

HEATING VENTILATING AIR CONDITIONING GUIDE 1940

Density of air at 95 F dry-bulb and 75 F wet-bulb for a barometric pressure of 29.92 in. is 0.07105 lb per cubic foot (Table 4, Chapter 1).

Dew-point of outdoor air is 66 F (psychrometric chart).

Partial pressure of vapor is 0.64378 in. Hg. (Pressure of saturated vapor at 66 F, Table 6, Chapter 1).

$$W = 0.622 \left(\frac{e}{B - e} \right) = 0.622 \left(\frac{0.64378}{29.92 - 0.64378} \right) = 0.0137 \text{ lb water vapor per pound dry air (Formula 5 a, Chapter 1).}$$

$$\frac{1}{1 + 0.0137} = 0.986 \text{ lb dry air per pound outside air.}$$

$$d_o = 0.07105 \times 0.986 = 0.0699 \text{ lb dry air per cubic foot outside air.}$$

$$H_s = 60 \times 500 \times 0.0699 \times 0.24 (95-80) = 7549 \text{ Btu per hour.}$$

$$\text{Total heat, } H = 60 d_o Q (h_o - h) \text{ (Formula 5).}$$

$$h_o = 38.46 \text{ Btu per pound dry air at 75 F wet-bulb (Table 6, Chapter 1).}$$

$$h = 31.51 \text{ Btu per pound dry air at 67 F wet-bulb (Table 6, Chapter 1).}$$

$$H = 60 \times 0.0699 \times 500 (38.46 - 31.51) = 14,574 \text{ Btu per hour.}$$

$$\text{Latent heat gain from outside air} = 14,574 - 7549 = 7025 \text{ Btu per hour.}$$

PEOPLE HEAT GAIN:

$$50 \times 225 = 11,250 \text{ Btu per hour, sensible heat.}$$

$$50 \times 206 = 10,300 \text{ Btu per hour, latent heat.}$$

LIGHT HEAT GAIN:

$$4200 \times 3.413 = 14,335 \text{ Btu per hour.}$$

SUMMARY:

COMPONENT OF LOAD	BTU PER HOUR	
	Sensible	Latent
Normal Transmission Load.....	16,164	
Sun Load.....	47,946	
Outside Air Heat Gain.....	7,549	7,025
People Heat Gain.....	11,250	10,300
Light Heat Gain.....	14,335	
Total.....	97,244	17,325

TOTAL LOAD:

$$97,244 + 17,325 = 114,569 \text{ Btu per hour.}$$

Chapter 9

COMBUSTION AND FUELS

Principles of Combustion, Classification of Coals, Firing Methods for Coals, Firing Methods for Coke, Dustless Treatment of Coal, Classification of Oils, Combustion of Oil, Classification of Gas, Combustion of Gas.

THE data given in the first part of this chapter are of general application to the various fuels used in domestic heating which are coal, coke, oil and gas. The choice of fuel is a question of dependability, cleanliness, fuel availability, economy, operating requirements and control.

FUNDAMENTAL PRINCIPLES OF COMBUSTION

Combustion may be defined as the chemical combination of a substance with oxygen with a resultant evolution of heat. The rate of combustion depends partly upon the specific rate of reaction of the combustible substance with oxygen and partly upon the rate at which oxygen is supplied and the surrounding conditions as they define the temperature.

Complete combustion is obtained when all of the combustible elements in the fuel are oxidized with all of the oxygen with which they can combine. All of the oxygen supplied may not be utilized.

Perfect combustion is defined as the result of supplying the required amount of oxygen for combination with all of the combustible elements of the fuel and utilizing all of the oxygen so supplied.

The oxygen required for the process of combustion is obtained from air which is a mechanical mixture of oxygen, nitrogen and small amounts of carbon dioxide, water vapor and inert gases. These inert gases are generally included with the nitrogen, and for engineering purposes the values given herewith may be used.

	BY VOLUME PER CENT	BY WEIGHT PER CENT
Oxygen, O_2	20.9	23.15
Nitrogen, N_2	79.1	76.85

The combination of oxygen with the combustible elements and compounds of a fuel is in accordance with fixed laws. In the case of perfect combustion the reactions and resultant combinations are shown in Table 1.

The most important condition governing the process of combustion is temperature. It is necessary to bring a combustible substance to its