

also gives the total heat gain into an air conditioned space when 78 F is maintained indoors, resulting from the effect of both radiation and air to air transmission. These values result from A.S.H.V.E. Laboratory data¹ and apply for expected design radiation intensity, and for a design day having a maximum temperature of 95 F. The resulting heat gains are averages for four typical glass block designs, two having smooth exterior faces, and the other two having exterior ribbed faces.

Heat Emission of Occupants

The heat and moisture given off by human beings under different states of activity are shown in various tables and figures of Chapter 12 which covers the physical and physiological principles of air conditioning. It will be observed from these data that the rate of sensible and latent heat emission by human beings varies greatly depending upon state of activity. In many applications this component becomes a large percentage of total load. Metabolic rates are markedly variable for some extreme environmental conditions and this is another important factor which must be considered in cooling load computations. Consideration should be given to the typical age and sex of the occupants (whether men, women, or children) and the duration of the occupancy (since for short occupancy applications the extra heat and moisture brought in by people may be an important factor in the load).

Heat Introduced by Outside Air

Heat and moisture are added by the outside air introduced for ventilation purposes and also by infiltration air entering the building through cracks, openings, and doors.

The volume of air entering due to infiltration may be estimated from data given in Chapters 8 and 14. Information on the amount of outside air required for ventilation will be found in Chapter 12. In general, ventilation air is supplied on a per person basis at a rate between 5 and 30 cfm per person (10 to 20 cfm being normal good practice), its specific amount depending upon the amount of contamination by smoke, food odors, etc.

As outside air is introduced through the air conditioning apparatus it tends to decrease infiltration by building up the pressure within the building. Usually, however, some infiltration still occurs unless the amount of outside air is very large. For instance, it is necessary to supply between 2,000 and 3,000 cfm of outside air through the apparatus to prevent infiltration through a single swinging door. As no demonstrated factors are generally available for the effect (on infiltration) of outside air introduced through the apparatus, it is necessary to use judgment in assigning an effect.

In determining the amount of outside air which must be drawn through the apparatus the amount of air needed for ventilation is established and it is normally possible to subtract from this the assumed amount of infiltration. The division between the ventilation provided by infiltration and by outside air is important to the designer, since the infiltration adds directly to the room sensible and moisture loads, whereas the outside air brought through the apparatus affects only the refrigeration load and the dehumidifier performance (except where shallow coils are used, in which case a portion of the outside air is effectively "by-passed" through the coil).

TABLE 13. HEAT GAIN FROM VARIOUS SOURCES^a

SOURCE	PER CENT NAME- PLATE RATING	PERCENTAGE OR BTU PER HOUR		
		Sensible	Latent	Total
<i>Electrically Heated Equipment</i>				
1. Electric Oven-Baking.....	70	80%	20%	100%
2. Baker's Oven.....	1025	80%	20%	100%
3. Coffee Urn—per Gallon Capacity.....	20	90%	10%	100%
4. Glass Coffee Maker—per Section.....	30	80%	20%	100%
5. Warming Receptacle.....	50	100%	0%	100%
6. Plate Warmer.....	80	—	—	—
7. Hot Plates.....	100	65%	35%	100%
8. Steam Table—Water Bath Type.....	75	90%	10%	100%
9. Frying Griddles.....	70	—	—	—
10. Fry Kettle.....	40	75%	25%	100%
11. Waffle Baker.....	60	90%	10%	100%
12. Sandwich Grille.....	50	90%	10%	100%
13. Toaster—Intermittent or Timed Control.....	100	90%	10%	100%
14. Toaster—Continuous.....	—	2050	—	2050
15. Hair Dryer in Beauty Parlor—600 w.....	—	2050	—	2050
16. Permanent Wave Machine in Beauty Parlor—24-25 w Units.....	—	—	—	—
<i>Gas Burning Equipment^b</i>				
17. Gas Heated Oven—Baking.....no vent connection	70	72%	28%	100%
.....gravity vent connection	35	100%	0%	100%
18. Open Top Burner—per Hole.....	50	45%	55%	100%
19. Hot or Closed Top—per Burner.....no vent connection	100	45%	55%	100%
.....gravity vent connection	70	50%	50%	100%
20. Coffee Urn—Large 18 in. Diam.—Single Drum.....	—	5000	5000	10,000
21. Coffee Urn—Small 12 in. Diam.—Single Drum.....	—	3000	3000	6000
22. Coffee Urn—per Gallon of Rated Capacity.....	—	500	500	1000
23. Plate Warmer.....no vent connection	60	90%	10%	100%
.....gravity vent connection	10	100%	0%	100%
24. Steam Table—Water Bath Type.....no vent connection	60	55%	45%	100%
.....gravity vent connection	42	50%	50%	100%
25. Frying Griddles.....no vent connection	75	81%	19%	100%
.....gravity vent connection	52	90%	10%	100%
26. Fry Kettle.....no vent connection	70	72%	28%	100%
.....gravity vent connection	49	80%	20%	100%
27. Egg Boiler—per Egg Compartment.....	—	2500	2500	5000
28. Cigar Lighter—Continuous Flame Type.....	—	2250	250	2500
29. Curling Iron Heater.....	—	2250	250	2500
30. Pilot Light.....	—	180	20	200
<i>Steam Heated Equipment^c</i>				
31. Steam Heated Surface Not Polished—per Square Foot of Surface.....	—	330	0	330
.....	—	130	0	130
32. Steam Heated Surface Polished—per Square Foot of Surface.....	—	80	0	80
33. Insulated Surface—per Square Foot.....	—	400	0	400
34. Bare Pipes, Not Polished—per Square Foot of Surface.....	—	220	0	220
35. Bare Pipes, Polished—per Square Foot of Surface.....	—	110	0	110
36. Insulated Pipes—per Square Foot.....	—	2000	2000	4000
37. Coffee Urn—Large, 18 in. Diam.—Single Drum.....	—	1200	1200	2400
38. Coffee Urn—Small, 12 in. Diam.—Single Drum.....	—	2500	2500	5000
39. Egg Boiler—per Egg Compartment.....	—	300	800	1100
40. Steam Table—per Square Foot of Top Surface.....	—	—	—	—
<i>Miscellaneous</i>				
41. Heat Liberated By Food per Person, as in a Restaurant.....	—	30	30	60
42. Heat Liberated from Hot Water used direct and on towels per hour—Barber Shops.....	—	100	200	300

^aHeat gain from electric or gas residential ranges or cooking stoves depends on size of the family, socio-economic status of the individual, time of day for principal meal, and whether the equipment is manually or automatically controlled. Total heat gain will probably not exceed 40 per cent name-plate rating. Per cent sensible and latent heat will depend upon use of equipment; dry heat; baking or boiling.

^bName-plate ratings of gas burning equipment can be obtained from a Directory of Approved Gas Appliances and Listed Accessories, obtainable from American Gas Association.

^cSteam Requirements of Process Equipment, Report of the Commercial Relations Committee, National District Heating Association (Heating, Piping and Air Conditioning, November, 1942, p. 675).