Dec	-7	-9	-12	-16	-17	-18	-16	-14	-12	-30
	Jan/Nov	-7	-9	-12	-16	-16	-16	-13	-10	-8	-29
	Feb/Oct	-6	-8	-11	-14	-13	-10	-4	1	4	-26
	Mar/Sept	-5	-7	-9	-10	-7	-4	2	7	11	-20
	Apr/Aug	-3	-4	-4	-4	-1	1	5	9	11	-11
	May/Jul	1	0	1	0	3	4	6	8	10	-3
	Jun	2	2	2	2	4	4	6	7	9	0

- (1) Corrections in this table are in degrees F. The correction is applied directly to the CLTD for a wall or roof as given in Tables 3.10 and 3.8.
- (2) The CLTD correction given in this table is *not* applicable to Table 3.23, Cooling Load Temperature Differences for Conduction through Glass.
- (3) For South latitudes, replace Jan. through Dec. by July through June.

Table 3.14A Overall Coefficients of Heat Transmission (U-Factor) of Windows and Skylights, Btu/(hr·ft<sup>2</sup>·F)

Description	Exterior Vertical Panels				Exterior Horizontal Panels (Skylights)	
	Summer**		Winter*		Summer <sup>1</sup>	Winter <sup>1</sup>
	No Indoor Shade	Indoor Shade***	No Indoor Shade	Indoor Shade***		
Flat Glass <sup>b</sup>						
Single Glass	1.04	0.81	1.10	0.83	0.83	1.23
Insulating Glass, Double <sup>c</sup>						
3/16 in. air space <sup>d</sup>	0.65	0.58	0.62	0.52	0.57	0.70
1/4 in. air space <sup>d</sup>	0.61	0.55	0.58	0.48	0.54	0.65
1/2 in. air space <sup>d</sup>	0.56	0.52	0.49	0.42	0.49	0.59
1/2 in. air space, low emittance coating <sup>f</sup>						
e = 0.20	0.38	0.37	0.32	0.30	0.36	0.48
e = 0.40	0.45	0.44	0.38	0.35	0.42	0.52
e = 0.60	0.51	0.48	0.43	0.38	0.46	0.56
Insulating Glass, Triple <sup>c</sup>						
1/4 in. air space <sup>d</sup>	0.44	0.40	0.39	0.31		
1/2 in. air space <sup>d</sup>	0.39	0.36	0.31	0.26		
Storm Windows						
1 in. to 4 in. air spaces <sup>d</sup>	0.50	0.48	0.50	0.42		
Plastic Bubbles <sup>b</sup>						
Single					0.80	1.15
Double					0.46	0.70

Table 3.18 Shading Coefficients for Glass Without or With Interior Shading by Venetian Blinds or Roller Shades

	Type of Glass	Nominal Thickness Each Light <sup>a</sup>	Solar Trans. <sup>b</sup>	No Interior Shading		Type of Interior Shading				
				h <sub>v</sub> = 4.0	h <sub>v</sub> = 3.0	Venetian Blinds		Roller Shades		
						Medium	Light	Opaque		Translucent
							Dark	Light	Light	
SINGLE GLASS	Single Clear	3/32 to 1/4	0.87-0.80	1.00	1.00					
	Single Clear	1/4 to 1/2	0.80-0.71	0.94	0.95					
	Single Clear	3/8	0.72	0.90	0.92	0.64	0.55	0.59	0.25	0.39
	Single Clear	1/2	0.67	0.87	0.88					
	Single Clear Pattern	1/8 to 9/32	0.87-0.79	0.83	0.85					
	Single Heat Absorbing Pattern	1/8		0.83	0.85					
	Single Heat Absorbing <sup>c</sup>	3/16 to 1/4	0.46	0.69	0.73					
	Single Heat Absorbing Pattern	3/16 to 1/4		0.69	0.73	0.57	0.53	0.45	0.30	0.36
	Single Tinted	1/8 to 7/32	0.59-0.45	0.69	0.73					
	Single Heat Absorbing or Pattern		0.44-0.30	0.60	0.64	0.54	0.52	0.40	0.28	0.32
	Single Heat Absorbing <sup>c</sup>	3/8	0.34	0.60	0.64					
	Single Heat Absorbing or Pattern	1/2	0.44-0.30	0.53	0.58	0.42	0.40	0.36	0.28	0.31
	Single Reflective Coated Glass			0.30		0.25	0.23			
			0.40		0.33	0.29				
			0.50		0.42	0.38				
			0.60		0.50	0.44				
INSULATING GLASS	Double <sup>d</sup> Clear Out	3/32, 1/8	0.71 <sup>a</sup>	0.88	0.88	0.57	0.51	0.60	0.25	0.37
	Double <sup>d</sup> Clear In									
	Double <sup>d</sup> Clear Out	1/4	0.61 <sup>a</sup>	0.81	0.82					
	Double <sup>d</sup> Clear In									
	Double <sup>d</sup> Heat Absorbing Out	1/4	0.36 <sup>a</sup>	0.55	0.58					
	Double <sup>d</sup> Clear In					0.39	0.36	0.40	0.22	0.30
	Double <sup>d</sup> Reflective Coated Glass			0.20		0.19	0.18			
			0.30		0.27	0.26				
			0.40		0.34	0.33				
Triple Clear	1/4		0.71							
Triple Clear	1/8		0.80							

<sup>a</sup> Refer to manufacturer's literature for values.

<sup>b</sup> For vertical blinds with opaque white and beige louvers in the tightly closed position, SC is 0.25 and 0.29 when used with glass of 0.71 to 0.80 transmittance.

<sup>c</sup> Refers to grey, bronze and green tinted heat-absorbing glass.

<sup>d</sup> Refers to factory-fabricated units with 3/16, 1/4 or 1/2 in. air space or to prime windows plus storm windows.

**Table 3.25 Maximum Solar Heat Gain Factor, Btu/(hr · ft<sup>2</sup>) for Sunlit Glass, North Latitudes**

0 Deg											16 Deg										
	NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		
Jan.	34	34	88	177	234	254	235	182	118	296	Jan.	30	30	55	147	210	244	251	223	199	248
Feb.	36	39	132	205	245	247	210	141	67	306	Feb.	33	33	96	180	231	247	233	188	154	275
Mar.	38	87	170	223	242	223	170	87	38	303	Mar.	35	53	140	205	239	235	197	138	93	291
Apr.	71	134	193	224	221	184	118	38	37	284	Apr.	39	99	172	216	227	204	150	77	45	289
May	113	164	203	218	201	154	80	37	37	265	May	52	132	189	218	215	179	115	45	41	282
June	129	173	206	212	191	140	66	37	37	255	June	66	142	194	217	207	167	99	41	41	277
July	115	164	201	213	195	149	77	38	38	260	July	55	132	187	214	210	174	111	44	42	277
Aug.	75	134	187	216	212	175	112	39	38	276	Aug.	41	100	168	209	219	196	143	74	46	282
Sep.	40	84	163	213	231	213	163	84	40	293	Sep.	36	50	134	196	227	224	191	134	93	282
Oct.	37	40	129	199	236	238	202	135	66	299	Oct.	33	33	95	174	223	237	225	183	150	270
Nov.	35	35	88	175	230	250	230	179	117	293	Nov.	30	30	55	145	206	241	247	220	196	246
Dec.	34	34	71	164	226	253	240	196	138	288	Dec.	29	29	41	132	198	241	254	233	212	234

4 Deg											20 Deg										
	NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		
Jan.	33	33	79	170	229	252	237	193	141	286	Jan.	29	29	48	138	201	243	253	233	214	232
Feb.	35	35	123	199	242	248	215	152	88	301	Feb.	31	31	88	173	226	244	238	201	174	263
Mar.	38	77	163	219	242	227	177	96	43	302	Mar.	34	49	132	200	237	236	206	152	115	284
Apr.	55	125	189	223	223	190	126	43	38	287	Apr.	38	92	166	213	228	208	158	91	58	287
May	93	154	200	220	206	161	89	38	38	272	May	47	123	184	217	217	184	124	54	42	283
June	110	164	202	215	196	147	73	38	38	263	June	59	135	189	216	210	173	108	45	42	279
July	96	154	197	215	200	156	85	39	38	267	July	48	124	182	213	212	179	119	53	43	278
Aug.	59	124	184	215	214	181	120	42	40	279	Aug.	40	91	162	206	220	200	152	88	57	280
Sep.	39	75	156	209	231	216	170	93	44	293	Sep.	36	46	127	191	225	225	199	148	114	275
Oct.	36	36	120	193	234	239	207	148	86	294	Oct.	32	32	87	167	217	236	231	196	170	258
Nov.	34	34	79	168	226	248	232	190	139	284	Nov.	29	29	48	136	197	239	249	229	211	230
Dec.	33	33	62	157	221	250	242	206	160	277	Dec.	27	27	35	122	187	238	254	241	226	217

8 Deg											24 Deg										
	NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		
Jan.	32	32	71	163	224	250	242	203	162	275	Jan.	27	27	41	128	190	240	253	241	227	214
Feb.	34	34	114	193	239	248	219	165	110	294	Feb.	30	30	80	165	220	244	243	213	192	249
Mar.	37	67	156	215	241	230	184	110	55	300	Mar.	34	45	124	195	234	237	214	168	137	275
Apr.	44	117	184	221	225	195	134	53	39	289	Apr.	37	88	159	209	228	212	169	107	75	283
May	74	146	198	220	209	167	97	39	38	277	May	43	117	178	214	218	190	132	67	46	282
June	90	155	200	217	200	141	82	39	39	269	June	55	127	184	214	212	179	117	55	43	279
July	77	145	195	215	204	162	93	40	39	272	July	45	116	176	210	213	185	129	65	46	278
Aug.	47	117	179	214	216	186	128	51	41	282	Aug.	38	87	156	203	220	204	162	103	72	277
Sep.	38	66	149	205	230	219	176	107	56	290	Sep.	35	42	119	185	222	225	206	163	134	266
Oct.	35	35	112	187	231	239	211	160	108	288	Oct.	31	31	79	159	211	237	235	207	187	244
Nov.	33	33	71	161	220	245	233	200	160	273	Nov.	27	27	42	126	187	236	249	237	224	213
Dec.	31	31	55	149	215	246	247	215	179	265	Dec.	26	26	29	112	180	234	247	247	237	199

12 Deg											28 Deg										
	NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		NNE/ N	NE/ NNW	ENE/ NW	E/ WNW	ESE/ W	SE/ WSW	SSE/ SW	S	HOR		
Jan.	31	31	63	155	217	246	247	212	182	262	Jan.	25	25	35	117	183	235	251	247	238	196
Feb.	34	34	105	186	235	248	226	177	133	286	Feb.	29	29	72	157	213	244	246	224	207	234
Mar.	36	58	148	210	240	233	190	124	73	297	Mar.	33	41	116	189	231	237	221	182	157	265
Apr.	40	108	178	219	227	200	142	64	40	290	Apr.	36	84	151	205	228	216	178	124	94	278
May	60	139	194	220	212	173	106	40	40	280	May	40	115	172	211	219	195	144	83	58	280
June	75	149	198	217	204	161	90	40	40	274	June	51	125	178	211	213	184	128	68	49	278
July	63	139	191	215	207	168	102	41	41	275	July	41	114	170	208	215	190	140	80	57	276
Aug.	42	109	174	212	218	191	135	62	142	282	Aug.	38	83	149	199	220	207	172	120	91	272
Sep.	37	57	142	201	229	222	182	121	73	287	Sep.	34	38	111	179	219	226	213	177	154	256
Oct.	34	34	103	180	227	238	219	172	130	280	Oct.	30	30	71	151	204	236	238	217	202	229
Nov.	32	32	63	153	214	241	243	209	179	260	Nov.	26	26	35	115	181	232	247	243	235	195
Dec.	30	30	47	141	207	242	251	223	197	250	Dec.	24	24	24	99	172	227	248	251	246	179

**Table 3.23 Cooling Load Temperature Difference for Conduction Through Glass and Conduction Through Doors**

Solar Time, hr																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CLTD, F																							
10	-1	-2	-2	-2	-2	0	2	4	7	9	12	13	14	14	13	12	10	8	6	4	3	2	2



**Table 3.28 Cooling Load Factors for Glass with Interior Shading, North Latitudes  
(All Room Constructions)**

Fenestration Facing	Solar Time, hr																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	0.08	0.07	0.06	0.06	0.07	0.73	0.66	0.65	0.73	0.80	0.86	0.89	0.89	0.86	0.82	0.75	0.78	0.91	0.24	0.18	0.15	0.13	0.11	0.10
NNE	0.03	0.03	0.02	0.02	0.03	0.64	0.77	0.62	0.42	0.37	0.37	0.37	0.36	0.35	0.32	0.28	0.23	0.17	0.08	0.07	0.06	0.05	0.04	0.04
NE	0.03	0.02	0.02	0.02	0.02	0.56	0.76	0.74	0.58	0.37	0.29	0.27	0.26	0.24	0.22	0.20	0.16	0.12	0.06	0.05	0.04	0.04	0.03	0.03
ENE	0.03	0.02	0.02	0.02	0.02	0.52	0.76	0.80	0.71	0.52	0.31	0.26	0.24	0.22	0.20	0.18	0.15	0.11	0.06	0.05	0.04	0.04	0.03	0.03
E	0.03	0.02	0.02	0.02	0.02	0.47	0.72	0.80	0.76	0.62	0.41	0.27	0.24	0.22	0.20	0.17	0.14	0.11	0.06	0.05	0.05	0.04	0.03	0.03
ESE	0.03	0.03	0.02	0.02	0.02	0.41	0.67	0.79	0.80	0.72	0.54	0.34	0.27	0.24	0.21	0.19	0.15	0.12	0.07	0.06	0.05	0.04	0.04	0.03
SE	0.03	0.03	0.02	0.02	0.02	0.30	0.57	0.74	0.81	0.79	0.68	0.49	0.33	0.28	0.25	0.22	0.18	0.13	0.08	0.07	0.06	0.05	0.04	0.04
SSE	0.04	0.03	0.03	0.03	0.02	0.12	0.31	0.54	0.72	0.81	0.81	0.71	0.54	0.38	0.32	0.27	0.22	0.16	0.09	0.08	0.07	0.06	0.05	0.04
S	0.04	0.04	0.03	0.03	0.03	0.09	0.16	0.23	0.38	0.58	0.75	0.83	0.80	0.68	0.50	0.35	0.27	0.19	0.11	0.09	0.08	0.07	0.06	0.05
SSW	0.05	0.04	0.04	0.03	0.03	0.09	0.14	0.18	0.22	0.27	0.43	0.63	0.78	0.84	0.80	0.66	0.46	0.25	0.13	0.11	0.09	0.08	0.07	0.06
SW	0.05	0.05	0.04	0.04	0.03	0.07	0.11	0.14	0.16	0.19	0.22	0.38	0.59	0.75	0.83	0.81	0.69	0.45	0.16	0.12	0.10	0.09	0.07	0.06
WSW	0.05	0.05	0.04	0.04	0.03	0.07	0.10	0.12	0.14	0.16	0.17	0.23	0.44	0.64	0.78	0.84	0.78	0.55	0.16	0.12	0.10	0.09	0.07	0.06
W	0.05	0.05	0.04	0.04	0.03	0.06	0.09	0.11	0.13	0.15	0.16	0.17	0.31	0.53	0.72	0.82	0.81	0.61	0.16	0.12	0.10	0.08	0.07	0.06
WNW	0.05	0.05	0.04	0.03	0.03	0.07	0.10	0.12	0.14	0.16	0.17	0.18	0.22	0.43	0.65	0.80	0.84	0.66	0.16	0.12	0.10	0.08	0.07	0.06
NW	0.05	0.04	0.04	0.03	0.03	0.07	0.11	0.14	0.17	0.19	0.20	0.21	0.22	0.30	0.52	0.73	0.82	0.69	0.16	0.12	0.10	0.08	0.07	0.06
NNW	0.05	0.05	0.04	0.03	0.03	0.11	0.17	0.22	0.26	0.30	0.32	0.33	0.34	0.34	0.39	0.61	0.82	0.76	0.17	0.12	0.10	0.08	0.07	0.06
HOR.	0.06	0.05	0.04	0.04	0.03	0.12	0.27	0.44	0.59	0.72	0.81	0.85	0.85	0.81	0.71	0.58	0.42	0.25	0.14	0.12	0.10	0.08	0.07	0.06

**Table 4.5 Rates of Heat Gain from Occupants of Conditioned Spaces<sup>a</sup>**

Degree of Activity	Typical Application	ADULT MALE		ADJUSTED GROUP <sup>b</sup>		ADJUSTED GROUP <sup>b</sup>		ADJUSTED GROUP <sup>b</sup>	
		Watts	Btu/hr	Watts	Btu/hr	Watts	Btu/hr	Watts	Btu/hr
Seated at rest	Theater, movie	175	400	100	350	60	210	40	140
Seated, very light work writing	Offices, hotels, apartments	140	480	120	470	85	250	55	190
Seated, eating	Restaurants <sup>c</sup>	150	520	170	580 <sup>d</sup>	75	255	95	325
Seated, light work, typing	Offices, hotels, apartments	185	640	150	510	75	255	75	255
Standing, light work or walking slowly	Retail store, bank	235	800	185	640	90	315	95	325
Light bench work	Factory	255	880	230	780	100	345	130	435
Walking, 3 mph, light machine work	Factory	305	1040	305	1040	100	345	205	695
Bowling <sup>e</sup>	Bowling alley	350	1200	280	960	100	345	180	615
Moderate dancing	Dance hall	400	1360	375	1280	120	405	255	875
Heavy work, heavy machine work, lifting	Factory	470	1600	470	1600	165	565	300	1035
Heavy work, athletics	Gymnasium	585	2000	525	1800	185	635	340	1165

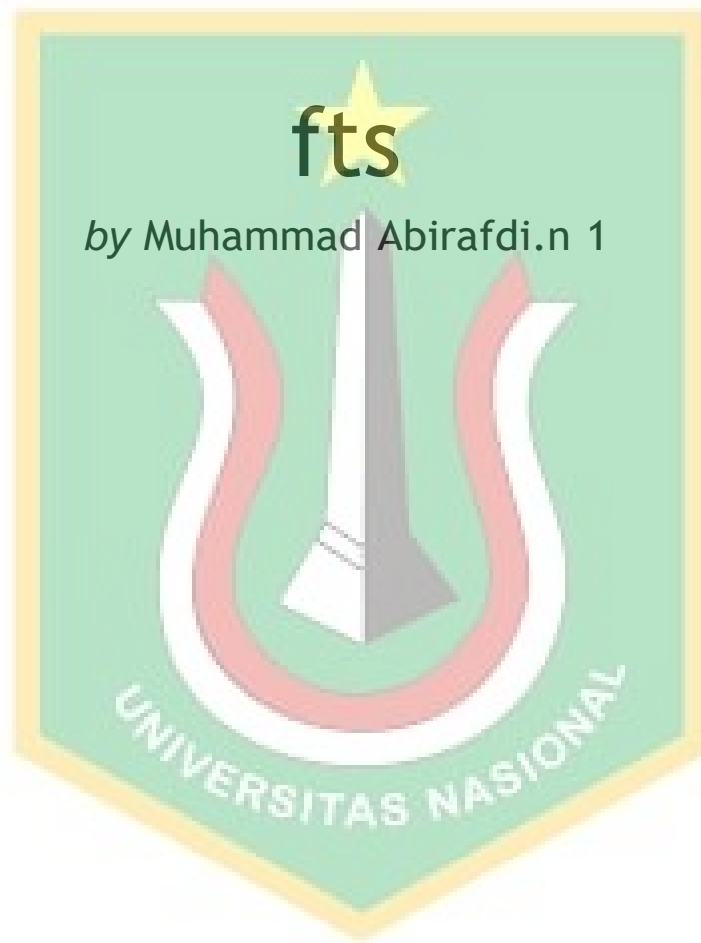
<sup>a</sup>Note: Tabulated values are based on 78 F room dry-bulb temperature. For 80 F room dry-bulb, the total heat remains the same, but the sensible heat value should be decreased by approximately 8% and the latent heat values increased accordingly.

<sup>b</sup>Adjusted total heat gain is based on normal percentage of men, women, and children for the application listed, with the postulate that the gain from an adult female is 85% of that for an adult male, and that the gain from a child is 75% of that for an adult male.

<sup>c</sup>Adjusted total heat value for eating in a restaurant, includes 60 Btu/hr for food per individual (30 Btu sensible and 30 Btu latent).

<sup>d</sup>For bowling figure one person per alley actually bowling, and all others as sitting (400 Btu/hr) or standing and walking slowly (790 Btu/hr).

Also refer to Tables 4 and 5, Chapter 8, 1977 ASHRAE Handbook of Fundamentals.



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