

(1) 由 COP_{HP} 之定義可得

$$COP_{HP} \equiv \frac{\dot{Q}_H}{\dot{W}_{in}} = 2.5 \dots\dots\dots ①$$

其中取室內為系統，由能量守恆可得

$$\dot{Q}_H = \dot{Q}_{out} = 80000 \text{ (kJ/h)} \dots\dots\dots ②$$

代入①可得熱泵消耗功率為

$$\frac{80000}{\dot{W}_{in}} = 2.5$$

$$\Rightarrow \dot{W}_{in} = 32000 \text{ (kJ/h)}$$

(2) 熱泵之吸熱率為

$$\dot{Q}_L = \dot{Q}_H - \dot{W}_{in} = 80000 - 32000 = 48000 \text{ (kJ/h)}$$

例題2

A reversible device is used as refrigerator for cooling in summer and as heat pump for heating in winter. The house is maintained at 24°C year around. The heat loss or gain is 0.44kW per degree difference between outside and inside temperatures. The average outside temperature is 32°C in the summer and -4°C in the winter. Determine the power requirements for both heating and cooling. (10%)

【台大機械】

解：(1) 在夏天時，性能係數為

$$COP_{R,rev} \equiv \frac{\dot{Q}_L}{\dot{W}_{in}} = \frac{1}{\frac{T_H}{T_L} - 1} \dots\dots\dots ①$$

其中

$$\dot{Q}_H = 0.44(32 - 24) = 3.52 \text{ (kW)}$$

由能量守恆可得

$$\dot{Q}_H = \dot{Q}_L + \dot{W}_{in} \Rightarrow \dot{Q}_L = 3.52 - \dot{W}_{in}$$

代入①可得，輸入功率為

7-4 熱力學必勝秘笈

$$\frac{3.52\dot{W}_{in}}{\dot{W}_{in}} = \frac{1}{\frac{32+273}{24+273}-1} \Rightarrow \dot{W}_{in} = 0.097(\text{kW})$$

(2)在冬天時，性能係數為

$$COP_{HP,rev} \frac{\dot{Q}_H}{\dot{W}_{in}} = \frac{1}{1 - \frac{T_L}{T_H}} \dots\dots\dots ②$$

其中由

$$\dot{Q}_H = 0.44[24 - (-4)] = 12.32(\text{kW})$$

代入②可得，輸入功率為

$$\frac{12.32}{\dot{W}_{in}} = \frac{1}{1 - \frac{-4+273}{24+273}} \Rightarrow \dot{W}_{in} = 1.16(\text{kW})$$

§ 7-2 蒸氣冷凍循環

如圖7-3所示，為蒸氣冷凍循環之構造簡圖。

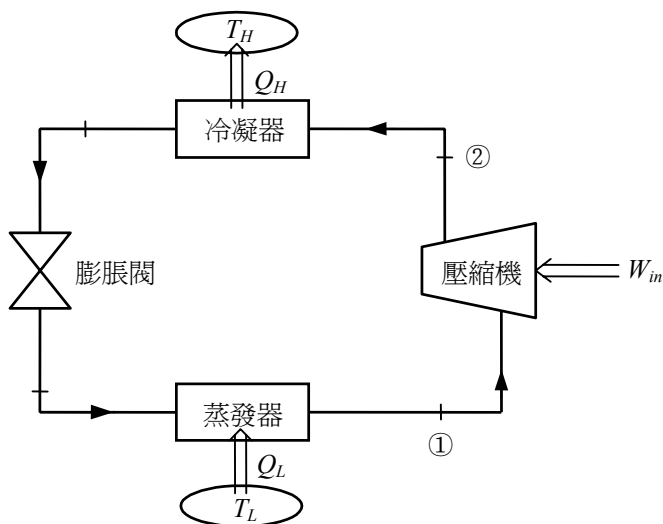


圖7-3 蒸氣冷凍循環

1. 循環之各過程