4.2 PEOPLE

Load Source	Equation	Description and Reference
People	$q_s = \frac{q_s}{\text{person}} \times \text{No. of people} \times \text{CLF}$	→ Sensible cooling load in Btu/hr → Sensible heat gain per person — Table 4.5 → Number of people — if not known use first column in Table 5.3 to calculate number → Cooling load factor — Table 4.6 Use CLF = 1.0 if cooling system does not run 24 hr a day. Use CLF = 1.0 for auditoriums, theaters or when people density is high, such as for more than 100 people/1000 ft².
	$q_l = \frac{q_l}{\text{person}} \times \text{No. of people}$	→ Latent cooling load in Btu/hr → Latent heat gain per person — Table 4.5 → Number of people — if not known use first column in Table 5.3 to calculate the number

EXAMPLE 4.3

Determine the cooling load at 1400 and 2000 hr due to 6 people in an office from 9:00 AM to 5:00 PM. The office temperature is 78 F.

SOLUTION 4.3

Because Table 4.5 is based on 78 F the tabulated data can be used directly. For very light office work

$$q_{s/\text{person}} = 230 \text{ Btu/hr}$$
$$q_{l/\text{person}} = 190 \text{ Btu/hr}$$

People occupy the office for 8 hr and 1400 is 5 hr after entering the conditioned space, thus Table 4.6 gives

$$\text{CLF} = 0.76$$

Thus $q_s = 0.76 \times 230 \times 6 = 1050$ Btu/hr at 1400 hr
$q_l = 190 \times 6 = 1140$ Btu/hr at 1400 hr

2000 hr is 11 hr after entering the office thus Table 4.6 gives

$$\text{CLF} = 0.25$$

Thus $q_s = 0.25 \times 230 \times 6 = 345$ Btu/hr at 2000 hr
$q_l = 0$ (No latent load after people have left the space)

If the cooling system is shut down after 5:00 PM then a CLF of 1.0 should be used to find q_s.

Table 4.5 Rates of Heat Gain from Occupants of Conditioned Spaces [a]

Degree of Activity	Typical Application	ADULT MALE Total ($q_{s/\text{person}} + q_{l/\text{person}}$)		ADJUSTED GROUP[b] Total ($q_{s/\text{person}} + q_{l/\text{person}}$)		ADJUSTED GROUP[b] Sensible $q_{s/\text{person}}$		ADJUSTED GROUP[b] Latent $q_{l/\text{person}}$	
		Watts	Btu/hr	Watts	Btu/hr	Watts	Btu/hr	Watts	Btu/hr
Seated at rest	Theater, movie	115	400	100	350	60	210	40	140
Seated, very light work writing	Offices, hotels, apts	140	480	120	420	65	230	55	190
Seated, eating	Restaurant[c]	150	520	170	580[c]	75	255	95	325
Seated, light work, typing	Offices, hotels, apts	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[d]	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

[a]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.

[b]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.

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

[d]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.