

$$c. \frac{200}{57.77} = 3.46 \text{ lb per minute per ton.}$$

$$d. 9000 \times \frac{3.46}{33,000} = 0.944 \text{ hp per ton.}$$

$$e. 200 + 0.944 \times 42.5 = 240 \text{ Btu per minute per ton.}$$

$$\text{Check: Heat content leaving compressor} = 85.25 + 11.6 = 96.85 \\ (96.85 - 27.48) 3.46 = 240 \text{ Btu per minute per ton.}$$

$$f. \text{ Heat Content} = 96.85.$$

$$\text{Pressure} = 114.3 \text{ lb per square inch.}$$

$$\text{From Table 3, Temp.} = 146 \text{ F.}$$

2 ● If the velocity of vapor in the suction pipe is 50 fps and there are 10 velocity heads lost between evaporator and compressor, what is the saturation temperature at the evaporator?

$$h = \frac{V_s^2}{2g}$$

$$h = 10 \times \left(\frac{50}{2g} \right)^2 = 388 \text{ ft head.}$$

$$\text{Head per degree} = (47.28 - 43.16) \times \left(\frac{0.863 + 0.792}{2} \right) \times \frac{144}{5} = 98.4 \text{ ft.}$$

$$\text{Check: Head per degree} = 9000 \times \frac{0.7}{(90 - 30)} = 105 \text{ ft. (Approx.)}$$

$$\text{Temperature} = 30 + \frac{388}{98.4} = 34 \text{ F.}$$

3 ● If the refrigerant is sub-cooled to 70 F, what is the effect on: a. Work per pound; b. Refrigerating effect; c. Horsepower per ton?

a. No effect on work per pound.

$$b. (85.25 - 23.90) = 61.35.$$

$$61.35 - 57.77 = 3.58 \text{ Btu increase.}$$

$$\frac{3.58}{57.77} = 6.2 \text{ per cent increase.}$$

$$c. \frac{200}{61.35} = 3.27 \text{ lb per minute per ton.}$$

$$9000 \times \frac{3.27}{33,000} = 0.891 \text{ hp per ton.}$$

$$0.944 - 0.891 = 0.053 \text{ hp decrease.}$$

$$\frac{0.053}{0.944} = 5.6 \text{ per cent decrease.}$$

4 ● What is the approximate change in capacity of the following types of systems per degree at 40 F: a. Reciprocating; b. Centrifugal; c. Ejector?

a. 2.5 per cent.

b. 3.0 per cent.

c. 7.5 per cent.

5 ● a. Which type of system will maintain the most uniform evaporator temperature with change of load?

b. Which system will maintain the most uniform load with change of evaporator temperature?

From Fig. 6.

a. Steam ejector.

b. Reciprocating and rotary.

6 ● a. What is the velocity of steam expanding from 100 lb per square inch gage, saturated to 0.0178 lb per square inch absolute, corresponding to 50 F if the nozzle has an efficiency of 90 per cent?

b. What is the velocity of the mixture of this steam with one-third the mass of entrained steam moving at 300 fps?

$$a. V = \sqrt{778 \times 2g \times 0.9 \times (1190.7 - 815.4)}$$

$$V = 4110 \text{ fps.}$$

$$b. V_{\text{mix}} = \frac{3 \times 4110 + 1 \times 300}{4} = 3158 \text{ fps.}$$

7 ● If air entering an open adsorption system at 80 F and 50 per cent relative humidity is dehumidified and cooled to a temperature of 90 F and 12 per cent relative humidity, how much air is cooled per ton of refrigeration and what is the latent heat of the water which is adsorbed?

Entering Conditions

66.6 F WB.

30.85 Btu Total Heat

76.0 Grains per Pound

Leaving Conditions

59.1 F WB.

25.59 Btu Total Heat

24.5 Grains per Pound

$$\text{cfm} = \frac{200 \times 13.5}{(30.85 - 25.59)} = 513 \text{ cfm per ton.}$$

$$L = \frac{513 \times (76.0 - 24.5) \times 1044}{13.5 \times 7000} = 292.5 \text{ Btu.}$$

$$\text{Check: } L = 200 + \left(\frac{513 \times 0.2415 \times 10}{13.5} \right) = 291.6 \text{ Btu.}$$

8 ● If air entering an open adsorption system at 80 F and 50 per cent relative humidity is cooled to 75 F and 12 per cent relative humidity, how much air is required per ton and what is the latent heat of the water which is absorbed?

Entering Conditions

66.6 F WB

30.85 Btu Total Heat

76.0 Grains per Pound

Leaving Conditions

50.3 F WB

20.35 Btu Total Heat

14.4 Grains per Pound

$$\text{cfm} = \frac{200 \times 13.5}{(30.85 - 20.35)} = 257 \text{ cfm per ton.}$$

$$L = \frac{257 \times (76.0 - 14.4) \times 1044}{13.5 \times 7000} = 175.2 \text{ Btu.}$$

$$\text{Check: } L = 200 - \left(\frac{257 \times 0.2415 \times 5}{13.5} \right) = 177.0 \text{ Btu.}$$

9 ● Why is it possible for a reversed cycle refrigeration unit to show a better performance in heating operation than when operating during the cooling season?