

國立臺北科技大學 100 學年度碩士班招生考試

系所組別：1410 能源與冷凍空調工程系碩士班甲組

第二節 冷凍空調原理 試題

第一頁 共二頁

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (20%) A two-stage compression refrigeration system with an adiabatic liquid-vapor separation unit shown in Fig. P1 uses refrigerant R-134a as the working fluid. The system operates the evaporator at 0.4 MPa, the condenser at 1.6 MPa, and the separator at 0.8 MPa. The compressors use 25 kW of power. Determine the rate of cooling provided by the evaporator and the COP of this cycle. The refrigerant is saturated liquid at the inlet of each expansion valve and saturated vapor at the inlet of each compressor, and compressors are isentropic.

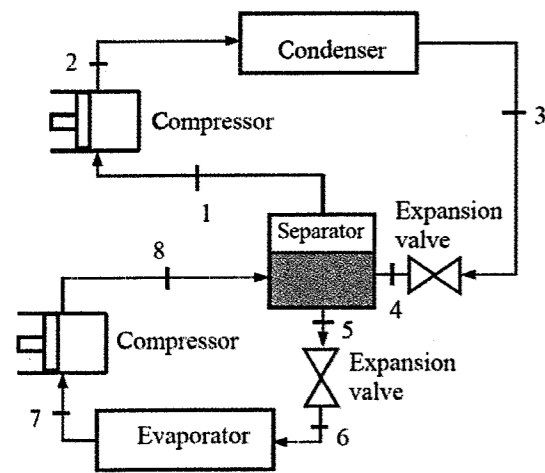


Fig. P1

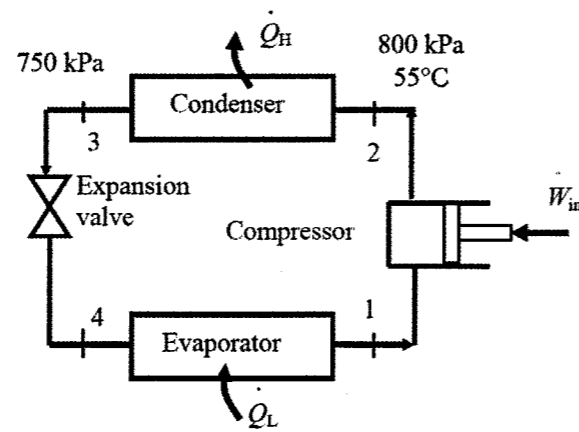


Fig. P2

2. (20%) R-134a enters the condenser of a residential heat pump, as shown in Fig. P2, at 800 kPa and 55°C at a rate of 0.018 kg/s and leaves at 750 kPa subcooled by 3°C. The refrigerant enters the compressor at 200 kPa superheated by 4°C. Determine (a) the isentropic efficiency of the compressor, (b) the rate of heat supplied to the heated room, and (c) the COP of the heat pump. Also, determine (d) the COP and the rate of heat

supplied to the heated room if this heat pump operated on the ideal vapor-compression cycle between the pressure limits of 200 and 800 kPa.

3. (20%) An air-conditioning system operates at a total pressure of 1 atm and consists of a heating section and a humidifier that supplies wet steam (saturated water vapor) at 100°C. Air enters the heating section at 10°C and 70 percent relative humidity at a rate of 35 m³/min, and it leaves the humidifying section at 20°C and 60% relative humidity. Determine (a) the temperature and relative humidity of air when it leaves the heating section, (b) the rate of heat transfer in the heating section, and (c) the rate at which water is added to the air in the humidifying section.

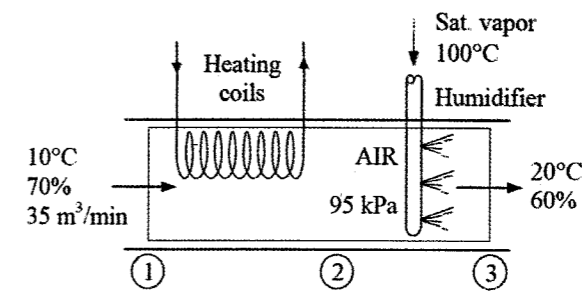


Fig. P3

4. (20%) Water at 38°C is to be cooled in a cooling tower which it enters at a rate of 4500 kg/h. Humid air enters this tower at 1 atm, 15°C, and 20 percent relative humidity with a dry air flow rate of 3000 kg/h and leaves at 24°C and 0.018 kg H₂O/kg dry air. Determine the relative humidity at which the air leaves the tower and water's exit temperature.

5. (20%) The drinking water needs of a production facility with 20 employees is to be met by bubbler type water fountain. The refrigerated water fountain is to cool water from 22°C to 8°C and supply cold water at a rate of 0.4 L per hour per person. Heat is transferred to the reservoir from the surroundings at 25°C at a rate of 45 W. If the COP of the refrigeration system is 2.9, determine the size of the compressor, in W, that will be suitable for the refrigeration system of this water cooler.

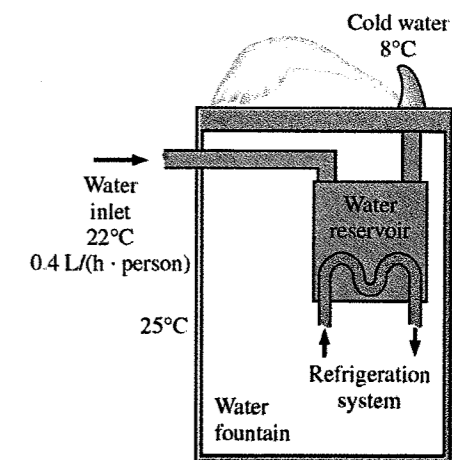
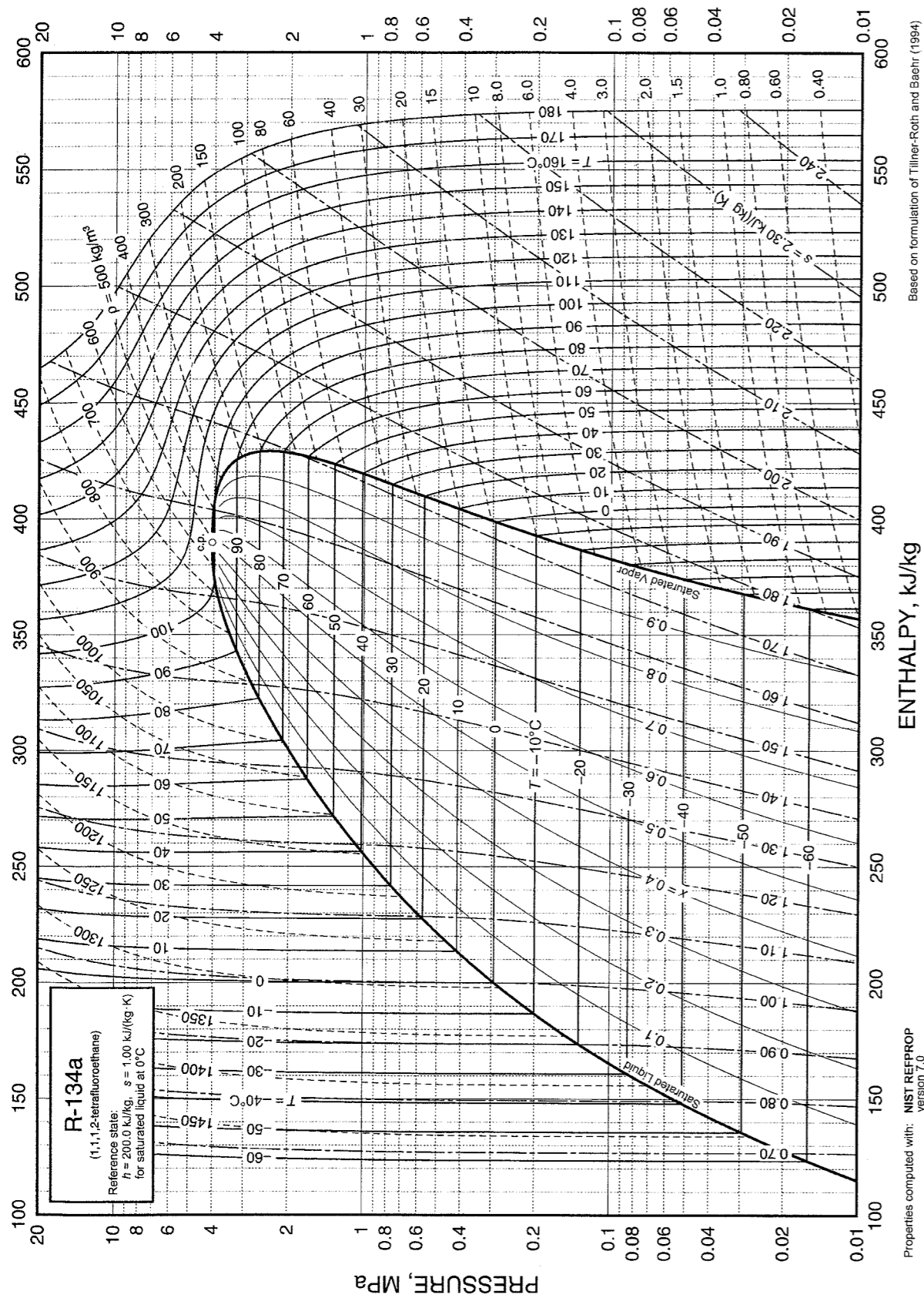


Fig. P5

注意：背面尚有參考資料



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