REFRENG
Problem Set

Actual Vapor Compression Cycle

Problem 1

An industrial plant has available a 4 - cylinder, 76 - mm bore by 102 - mm stroke, 800 rpm, single-acting compressor for use with R-12. Proposed operating conditions for the compressor are 38°C condensing temperature and 5°C evaporating temperature. It is estimated that the refrigerant will enter the expansion valve as saturated liquid, that the vapor will leave the evaporator at a temperature of 7^{o}C and will enter the compressor at 13°C. Assume a compressor volumetric efficiency of 70% and frictionless flow. Calculate the refrigerating capacity in KW for a system equipped with this compressor.

Problem 2

A R-12 refrigeration system requires a load of 54 KW at an evaporator pressure of 270 KPa and a condenser pressure of 1009 KPa. The refrigerant is sub cooled 10 degrees before entering the expansion valve and the vapor is superheated 14 degrees before entering the compressor. A twin - cylinder compressor with stroke equal to 1.25 times the bore is to be used at a speed of 27 rps. The volumetric efficiency is 84%. Determine:

a. the quantity of cooling water in the condenser for an 11 - degree increase in temperature;
b. the bore and stroke
c. the compressor power.

Problem 3

A R-22 refrigeration system carries a load of 82 KW an evaporator pressure of 354 KPa and a condenser pressure of 1460 KPa. The liquid refrigerant is sub cooled by 4 degrees before entering the expansion valve and the vapor is superheated by 5 degrees before entering the compressor. The compressor operates at 28 rps. The stroke - to - bore ratio of the twin cylinder compressor is 1.2 and the actual volumetric efficiency is 82%. Determine:

a. the mass flow rate of the refrigerant;
b. the mass flow rate of the cooling tower in the condenser for a 7 degree change in temperature;
c. the bore and stroke.

Problem 4

A Freon - 12 refrigeration system, with a 10 - TR capacity and a coefficient of performance of 3.23, operates with a condenser pressure of 984.5 KPa and an evaporator pressure of 150.8 KPa. The temperatures entering and leaving the compressor are -10°C and 80°C, respectively. The temperature entering -the expansion valve is 34°C. The compressor is water - jacketed and operates with unknown pressure drops through the valves. Calculate:

a. the mass flow rate of refrigerant;
b. the indicated work;
c. the heat removed by the jacket water.

Problem 5

A test of a 10 - TR ammonia vapor compression refrigeration system gave the following results: condenser P = 1600 Kpa; evaporator P = 191 KPa; temp leaving evaporator coils = -10C; temp entering compressor = 0C; temp leaving compressor = 100C; temp entering condenser = 80C; temp leaving condenser = 35C; COP = 3.1. Determine the heat lost or gained

(1) between the evaporator coils and compressor,

(2) between the compressor and condenser, and

(3) to condenser water.

Determine also the following:

(1) the temperature in the evaporator coils in saturated state, and

(2) the quantity of the vapor in the evaporator coils following expansion through valve.

Determine (1) the work, and (2) the heat absorbed by jacket water.