Meeting_005

Tuesday, March 02, 2021 8:45 AM

$T\,(^\circ C)$	$P\,(kPa)$	$v\,(m^3/kg)$	فاز
−8	320	0.0007571	مایع متراکم ✓
30	770.64	0.015	مخلوط
−12.73	180	0.11041	بخار اشباع
80	600	0.044710	بخار فوق گرم

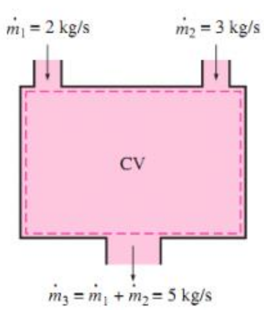
R-۱۳۴a: −۴۰°C

R-22: −۸۰°C

$$\begin{cases} T = -۸ & \longrightarrow T < T_{sat} \longrightarrow \\ P = ۳۲۰\ kPa & \longrightarrow T_{sat} = ۲{,}۴۶\ ^\circ C \end{cases}$$

سیستم باز:
- پایا ← در داخل سیستم جرم یا انرژی ذخیره نمی‌شود.
- گذرا ← در داخل سیستم جرم یا انرژی می‌تواند ذخیره شود.

اولین معادله: موازنه جرم



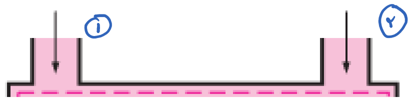
$$\dot m_{in} = \dot m_{out} \Rightarrow \dot m_1 + \dot m_۲ = \dot m_3$$

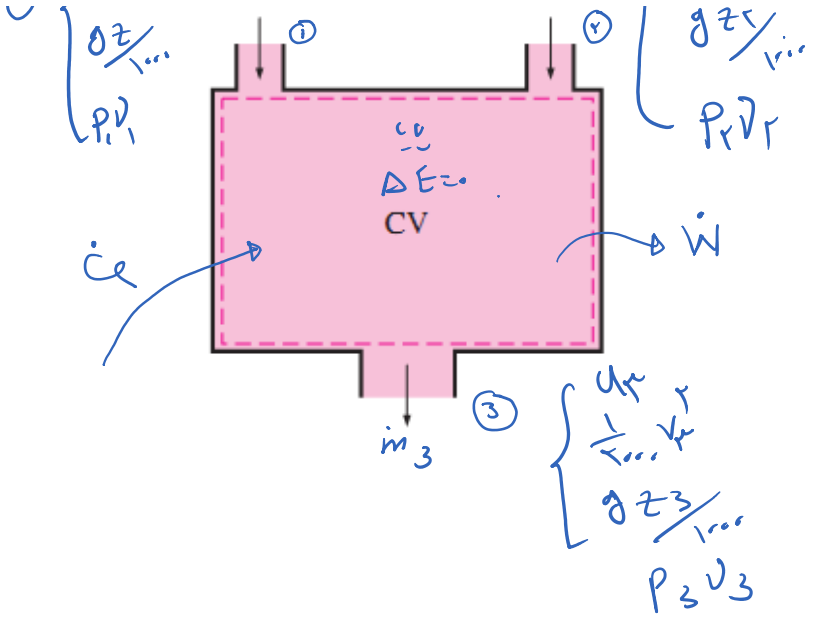
$$۲ + ۳ = ۵ = \dot m_3 \ (kg/s)$$

$$h = u + pv$$

$$\boxed{\dot m = \rho Q = \rho A V}$$

① $\begin{cases} u_1 \\ \frac{1}{۲۰۰۰} V_1^۲ \\ \frac{g z_1}{۱۰۰۰} \end{cases}$ $\dot m_1$ ① $\dot m_۲$ ② $\begin{cases} u_۲ \\ \frac{1}{۲۰۰۰} V_۲^۲ \\ \frac{g z_۲}{۱۰۰۰} \end{cases}$





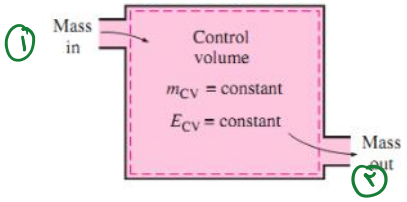
$$\Delta E = 0 \longrightarrow E_{in} = E_{out} \longrightarrow \dot{Q} + \dot{m}_1\left[h_1 + \frac{1}{2000}v_1^2 + \frac{gz_1}{1000}\right] + \dot{m}_2\left[h_2 + \frac{V_2^2}{2000} + \frac{gz_2}{1000}\right]$$

$$= \dot{W} + \underset{\dot{m}_3}{[}\left[h_3 + \frac{V_3^2}{2000} + \frac{gz_3}{1000}\right]$$

$$\dot{Q} - \dot{W} = \dot{m}_3\left[h_3 + \frac{V_3^2}{2000} + \frac{gz_3}{1000}\right] - \dot{m}_1\left[h_1 + \frac{V_1^2}{2000} + \frac{gz_1}{1000}\right] - \dot{m}_2\left[h_2 + \frac{V_2^2}{2000} + \frac{gz_2}{1000}\right]$$

زمانی که در یک سیستم دو ورودی یا چند خروجی مجهول داریم

$$\dot{m}_{in} = \dot{m}_{out} \longrightarrow \dot{m}_1 = \dot{m}_2$$



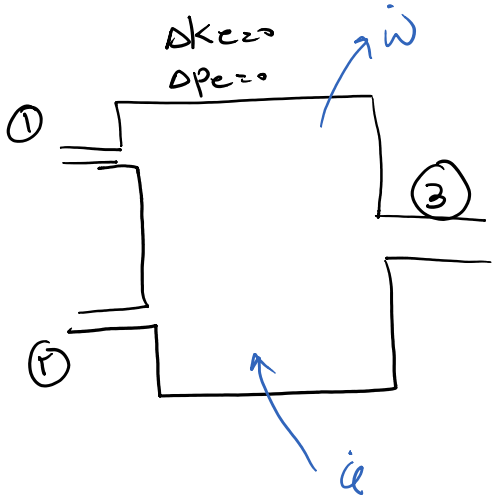
$$\dot{Q} - \dot{W} = \dot{m}_2\left[h_2 + \frac{V_2^2}{2000} + \frac{gz_2}{1000}\right] - \dot{m}_1\left[h_1 + \frac{V_1^2}{2000} + \frac{gz_1}{1000}\right]$$

$$\dot{Q} - \dot{W} = \dot{m}\left[h_2 - h_1 + \frac{V_2^2 - V_1^2}{2000} + \frac{g(z_2 - z_1)}{1000}\right]$$

$\Delta ke = 0$
$\Delta pe = 0$

$$\dot{Q} - \dot{W} = \dot{m}(h_2 - h_1)$$

$$q - w = h_2 - h_1$$



$$\dot{m}_3 = \dot{m}_1 + \dot{m}_2$$

$$\dot{Q} - \dot{W} = \dot{m}_3 h_3 - \dot{m}_1 h_1 - \dot{m}_2 h_2$$

EXAMPLE 5–4 Deceleration of Air in a Diffuser

Air at 10°C and 80 kPa enters the diffuser of a jet engine steadily with a velocity of 200 m/s. The inlet area of the diffuser is 0.4 m². The air leaves the diffuser with a velocity that is very small compared with the inlet velocity. Determine (*a*) the mass flow rate of the air and (*b*) the temperature of the air leaving the diffuser.

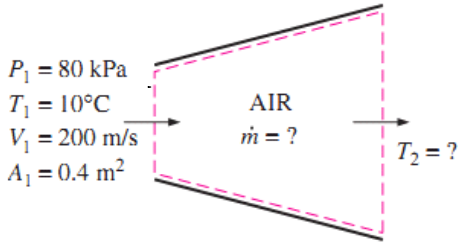
$h \longrightarrow T$

$T_1 = 283 \longrightarrow h_1 = 283.27\ kJ/kg$

Air

① $T = 10°C$, $P = 80\ kPa$, $V = 200\ m/s$, $A = 0.4\ m^2$

② $V = 0$, $\dot{m} = ?$, $T = ?$



$\dot{m}_{in} = \dot{m}_{out}$ $\quad \dot{m}_{in} = \rho_{in} \cdot Q_{in} = \rho_{in} \cdot V_{in} \cdot A_{in} = \frac{1}{v_{in}} A_{in} \cdot V_{in} = \frac{200 \times 0.4}{1.018} =$

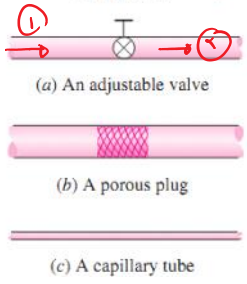
$P_1 v_1 = R T_1 \Rightarrow 80 \times v_1 = 0.287 \times (283) \longrightarrow v_1 = 1.018$

$P_1 v_1 = R T_1 \Rightarrow \Lambda\circ \times v_1 = \cdot/\text{۲۸۷} \times (\text{۲۸۳}) \rightarrow v_1 = \text{۱}/\text{۰۱۵}$

$q - w = (h_2 - h_1) + \frac{1}{2\cdots}(v_2^2 - v_1^2) + \frac{g}{2\cdots}(z_2 - z_1)$

$h_2 - h_1 - \frac{v_1^2}{2\cdots} = 0 \rightarrow h_2 - h_1 = \frac{v_1^2}{2\cdots}$

$h_2 = \frac{\text{۴}\times\text{۱}\cdot^{\text{۴}}}{2\cdots} + \text{۲۸۳} = \frac{\text{۴}\cdots}{2} + \text{۲۸۳} = \text{۴۸۳} \rightarrow T_2 = \text{۴۸}\cdot\ K$



خرابیدر شیرهای فشارشکن آنتالپی ثابت است.

$q - w = (h_2 - h_1) + \frac{1}{2\cdots}(v_2^2 - v_1^2) + \frac{g}{1\cdots}(z_2 - z_1)$

$\rightarrow h_2 = h_1$

EXAMPLE 5–8 Expansion of Refrigerant-134a in a Refrigerator

Refrigerant-134a enters the capillary tube of a refrigerator as saturated liquid at 0.8 MPa and is throttled to a pressure of 0.12 MPa. Determine the quality of the refrigerant at the final state and the temperature drop during this process.

① مایع اشباع : فازش

$P = \cdot/\text{۸}\ MPa = \text{۸}\cdot\cdot\ kpa$

② $P = \cdot/\text{۱۲}\ MPa$

$x = ?$

$\Delta T = ?$

22.49 214.48 236.97

$h_g = \text{۲۳۶}/\text{۹۷}$

① $v_1 = v_f = \cdot/\cdots\text{۸}$

$T_1 = \text{۳۱}/\text{۳۱}$

$s_1 = \cdot/\text{۳۲۵}\text{۴}\text{۴}$

② $P = \cdot/\text{۱۲}\ MPa = \text{۱۲}\cdot\ kpa \rightarrow h_f = \text{۲۲}/\text{۲۹}$

$h_2 = h_1 = \text{۹۵}/\text{۴۷}$

① $\begin{cases} T_1 = ٣١,٣١ \\ s_1 = ٠,٣٦٥٤٠٤ \\ h_1 = ٩٥,٤٧ \end{cases}$

② $\begin{cases} h_2 = h_1 = ٩٥,٤٧ \\ h_f < h_2 < h_g \end{cases}$ → مخلوط

$T_2 = -٢٢,٣٢$

$$h_2 = h_f + x(h_g - h_f)$$

$$٩٥,٤٧ = ٢٢,٤٩ + x(٢١٤,٤٨) \rightarrow x = \frac{٩٥,٤٧ - ٢٢,٤٩}{٢١٤,٤٨}$$

$$x = ٠,٣٤$$

$$\Delta T = T_2 - T_1 = -٢٢,٣٢ - ٣١,٣١$$

$$= -٥٣,٦$$