AIRCONDITIONING

Cooling Loads Calculations

Employer : 4M SA

Project : ASHRAE Office Room
: Example from ASHRAE 2013 Handbook - Fundamentals
: Chapter 18, Single Room Example (p. 18.37)

Location : Atlanta, Georgia

1. INTRODUCTION

This study is based upon the ASHRAE RTS methodology. Furthermore, the following literature was also used:

i) *ASHRAE Handbook of Fundamentals 2013*
ii) *ASHRAE Handbook of Systems and Equipment 2012*
iii) *ASHRAE Handbook of Applications 2011*
iv) *ASHRAE Standards for Natural and Mechanical Ventilation*
v) *ASHRAE Cooling and Heating Load Calculation Manual ASHRAE GRP 158*

2. ASSUMPTIONS & RULES OF CALCULATION

According to ASHRAE, the general procedure for calculating cooling load for each load component (lights, people, walls, roofs, windows, appliances, etc.) with RTS is as follows:
1. Calculate 24 h profile of component heat gains for design day (for conduction, first account for conduction time delay by applying conduction time series).
2. Split heat gains into radiant and convective parts using radiant and convective parts.
3. Apply appropriate radiant time series to radiant part of heat gains to account for time delay in conversion to cooling load.
4. Sum convective part of heat gain and delayed radiant part of heat gain to determine cooling load for each hour for each cooling load component.

Analytically, for each step:

1i. Walls and roofs heat gains calculation using Conduction Time Series (CTS)

The heat input calculation is given from the following equation:

$q_{i,\theta-n}=UA(t_{e,\theta-n}-t_{rc})$

where:

$q_{i,\theta-n}$: Conductive heat input for the surface n hours ago
U : Overall heat transfer coefficient for the surface
A : Surface area
$t_{e,\theta-n}$: Sol-air temperature n hours ago
t_{rc} : Presumed constant room air temperature

Conductive heat gain through walls or roofs can be calculated using conductive heat inputs for the current hours and past 23h and conduction time series:

$q_\theta= c_0q_{i,\theta}+ c_1q_{i,\theta-1}+ c_2q_{i,\theta-2}+ c_3q_{i,\theta-3}+ \dots +c_{23}q_{i,\theta-23}$

where:

q_θ : Hourly conductive heat gain for the surface
$q_{i,\theta}$: Heat input for current hour
$q_{i,\theta-n}$: Heat input n hours ago
c_0,c_1, etc. : Conduction time factors

1ii. Fenestration heat gain calculation

Fenestration heat gains can be split into three parts:

$q_b=AE_{t,b}SHGC(\theta)IAC(\theta,\Omega)$

$q_d=A(E_{t,d}+E_{t,r})<SHGC>_DIAC_D$

$q_c=AU(T_{out}-T_{in})$

where:

q_b: Direct beam solar heat gain
- A : Window area
- $E_{t,b}$: Beam direct irradiance
- SHGC(θ) : Beam solar heat gain coefficient as a function of incident angle θ
- IAC(θ,Ω) : Indoor solar attenuation coefficient for beam solar heat gain coefficient

q_d: Diffuse solar heat gain
- A : Window area
- $E_{t,d}$: Sky diffuse irradiance
- $E_{t,r}$: Ground-reflected diffuse irradiance
- $\langle SHGC \rangle_D$: Diffuse solar heat gain coefficient
- IAC_D : Indoor solar attenuation coefficient for diffuse solar heat gain coefficient

q_c: Conductive heat gain
- A : Window area
- U : Overall U-factor, including frame and mounting orientation
- T_{out} : Outdoor temperature
- T_{in} : Indoor temperature

Total fenestration heat gain Q:

$$Q= q_b + q_d +q_c$$

1iii. Interior surfaces heat gain calculation

Whenever a conditioned space is adjacent to a space with a different temperature, heat transfer through the separating physical section must be considered. The heat transfer rate is given by:

$$q=U*A*(t_b-t_i)$$

where:

- q : Heat transfer rate
- U : Overall heat transfer coefficient between adjacent and conditioned space
- A : Area of separating section concerned
- t_b : Average air temperature in adjacent space
- t_i : Air temperature in conditioned space

Where nothing is known for the adjacent space except that it is of conventional construction contains no heat sources and itself receives no significant solar heat gain, t_b-t_i may be considered the difference between the outdoor air and conditioned space design dry-bulb temperatures minus 3 K.

1iv. Floors heat gain calculation

For floors directly in contact with the ground or over an underground basement that is neither ventilated nor conditioned, sensible heat transfer may be neglected for cooling load estimates because usually there is a heat loss rather than a gain.

1v. Internal heat gains calculation

1v.1. Lighting

The lighting heat gains are calculated using the following equation:

$$q_{el} = W F_{ul} F_{sa}$$

where:

q_{el} : Heat gain
W : Total light wattage
F_{ul} : Lighting use factor
F_{sa} : Lighting special allowance factor

1v.2. People

The occupants heat gains are distinguished in sensible and latent heat gains. The calculation equations of sensible and latent heat gains are given bellow:

$$q_s = q_{s,\,per}\,N$$

$$q_l = q_{l,\,per}\,N$$

where:

q_s : Occupants sensible heat gain
q_l : Occupants latent heat gain
$q_{s,\,per}$: Sensible heat gain per person
$q_{l,\,per}$: Sensible heat gain per person
N : Number of occupants

1v.3. Appliances

The appliances loads are distinguished in sensible load and latent load. The calculation equations are given bellow:

$$q_s = Q_s \times F_U\, F_R$$

$$q_l = Q_l \times N$$

where:

q_s : Appliances total sensible load
q_l : Appliances total latent load
Q_s : Sensible load of appliance
$Q_{l,}$: Latent load of appliance
F_U : Usage factor
F_R : Radiation factor
N : Number of appliances that operate in the space

1v.4. Ventilation and Infiltration

Air-conditioning design often requires the calculation of the sensible and latent heat gain. The equations are given bellow:

$$q_s = 1.23\ Q_s \Delta t$$

$$q_l = 3010\ Q_s \Delta W$$

where:

q_s : Sensible heat gain due to infiltration
q_l : Latent heat gain due to infiltration
Q_s : Infiltration airflow at standard air conditions
t_o : Outdoor air temperature
t_i : Indoor air temperature
W_o : Outdoor air humidity ratio
W_i : Indoor air humidity ratio
1.23: Air sensible heat factor at standard air conditions

3010: Air latent heat factor at standard air conditions

2. Separation of heat gains in radiant and convective fractions

The cooling load for each load component (lights, people, walls, roofs, windows, appliances etc.) for a particular hour is the sum of the convective portion of the heat gain for that hour plus the time-delayed portion of radiant heat gains for that hour and the previous 23 h.
The following table contains recommendations for splitting each of the heat gain components into convective and radiant portions:

Radiative fraction	Convective fraction	
0.60	0.40	Occupants, typical office conditions
0.1 to 0.8	0.9 to 0.2	Equipment
varies	varies	Lighting
0.46	0.54	Conduction heat gain through walls and floors
0.60	0.40	Conduction heat gain through roof
0.33	0.67	Conduction heat gain through windows (SHGC > 0.5)
0.46	0.54	Conduction heat gain through windows (SHGC < 0.5)
1.00	0	Solar heat gain through fenestration (without interior shading)
varies	varies	Solar heat gain through fenestration (with interior shading)
0	1.00	Infiltration

3. Radiant portion of sensible cooling load

The radiant part of sensible cooling load is calculated by applying RTS factors according to the following equation:

$$Q_{r,\theta}= r_0q_{r,\theta}+ r_1q_{r,\theta-1}+ r_2q_{r,\theta-2}+ r_3q_{r,\theta-3}+ \dots +r_{23}q_{r,\theta-23}$$

where:

$Q_{r,\theta}$: Radiant cooling load for current hour θ
$q_{r,\theta}$: Radiant heat gain for current hour
$q_{r,\theta-n}$: Radiant heat gain n hours ago
r_0, r_1, etc. : Radiant time factors

4. Convective portion of sensible cooling load

The convective part of sensible cooling load is calculated according to the following equation:

$$Q_{i,c}= q_{i,c}$$

where $q_{i,c}$ is convective portion of heat gain from heat gain element i :

$$q_{i,c}= q_{i,s}\,(1- F_r)$$

$q_{i,s}$: Sensible heat gain from heat gain element i,
F_r : Fraction of heat gain that is radiant

5. Total Cooling Loads

The instantaneous room cooling load is calculated according to the following equations:

$$Q_s= \Sigma Q_{i,r} + \Sigma Q_{i,c}$$

$Q_l = \Sigma q_{i,l}$

where:

Q_s : Room sensible cooling load
$\Sigma Q_{i,r}$: Radiant portion of sensible cooling load for current hour, resulting from heat gain element i,
$\Sigma Q_{i,c}$: Convective portion of sensible cooling load resulting from heat gain element i,
Q_l : Room latent cooling load
$q_{i,l}$: Latent heat gain for heat gain element i,

3. PRESENTATION OF RESULTS

The computed results are given both overall and analytically for all calculated hours. In the calculation sheets the results per space are tabulated in the following groups:

1. Building Elements table:
- Surface type (e.g. W= Wall etc.)
- Orientation
- Length (m)
- Height or Width (m)
- U-factor (W/m^2K or $Kcal/hm^2C$)
- Surface area (m^2)
- Number of equal surfaces
- Total surface area (m^2)
- Subtracted surface area (m^2)
- Calculated surface area (m^2)
- Inside shading
- Projection shading
- Arbitrary shading coefficients

2. Loads of the above table per surface area and time (Btu/h, W, or Kcal/h)

3. Additional loads per hour (Btu/h, W, or Kcal/h)
- Lighting
- Population
- Equipment

4. Total space loads per hour (Kbtu/h, KW, or Mcal/h)

5. Ventilation loads per hour (and maximum) (Kbtu/h, KW, or Kcal/h)

i) The first group includes the geometrical dimensions of the building elements, as well as indications of possible shadow occurrences.
ii) In the second group the cooling loads are presented as calculated for each building element, according to the calculation rules that were given above.
iii) The third group includes the additional loads, due to lighting, population and appliances, and given in total, sensible and latent loads.
iv) In the last group the overall sums of the space loads per hour are given, for sensible, latent and total loads, as well as ventilation load.

In a similar way, the system calculation sheets are presented. In these, the loads of the corresponding to each system spaces are grouped and resolved into the different causes. Ventilation loads for each system are also given. Finally, the shadowing coefficients are presented in separate sheets.

BUILDING PARAMETERS

City	: Atlanta
Room Temperature (°C)	: 23.9
Indoor humidity (%)	: 50
Difference T_{OUT}. - $T_{NOT\ AIRCOND.SP.}$ (°C)	: 5
Difference T_{Soil} - T_{Indoor} (°C)	: -5
Number of Levels (Floors)	: 2
Typical Level Height (m)	: 2.74
Energy Units	: W
Calculation Method	: ASHRAE RTS

STRUCTURAL ELEMENTS

Typical Elements of Building - **External walls**

Outer Walls	Description	Type of ASHRAE CLTD	Type of ASHRAE TFM	Type of ASHRAE RTS*	U-Factor (W/m²K)	Color
W1	Brick wall	-	-	11	0.44	3 (Light)
W2	Spandrel wall	-	-	1	0.44	1 (Dark)

* Wall CTS Type 1 : Spandrel glass, insulation board, gyp board
Wall CTS Type 11 : Brick, insulation board, sheathing, gyp board

Typical Elements of Building - **Roofs**

Ceilings	Description	Type of ASHRAE CLTD	Type of ASHRAE TFM	Type of ASHRAE RTS*	U-Factor (W/m²K)	Color
C1	Flat metal deck	-	-	11	0.18	1.3 (Light)

* Roof CTS Type 11 : Membrane, sheathing, insulation board, metal deck

Typical Elements of Building - **Openings**

Openings	Description	Width (m)	Height (m)	Openings U Factor (W/m²K)	Frame Type	Glazing system
O1	Double glazed window	1.91	1.95	3.18	2 (Metal or without frame)	5d. Uncoated double glazing system

CALCULATIONS

Level : Second floor
Space : 1
Name : Office room

Surfaces

Surface Type	Orientation	U-Factor (W/m²K)	Length (m)	Height or Width (m)	Surface (m2)	Surface Occurren ces	Total Surface (m²)	Calculated Surface (m²)	Projection Shading
W1	SE	0.44	1	5.57	5.57	1	5.57	5.57	
W2	SE	0.44	1	5.57	5.57	1	5.57	5.57	
O1	SE	3.18	1.91	1.95	3.72	1	3.72	3.72	SHADE
W1	SW	0.44	1	3.72	3.72	1	3.72	3.72	
W2	SW	0.44	1	5.57	5.57	1	5.57	5.57	
O1	SW	3.18	1.91	1.95	3.72	1	3.72	3.72	SHADE
C1	C	0.18	3.96	3.05	12.08	1	12.08	12.08	

Surfaces Shading Coefficients

Surface Type	Calculated Surface (m²)	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
W1 (SE)	5.57	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
W2 (SE)	5.57	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
O1 (SE)	3.72	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00
W1 (SW)	3.72	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
W2 (SW)	5.57	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
O1 (SW)	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	12.08	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Surface Type	Calculated Surface (m²)	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
W1 (SE)	5.57	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
W2 (SE)	5.57	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00

O1 (SE)	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W1 (SW)	3.72	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
W2 (SW)	5.57	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
O1 (SW)	3.72	0.00	0.00	0.00	0.00	0.00	0.25	0.67	0.00	0.00	0.00	0.00	0.00
C1	12.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00

Loads per Surface and hour (W) [Roof load absorbed in the return air-stream: 30%]

Surface Type	Calculated Surface (m²)	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
W1 (SE)	5.57	14	12	9	7	5	3	2	1	2	5	10	16
W2 (SE)	5.57	4	2	1	0	-1	-1	2	15	33	50	63	69
O1 (SE)	3.72	10	4	0	-5	-9	4	53	116	180	233	274	296
W1 (SW)	3.72	14	11	9	7	5	4	3	2	2	2	3	5
W2 (SW)	5.57	**5**	**3**	**2**	**1**	**0**	**-1**	**1**	**5**	**12**	**19**	**26**	**32**
O1 (SW)	3.72	13	7	3	-2	-5	4	43	94	147	194	233	270
C1	12.08	-2	-3	-4	-5	-5	-6	-6	-2	4	12	21	28

Surface Type	Calculated Surface (m²)	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
W1 (SE)	5.57	22	26	**30**	31	32	31	30	28	25	23	20	17
W2 (SE)	5.57	68	61	**51**	44	38	33	27	20	14	11	8	6
O1 (SE)	3.72	303	297	**276**	244	208	164	110	68	51	38	27	18
W1 (SW)	3.72	7	10	**13**	17	21	25	28	28	27	24	20	17
W2 (SW)	5.57	**39**	**55**	**73**	**87**	**94**	**90**	**75**	**49**	**26**	**15**	**10**	**7**
O1 (SW)	3.72	299	318	**322**	305	269	271	222	102	69	48	34	22
C1	12.08	34	38	**39**	38	34	28	21	13	7	3	1	-1

Lighting Data (W)

Lighting Type	Coeff.	Power (W)	Total
4-lamp pendant fluorescent	0.85	130	110.5

Lighting Schedule and Load in Space per Hour

Title	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
Time Schedule	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Load (W)	**8**	**8**	**7**	**6**	**6**	**5**	**83**	**93**	**98**	**100**	**102**	**102**

Title	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
Time Schedule	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Load (W)	**103**	**103**	**104**	**104**	**105**	**105**	**28**	**18**	**13**	**10**	**9**	**8**

People Data (W)

Degree of Activity	Coeff. Sensible	Coeff. Latent	Number of Persons	Total Sensible	Total Latent	Total
Moderately active office work	73.27	58.62	1	73.27	58.62	131.89

People Schedule and Load in space per hour

Title	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
Time Schedule	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
Sensible Load	4	4	4	3	3	3	2	53	60	63	65	66
Latent Load	0	0	0	0	0	0	0	59	59	59	59	59
Total	4	4	4	3	3	3	2	112	119	122	124	125

Title	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
Time Schedule	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sensible Load	67	68	**68**	69	17	11	7	6	5	4	4	4
Latent Load	59	59	**59**	59	0	0	0	0	0	0	0	0
Total	126	126	127	127	17	11	7	6	5	4	4	4

Equipment Data (W)

Type of Appliance	Coeff. Sensible	Coeff. Latent	Equipment Number	Total Sensible	Total Latent	Total
Computer and personal printer	130	0	1	130	0	130

Equipment Schedule and Load in Space per Hour

Title	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
Time Schedule	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
Sensible Load	1	1	1	1	1	1	1	124	126	127	128	128
Latent Load	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1	124	126	127	128	128

Title	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
Time Schedule	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sensible Load	128	128	**128**	129	5	3	2	2	1	1	1	1
Latent Load	0	0	0	0	0	0	0	0	0	0	0	0
Total	128	128	128	129	5	3	2	2	1	1	1	1

Space Loads per hour (W)

Load Type	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
Lighting	8	8	7	6	6	5	83	93	98	100	102	102
People (Sensible Loads)	4	4	4	3	3	3	2	53	60	63	65	66
People (Latent Loads)	0	0	0	0	0	0	0	59	59	59	59	59
People (Total Load)	4	4	4	3	3	3	2	112	119	122	124	125
Equipment (Sensible)	1	1	1	1	1	1	1	124	126	127	128	128
Equipment (Latent)	0	0	0	0	0	0	0	0	0	0	0	0
Equipment (Total)	1	1	1	1	1	1	1	124	126	127	128	128
Infiltration	0	0	0	0	0	0	0	0	0	0	0	0

Load Type	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
Lighting	103	103	**104**	104	105	105	28	18	13	10	9	8
People (Sensible Loads)	67	68	**68**	69	17	11	7	6	5	4	4	4
People (Latent Loads)	59	59	**59**	59	0	0	0	0	0	0	0	0
People (Total Load)	126	126	127	127	17	11	7	6	5	4	4	4
Equipment (Sensible)	128	128	**128**	129	5	3	2	2	1	1	1	1
Equipment (Latent)	0	0	0	0	0	0	0	0	0	0	0	0
Equipment (Total)	128	128	128	129	5	3	2	2	1	1	1	1
Infiltration	0	0	0	0	0	0	0	0	0	0	0	0

Total Space Loads per Hour (W)

Load Type	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
Sensible	70	48	31	14	-1	16	183	501	663	807	924	1012
Latent	0	0	0	0	0	0	0	59	59	59	59	59
Total	70	48	31	14	-1	16	183	560	722	866	983	1070

Load Type	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
Sensible	1071	1104	1104	1068	823	761	549	333	238	176	134	99
Latent	59	59	59	59	0	0	0	0	0	0	0	0
Total	1129	1162	1163	1127	823	761	549	333	238	176	134	99

TEMPERATURE DATA

Date : July, 23
Mean maximum temperature (°C) : 33.3
Daily range (°C) : 11.4
Outdoor Humidity (%) : 44.09

Hour	T_o	T_e NE (45°)	T_e E (90°)	T_e SE (135°)	T_e S (180°)	T_e SW (225°)	T_e W (270°)	T_e NW (315°)	T_e N (0°)
1	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
2	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
3	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
4	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1
5	21.9	21.9	21.9	21.9	21.9	21.9	21.9	21.9	21.9
6	22.1	25.9	25.9	24.0	22.7	22.7	22.7	22.7	24.0
7	22.9	45.9	48.3	37.1	25.3	25.3	25.3	25.3	31.6
8	24.9	54.8	61.3	48.6	29.3	29.0	29.0	29.0	33.7
9	27.0	56.3	66.2	56.3	33.3	32.7	32.7	32.7	33.3
10	29.0	53.1	64.9	59.8	41.2	36.0	36.0	36.0	36.4
11	30.7	47.2	59.0	59.2	47.7	38.9	38.6	38.6	38.8
12	31.8	40.9	49.7	54.7	51.7	42.4	40.5	40.3	40.4
13	32.7	41.5	41.8	47.6	53.1	52.1	45.2	41.7	41.4
14	33.3	41.5	41.5	42.0	51.9	59.5	56.9	45.8	41.7
15	33.3	40.8	40.8	40.8	48.0	63.5	66.1	54.1	41.1
16	32.6	39.0	39.0	39.0	41.8	63.1	70.9	59.9	39.5
17	31.7	36.6	36.6	36.6	37.0	58.6	70.3	62.1	39.5
18	30.6	33.8	33.8	33.8	33.9	49.7	62.3	58.1	39.9
19	28.9	30.2	30.2	30.2	30.2	36.4	43.8	43.1	35.0
20	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6
21	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6
22	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
23	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8
24	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0

GENERAL TABLES

Wall & Roof Conduction Time Factors
[ASHRAE Ch. 18 - Tables 16-17]

	Hour																							
Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
W1 - 11	0	5	14	17	15	12	9	7	5	4	3	2	2	1	1	1	1	1	0	0	0	0	0	0
W2 - 1	18	58	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C1 - 11	8	53	30	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Representative Nonsolar RTS Values for Light to Heavy Construction
[ASHRAE Ch. 18 - Table 19]

Medium with Carpet and 50% Glass

	Hour																							
Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Space	49	17	9	5	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0