PART 6

Cooling Load Rules of Thumb

6.01 Offices, Commercial

A. General:

1. Total Heat	300–400 Sq.Ft./Ton;	(Range 230–520)
2. Total Heat	30–40 Btuh/Sq.Ft.;	(Range 23–52)
3. Room Sens. Heat	25–28 Btuh/Sq.Ft.;	(Range 19–37)
4. SHR	0.75–0.93	
5. Perimeter Spaces	1.0–3.0 CFM/Sq.Ft.	
6. Interior Spaces	0.5–1.5 CFM/Sq.Ft.	
7. Building Block CFM	1.0–1.5 CFM/Sq.Ft.	
8. Air Change Rate	4–10 AC/Hr.	

B. Large, Perimeter:

1. Total Heat	225–275 Sq.Ft./Ton
2. Total Heat	43–53 Btuh/Sq.Ft.

C. Large, Interior:

1. Total Heat	300–350 Sq.Ft./Ton
2. Total Heat	34–40 Btuh/Sq.Ft.

D. Small:

1. Total Heat	325–375 Sq.Ft./Ton
2. Total Heat	32–37 Btuh/Sq.Ft.

6.02 Banks, Court Houses, Municipal Buildings, Town Halls

A. Total Heat	**200–250 Sq.Ft./Ton**	**(Range 160–340)**
B. Total Heat	**48–60 Btuh/Sq.Ft.**	**(Range 35–75)**
C. Room Sens. Heat	**28–38 Btuh/Sq.Ft.**	**(Range 21–48)**
D. SHR	**0.75–0.90**	
E. Air Change Rate	**4–10 AC/Hr.**	

6.03 Police Stations, Fire Stations, Post Offices

A. Total Heat	**250–350 Sq.Ft./Ton**	**(Range 200–400)**
B. Total Heat	**34–48 Btuh/Sq.Ft.**	**(Range 30–60)**
C. Room Sens. Heat	**25–35 Btuh/Sq.Ft.**	**(Range 20–40)**
D. SHR	**0.75–0.90**	
E. Air Change Rate	**4–10 AC/Hr.**	

6.04 Precision Manufacturing

A. Total Heat	**50–300 Sq.Ft./Ton**	
B. Total Heat	**40–240 Btuh/Sq.Ft.**	
C. Room Sens. Heat	**32–228 Btuh/Sq.Ft.**	
D. SHR	**0.80–0.95**	
E. Air Change Rate	**10–50 AC/Hr.**	

6.05 Computer Rooms

A. Total Heat	**50–150 Sq.Ft./Ton**	
B. Total Heat	**80–240 Btuh/Sq.Ft.**	
C. Room Sens. Heat	**64–228 Btuh/Sq.Ft.**	
D. SHR	**0.80–0.95**	
E. Air Flow	**2.0–4.0 CFM/Sq.Ft.**	
F. Air Change Rate	**15–20 AC/Hr.**	

6.06 Restaurants

A. Total Heat	**100–250 Sq.Ft./Ton**	**(Range 75–300)**
B. Total Heat	**48–120 Btuh/Sq.Ft.**	**(Range 40–155)**
C. Room Sens. Heat	**21–62 Btuh/Sq.Ft.**	**(Range 20–80)**
D. SHR	**0.65–0.80**	
E. Air Flow	**1.5–4.0 CFM/Sq.Ft.**	
F. Air Change Rate	**8–12 AC/Hr.**	

6.07 Kitchens (Depends Primarily on Kitchen Equipment)

A. Total Heat	**150–350 Sq.Ft./Ton**	**(At 85°F. Space)**
B. Total Heat	**34–80 Btuh/Sq.Ft.**	**(At 85°F. Space)**
C. Room Sens. Heat	**20–56 Btuh/Sq.Ft.**	**(At 85°F. Space)**
D. SHR	**0.60–0.70**	
E. Air Flow	**1.5–2.5 CFM/Sq.Ft.**	
F. Air Change Rate	**12–15 AC/Hr.**	

6.08 Cocktail Lounges, Bars, Taverns, Clubhouses, Nightclubs

A.	Total Heat	150–200 Sq.Ft./Ton	(Range 75–300)
B.	Total Heat	60–80 Btuh/Sq.Ft.	(Range 40–155)
C.	Room Sens. Heat	27–40 Btuh/Sq.Ft.	(Range 20–80)
D.	SHR	0.65–0.80	
E.	Spaces	1.5–4.0 CFM/Sq.Ft.	
F.	Air Change Rate	15–20 AC/Hr.	Cocktail Lounges, Bars, Taverns, Clubhouses
G.	Air Change Rate	20–30 AC/Hr.	Night Clubs

6.09 Hospital Patient Rooms, Nursing Home Patient Rooms

A.	Total Heat	250–300 Sq.Ft./Ton	(Range 200–400)
B.	Total Heat	40–48 Btuh/Sq.Ft.	(Range 30–60)
C.	Room Sens. Heat	32–46 Btuh/Sq.Ft.	(Range 25–50)
D.	SHR	0.75–0.85	

6.10 Buildings w/100% OA Systems (i.e., Laboratories, Hospitals)

A.	Total Heat	100–300 Sq.Ft./Ton
B.	Total Heat	40–120 Btuh/Sq.Ft.

6.11 Medical/Dental Centers, Clinics, and Offices

A.	Total Heat	250–300 Sq.Ft./Ton	(Range 200–400)
B.	Total Heat	40–48 Btuh/Sq.Ft.	(Range 30–60)
C.	Room Sens. Heat	32–46 Btuh/Sq.Ft.	(Range 25–50)
D.	SHR	0.75–0.85	
E.	Air Change Rate	8–12 AC/Hr.	

6.12 Residential

A. Total Heat	**500–700 Sq.Ft./Ton**	
B. Total Heat	**17–24 Btuh/Sq.Ft.**	
C. Room Sens. Heat	**12–20 Btuh/Sq.Ft.**	
D. SHR	**0.80–0.95**	

6.13 Apartments (Eff., 1 Room, 2 Room)

A. Total Heat	**350–450 Sq.Ft./Ton**	**(Range 300–500)**
B. Total Heat	**27–34 Btuh/Sq.Ft.**	**(Range 24–40)**
C. Room Sens. Heat	**22–30 Btuh/Sq.Ft.**	**(Range 20–35)**
D. SHR	**0.80–0.95**	

6.14 Motel and Hotel Public Spaces

A. Total Heat	**250–300 Sq.Ft./Ton**	**(Range 160–375)**
B. Total Heat	**40–48 Btuh/Sq.Ft.**	**(Range 32–74)**
C. Room Sens. Heat	**32–46 Btuh/Sq.Ft.**	**(Range 25–60)**
D. SHR	**0.75–0.90**	

6.15 Motel and Hotel Guest Rooms, Dormitories

A. Total Heat	**400–500 Sq.Ft./Ton**	**(Range 300–600)**
B. Total Heat	**24–30 Btuh/Sq.Ft.**	**(Range 20–40)**
C. Room Sens. Heat	**20–25 Btuh/Sq.Ft.**	**(Range 15–35)**
D. SHR	**0.80–0.95**	

6.16 School Classrooms

A. Total Heat	**225–275 Sq.Ft./Ton**	**(Range 150–350)**
B. Total Heat	**43–53 Btuh/Sq.Ft.**	**(Range 35–80)**
C. Room Sens. Heat	**25–42 Btuh/Sq.Ft.**	**(Range 20–65)**
D. SHR	**0.65–0.80**	
E. Air Change Rate	**4–12 AC/Hr.**	

6.17 Dining Halls, Lunch Rooms, Cafeterias, Luncheonettes

A. Total Heat	100–250 Sq.Ft./Ton	(Range 75–300)
B. Total Heat	48–120 Btuh/Sq.Ft.	(Range 40–155)
C. Room Sens. Heat	21–62 Btuh/Sq.Ft.	(Range 20–80)
D. SHR	0.65–0.80	
E. Spaces	1.5–4.0 CFM/Sq.Ft.	
F. Air Change Rate	12–15 AC/Hr.	

6.18 Libraries, Museums

A. Total Heat	250–350 Sq.Ft./Ton	(Range 160–400)
B. Total Heat	34–48 Btuh/Sq.Ft.	(Range 30–75)
C. Room Sens. Heat	22–32 Btuh/Sq.Ft.	(Range 20–50)
D. SHR	0.80–0.90	
E. Air Change Rate	8–12 AC/Hr.	

6.19 Retail, Department Stores

A. Total Heat	200–300 Sq.Ft./Ton	(Range 200–500)
B. Total Heat	40–60 Btuh/Sq.Ft.	(Range 24–60)
C. Room Sens. Heat	32–43 Btuh/Sq.Ft.	(Range 16–43)
D. SHR	0.65–0.90	
E. Air Change Rate	6–10 AC/Hr.	

6.20 Drug, Shoe, Dress, Jewelry, Beauty, Barber, and Other Shops

A. Total Heat	175–225 Sq.Ft./Ton	(Range 100–350)
B. Total Heat	53–69 Btuh/Sq.Ft.	(Range 35–115)
C. Room Sens. Heat	23–54 Btuh/Sq.Ft.	(Range 15–90)
D. SHR	0.65–0.90	
E. Air Change Rate	6–10 AC/Hr.	

6.21 Supermarkets

A. Total Heat	250–350 Sq.Ft./Ton	(Range 150–400)
B. Total Heat	34–48 Btuh/Sq.Ft.	(Range 30–80)
C. Room Sens. Heat	25–40 Btuh/Sq.Ft.	(Range 22–67)
D. SHR	0.65–0.85	
E. Air Change Rate	4–10 AC/Hr.	

6.22 Malls, Shopping Centers

A. Total Heat	150–350 Sq.Ft./Ton	(Range 150–400)
B. Total Heat	34–80 Btuh/Sq.Ft.	(Range 30–80)
C. Room Sens. Heat	25–67 Btuh/Sq.Ft.	(Range 22–67)
D. SHR	0.65–0.85	
E. Air Change Rate	6–10 AC/Hr.	

6.23 Jails

A. Total Heat	350–450 Sq.Ft./Ton	(Range 300–500)
B. Total Heat	27–34 Btuh/Sq.Ft.	(Range 24–40)
C. Room Sens. Heat	22–30 Btuh/Sq.Ft.	(Range 20–35)
D. SHR	0.80–0.95	

6.24 Auditoriums, Theaters

A. Total Heat	0.05–0.07 Tons/Seat
B. Total Heat	600–840 Btuh/Seat
C. Room Sens. Heat	325–385 Btuh/Seat
D. SHR	0.65–0.75
E. Air Flow	15–30 CFM/Seat
F. Air Change Rate	8–15 AC/Hr.

6.25 Churches

A. Total Heat	**0.04–0.06 Tons/Seat**
B. Total Heat	**480–720 Btuh/Seat**
C. Room Sens. Heat	**260–330 Btuh/Seat**
D. SHR	**0.65–0.75**
E. Air Flow	**15–30 CFM/Seat**
F. Air Change Rate	**8–15 AC/Hr.**

6.26 Bowling Alleys

A. Total Heat	**1.5–2.5 Tons/Alley**
B. Total Heat	**18,000–30,000 Btuh/Alley**
C. Air Change Rate	**10–15 AC/Hr.**

6.27 All Spaces

A. Total Heat	**300–500 CFM/Ton @ 20°F. ΔT**
B. Total Heat	**400 CFM/Ton ±20% @ 20°F. ΔT**
C. Perimeter Spaces	**1.0–3.0 CFM/Sq.Ft.**
D. Interior Spaces	**0.5–1.5 CFM/Sq.Ft.**
E. Building Block CFM	**1.0–1.5 CFM/Sq.Ft.**
F. Air Change Rate	**4 AC/Hr. Minimum**

Total heat includes ventilation. Room sensible heat does not include ventilation.

6.28 Cooling Load Calculation Procedure

A. Obtain building characteristics:

1. Materials
2. Size
3. Color
4. Shape
5. Location
6. Orientation, N, S, E, W, NE, SE, SW, NW, etc.
7. External/Internal shading
8. Occupancy type and time of day

B. Select outdoor design weather conditions:

1. Temperature
2. Wind direction and speed
3. Conditions in selecting outdoor design weather conditions:
   a. Type of structure, heavy, medium or light
   b. Is structure insulated?
   c. Is structure exposed to high wind?
   d. Infiltration or ventilation load
   e. Amount of glass
   f. Time of building occupancy
   g. Type of building occupancy
   h. Length of reduced indoor temperature
   i. What is daily temperature range, minimum/maximum?
   j. Are there significant variations from ASHRAE weather data?
   k. What type of heating devices will be used?
   l. Expected cost of fuel
4. See Part 16, Energy Conservation and Design Conditions, for code restrictions on selection of outdoor design conditions.

C. Select indoor design temperature to be maintained in each space. See Part 16, Energy Conservation and Design Conditions, for code restrictions on selection of indoor design conditions.

D. Estimate temperatures in un-conditioned spaces.

E. Select and/or compute U-values for walls, roof, windows, doors, partitions, etc.

F. Determine area of walls, windows, floors, doors, partitions, etc.

G. Compute conduction heat gains for all walls, windows, floors, doors, partitions, skylights, etc.

H. Compute solar heat gains for all walls, windows, floors, doors, partitions, skylights, etc.

I. Infiltration heat gains are generally ignored unless space temperature and humidity tolerance are critical.

J. Compute ventilation heat gain required.

K. Compute internal heat gains from lights, people, and equipment.

L. Compute sum of all heat gains indicated in items G, H, I, J, and K above

M. Include morning cool-down for buildings with intermittent use and night set up. See Part 16, Energy Conservation and Design Conditions, for code restrictions on excess HVAC system capacity permitted for morning cool-down.

N. Consider equipment and materials which will be brought into building above inside design temperature.

O. Cooling load calculations should be conducted using industry accepted methods to determine actual cooling load requirements.

6.29 Cooling Load Peak Time Estimate

MONTH OF PEAK ROOM COOLING LOAD FOR VARIOUS EXPOSURES										
WINDOW CHARACTERISTICS			PROBABLE MONTH OF PEAK ROOM COOLING LOAD							
% GLASS	SHADE COEF.	OVER-HANG	N	S	E	W	NE	SE	SW	NW
25	0.4	0	JULY	SEPT.	JULY	JULY	JULY	SEPT.	SEPT.	JULY
25	0.4	1:2	JULY	OCT.	JULY	AUG.	JULY	SEPT.	SEPT.	JULY
25	0.4	1:1	JULY	OCT.	JULY	JULY	JULY	SEPT.	OCT.	JULY
25	0.6	0	JULY	SEPT.	JULY	JULY	JULY	SEPT.	SEPT.	JULY
25	0.6	1:2	JULY	OCT.	JULY	AUG.	JULY	SEPT.	SEPT.	JULY
25	0.6	1:1	JULY	DEC.	JULY	SEPT.	JULY	SEPT.	OCT.	JULY
50	0.4	0	JULY	SEPT.	JULY	JULY	JULY	SEPT.	SEPT.	JULY
50	0.4	1:2	JULY	OCT.	JULY	AUG.	JULY	SEPT.	SEPT.	JULY
50	0.4	1:1	JULY	DEC.	JULY	SEPT.	JULY	SEPT.	OCT,	JULY
50	0.6	0	JULY	OCT.	JULY	JULY	JULY	SEPT.	SEPT.	JULY
50	0.6	1:2	JULY	DEC.	JULY	AUG.	JULY	SEPT.	OCT.	JULY
50	0.6	1:1	JULY	DEC.	JULY	SEPT.	JULY	SEPT.	DEC.	JULY

Notes:

1. **Percent glass is percentage of gross wall area for the particular exposure.**
2. **Shading coefficient refers to the overall shading coefficient. Shading coefficient of 0.4 is approximately equal to double pane glass with heat absorbing plate out and regular plate in, combined with medium color venetian blinds.**
3. **Although the room peak for south, southeast, and southwest exposures is September or later, the system peak will more than likely be in July.**
4. **Value for overhang is the ratio of the depth of the overhang to height of the window with the overhang at the same elevation as the top of the window.**
5. **The roof will peak in June or July.**