SUMMARY:

Component of Load	Btu per Hour
Combined Normal and Solar Radiation Transmission	21,413
Normal Transmission	5,993
Solar Radiation Through Glass	18,965
Outside Air	14,410
Occupants	21,550
Lights	14,335
Total (Sensible and Latent Heat Gain)	96,666

LATENT HEAT:

Outside air 6.03 lb water per hour.
Occupants 9.90 lb water per hour.

15.93 lb water per hour.

$15.93 \times h_{fg} = 15.93 \times 1062.7 = 16{,}929$ Btu per hour.

CONDITION LINE:

The condition line for this application may be determined from Equation 25 in Chapter 1 by taking the ratio of $96{,}666 \div 15.93 = 6070$ Btu per pound water. In this case, it crosses the saturation curve at a temperature for which the enthalpy h_s and the humidity ratio W_s satisfy the equation,

$$\frac{31.40 - h_s}{0.01115 - W_s} = 6070.$$

A trial-by-error computation gives a quick solution of 57.4 F, which can also be determined graphically on a Mollier chart. This is the apparatus dew-point as explained in Chapters 1 and 21.

REFRIGERATION LOAD:

Assuming 100 per cent saturation efficiency for the air conditioning apparatus, operation at the apparatus dew-point is possible. The thermodynamic properties involved in calculating the refrigeration required are:

	Inside Air	*After Cooling*	*After Separating*
t	80.0	57.4	57.4
h	31.40	24.678	24.65
W	0.01115	0.01115	0.01004

The refrigeration required is $31.4 - 24.678 = 6.722$ Btu per pound dry air. The total outside and recirculated dry air to be circulated through the air conditioning apparatus is $96{,}666 \div (31.40 - 24.65) = 14{,}321$ lb per hour. Hence, the total refrigeration required or the cooling load is $14{,}321 \times 6.722 = 96{,}265$ Btu per hour, or $96{,}265 \div 12{,}000$ (Btu extracted per hour per ton of refrigeration) $= 8.02$ tons.

The energy removed with the water eliminated is $14{,}321 \times (24.678 - 24.65) = 401$ Btu per hour. This plus the refrigeration accounts for the total removal of $96{,}265 + 401 = 96{,}666$ Btu per hour as required.

Chapter 8

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