

Importante

Puedo eliminar la publi de este documento con 1 coin

¿Cómo consigo coins? → Plan Turbo: barato
→ Planes pro: más coins

perdo
espacio



Necesito
concentración

ali ali ooh
esto con 1 coin me
lo quito yo...

WUOLAH

(b) Hay cavitación?

Para saber si caute. $CNPA_0 > CNPA_1$

$CNPA_1 = 5.600 \text{ G} \cdot 30208 \text{ G}^2 = 5.600 \cdot 1,41 \cdot 10^{-2} = 30208 (1,41 \cdot 10^{-2})^2$

$CNPA_1: 2,56 \text{ m}$

$CNPA_0 = \frac{P_1 - P_2}{\rho \cdot g} = h = \frac{EF}{g}$

$g \cdot h = 2 \cdot \pi \cdot r_1 = 21 \cdot 20 \cdot 1 \text{ m}$

$g \cdot 2F = 2 \cdot \pi \cdot r_1^2 \cdot \frac{1}{D}$

$g \cdot 2F = 2 \cdot \pi \cdot r_1^2 \cdot \frac{1}{D} \Rightarrow 1,41 \cdot 10^{-2} = \sqrt{\frac{2 \cdot \pi \cdot r_1^2}{g \cdot 2F}} \Rightarrow \sqrt{2 \cdot \pi \cdot r_1^2} = 1,41 \cdot 10^{-2} \cdot \sqrt{g \cdot 2F}$

$2F = 20,02 \cdot 2,815^2 \cdot \frac{14}{0,06} \Rightarrow EF = 55,45$

$CNPA_0 = 10,33 - 0,132 \cdot 1 - \frac{55,45}{7,8} \Rightarrow CNPA_0 = 3,433 \text{ m}$

Como $CNPA_0 > CNPA_1 \rightarrow$ la bomba va caute

(c) Calcular el máximo caudal para que no caute.

Para que no caute $CNPA_0 = CNPA_1$ (y sea Q_{max})

$CNPA_0 = 5.600 \text{ G} \cdot 30208 \text{ G}^2 \Rightarrow 3,433 = 5.600 \cdot \text{G} \cdot 30208 \text{ G}^2$

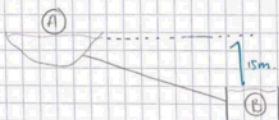
$\text{G} = 1,65 \cdot 10^{-2} \text{ m}^3/\text{s}$

(d) Rendimiento para el caudal máximo.

$\eta = 30 \cdot \text{G} \cdot 200 \text{ G}^3 \Rightarrow \eta = 30 \cdot 1,65 \cdot 10^{-2} \cdot 300 (1,65 \cdot 10^{-2})^3$

$\eta = 5,4733 \rightarrow \eta = 41,29\%$

WUOLAH



Tubería $\left\{ \begin{array}{l} L = 300m \\ D = 0,0762m \\ C = 0,016mm = 1,6 \cdot 10^{-5}m \end{array} \right.$

(a) Caudal

Bernoulli A \rightarrow B

$$\frac{1}{2} \left(\frac{V_B^2}{\alpha_B} - \frac{V_A^2}{\alpha_A} \right) + g(z_B - z_A) = \frac{P_B - P_A}{\rho} + \sum \frac{f L V^2}{2 D}$$

Supuestos

$$V_A = V_B$$

$$P_A = P_B = P_{atm}$$

$\alpha = 1 \rightarrow$ No hay pérdidas

$$g(z_B - z_A) + 2 f V^2 \frac{L}{D} = 0 \rightarrow 9,8(0 - 15) + 2 f V^2 \frac{300}{0,0762} = 0 \quad [Ec. 1]$$

$$Chen \rightarrow f = f(Re, \epsilon/D)$$

(1) Proceso iterativo

$$V' \rightarrow \text{Chen } f \rightarrow Ec. 1: V \rightarrow V = V' \rightarrow SI$$

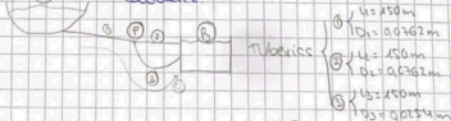
$$V' = 10^{-2} \quad V$$

| | | |
|-------|--------|-------|
| 5 | 4,6384 | 1,936 |
| 1,936 | 4,9830 | 1,936 |

$$\rightarrow V = 1,936 m/s$$

$$Q = V S = 1,936 \frac{m}{s} \cdot 0,0762^2 \rightarrow Q = 8,829 \cdot 10^{-3} m^3/s$$

(b) Caudales



En conservación $m_1 = m_2 + m_3$ $\left\{ \begin{array}{l} m = \rho \cdot Q \\ Q = V \cdot S \end{array} \right. \rightarrow g = de$

$$V_1 S_1 = V_2 S_2 + V_3 S_3 \rightarrow V_1 \cdot 2 \cdot 0,0762^2 = V_2 \cdot 0,0762^2 + V_3 \cdot 0,0754^2$$

$$5,806 \cdot 10^{-3} V_1 = 5,806 \cdot 10^{-3} V_2 + 6,452 \cdot 10^{-4} V_3 \quad [Ec. 1]$$

$$\text{Bernoulli } A \rightarrow P: \frac{1}{2} \left(\frac{V_P^2}{\alpha_P} - \frac{V_A^2}{\alpha_A} \right) + g(z_P - z_A) + \frac{P_P - P_A}{\rho} + \sum F_i = 0$$

$$\text{Bernoulli } P \rightarrow B: \frac{1}{2} \left(\frac{V_B^2}{\alpha_B} - \frac{V_P^2}{\alpha_P} \right) + g(z_B - z_P) + \frac{P_B - P_P}{\rho} + \sum F_i = 0$$

$$\text{Bernoulli } P \rightarrow C: \frac{1}{2} \left(\frac{V_C^2}{\alpha_C} - \frac{V_P^2}{\alpha_P} \right) + g(z_C - z_P) + \frac{P_C - P_P}{\rho} + \sum F_i = 0$$

Bernoulli $A \rightarrow P, P \rightarrow B$

$$\frac{1}{2} \left(\frac{V_B^2}{\alpha_B} - \frac{V_A^2}{\alpha_A} \right) + g(z_B - z_A) + \frac{P_B - P_A}{\rho} + \sum F_i + \sum F_j = 0 \quad \left\{ \begin{array}{l} V_A = V_B = 0 \\ P_A = P_B = P_{atm} \end{array} \right.$$

$$g(z_B - z_A) + 2 f_1 V_1^2 \frac{L_1}{D_1} + 2 f_2 V_2^2 \frac{L_2}{D_2} = 0$$

$$9.8(0.15) + 2 f_1 V_1^2 \frac{150}{0.0762} + 2 f_2 V_2^2 \frac{150}{0.0762} = 0 \quad [\text{Ec. 2}]$$

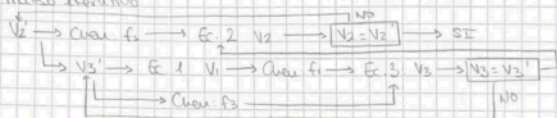
Bernoulli $A \rightarrow P, P \rightarrow C$

$$\frac{1}{2} \left(\frac{V_C^2}{\alpha_C} - \frac{V_A^2}{\alpha_A} \right) + g(z_C - z_A) + \frac{P_C - P_A}{\rho} + \sum F_i + \sum F_j = 0 \quad \left\{ \begin{array}{l} V_C = V_A = 0 \\ P_C = P_A = P_{atm} \end{array} \right.$$

$$g(z_C - z_A) + 2 f_1 V_1^2 \frac{L_1}{D_1} + 2 f_3 V_3^2 \frac{L_3}{D_3} = 0$$

$$9.8(0.15) + 2 f_1 V_1^2 \frac{150}{0.0762} + 2 f_3 V_3^2 \frac{150}{0.0762} = 0 \quad [\text{Ec. 3}]$$

* Proceso iterativo



| V_2' | V_3' | $f_2 \cdot 10^{-3}$ | $f_3 \cdot 10^{-3}$ | V_1 | $f_1 \cdot 10^{-3}$ | V_2 | V_3 |
|--------|--------|---------------------|---------------------|-------|---------------------|-------|-------|
| 2 | 3 | 4.9569 | 6.2883 | 2.333 | 4.8357 | 1.885 | 0.905 |
| 1.885 | 0.905 | 4.9963 | 3.2729 | 1.985 | 4.9705 | 1.885 | 0.905 |

$$Q_1 = V_1 S_1 = V_1 \cdot \frac{\pi}{4} D_1^2 = 1.985 \cdot \frac{\pi}{4} \cdot 0.0762^2 \rightarrow Q_1 = 9.054 \cdot 10^{-4} \text{ m}^3/\text{s}$$

$$Q_2 = V_2 S_2 = 1.885 \cdot \frac{\pi}{4} \cdot 0.0762^2 \rightarrow Q_2 = 8.575 \cdot 10^{-4} \text{ m}^3/\text{s}$$

$$Q_3 = V_3 S_3 = 0.905 \cdot \frac{\pi}{4} \cdot 0.0762^2 \rightarrow Q_3 = 4.536 \cdot 10^{-4} \text{ m}^3/\text{s}$$

Problema tuberías parcial 2023

$$S_c = 20 \text{ cm}^2$$

$$\gamma = 1.4$$

$$M = 299 \text{ /mol}$$

$$R = 8.31 \text{ J/mol.K}$$

$$P_1 = 1500 \text{ kPa}$$

$$T_1 = 35^\circ\text{C} = 308 \text{ K}$$

$$P_2 = 200 \text{ kPa}$$

$$T_2 = 173, 19 \text{ K}$$

• ¿Sección de salida y velocidad crítica?

- Ver que tipo de tubería es

$$\left(\frac{P_2}{P_1}\right) = \left(\frac{2}{\gamma+1}\right)^{\frac{\gamma}{\gamma-1}} = \left(\frac{2}{1.4+1}\right)^{\frac{1.4}{1.4-1}} \rightarrow \left(\frac{P_2}{P_1}\right)_c = 0.5283$$

$$P_{2c} = P_1 \left(\frac{P_2}{P_1}\right)_c = 1500000 \cdot \left(\frac{2}{1.4+1}\right)^{\frac{1.4}{1.4-1}} \rightarrow P_{2c} = 792422.68 \text{ Pa}$$

Como $P_{2c} > P_2$ la tubería es amplificada \rightarrow



• Sacamos T_2 con relaciones termodinámicas

$$P_1 T_1^{\frac{\gamma}{\gamma-1}} = P_2 T_2^{\frac{\gamma}{\gamma-1}} \rightarrow 1500000 \cdot 308^{\frac{1.4}{1.4-1}} = 200000 T_2^{\frac{1.4}{1.4-1}}$$

$$T_2 = 173, 19 \text{ K}$$

- Con la ECT asimilarla que relación V con T sacamos V_2

$$V_2^2 = V_1^2 = 2 \frac{\gamma}{\gamma-1} \frac{R}{M} (T_1 - T_2) \rightarrow V_1 \ll V_2$$

$$V_2^2 = 2 \frac{\gamma}{\gamma-1} \frac{R}{M} (T_1 - T_2) \rightarrow V_2^2 = 2 \frac{1.4}{1.4-1} \frac{8310}{29} \cdot (308 - 173, 19)$$

$$V_2 = 520 \text{ m/s}$$

• En continuidad $m_1 = m_2 = m_c$

$$m = \rho \cdot g$$

$$\rho = V \cdot S$$

$$m = V \cdot S \cdot g \rightarrow V_1 S_1 g_1 = V_2 S_2 g_2 = V_c S_c g_c$$

Sacamos V_c y P_c para sacar g_c y poder tener S_2

ECT $c \rightarrow 2$

$$V_2^2 - V_c^2 = 2 \frac{\gamma}{\gamma-1} \frac{P_2}{\rho_2} \left[\left(\frac{P_c}{P_2}\right)^{\frac{\gamma}{\gamma-1}} - 1 \right] \rightarrow T_2 = \frac{P_2 T_1}{P_c T_1}$$

$$520^2 - V_c^2 = 2 \frac{1.4}{1.4-1} \cdot \frac{200000}{29} \left[\left(\frac{792422.68}{200000}\right)^{\frac{1.4}{1.4-1}} - 1 \right]$$

$$V_c = 320 \text{ m/s}$$

$$V_0 S_2 \rho_2 = V_c \rho_c \rho_c$$

$$520 S_2 \cdot \frac{200000 \cdot 29}{8310 \cdot 173,19} = 320 \cdot 20 \cdot 10^{-4} \cdot \frac{792422,68 \cdot 29}{8310 \cdot 256,67}$$

$$S_2 = 3,29 \cdot 10^{-3} \text{ m}^2$$

5 Necesitamos la T_c usamos relaciones termodinámicas

$$P_c \cdot T_c^{\frac{\gamma}{\gamma-1}} = P_2 \cdot T_2^{\frac{\gamma}{\gamma-1}} \quad 792422,68 \cdot T_c^{\frac{1,4}{1,4-1}} = 200000 \cdot 173,19^{\frac{1,4}{1,4-1}}$$

$$T_c = 256,67 \text{ K}$$

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Problema:3

$$\mu = 100 \text{ cP} \cdot \frac{10^{-3} \frac{\text{kg}}{\text{m} \cdot \text{s}}}{1 \text{ cP}} = 0,1 \text{ kg/m} \cdot \text{s}$$

$$\rho = 0,8 \text{ g/cm}^3 \cdot \frac{1 \text{ kg}}{1000 \text{ g}} \cdot \frac{10^6 \text{ cm}^3}{1 \text{ m}^3} = 800 \text{ kg/m}^3$$

$$\rho_{\text{solu.az}} = 1,46 \text{ g/cm}^3 \cdot \frac{1 \text{ kg}}{1000 \text{ g}} \cdot \frac{10^6 \text{ cm}^3}{1 \text{ m}^3} = 1460 \text{ kg/m}^3$$

23000 rpm

$$m = 2,25 \frac{\text{kg}}{\text{h}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 0,000625 \text{ kg/s}$$

$$m = Q \cdot \rho \rightarrow Q = \frac{m}{\rho} = \frac{0,000625}{800} = 781,25 \cdot 10^{-9} \text{ m}^3/\text{s}$$

$$h = 19,5 \text{ cm} \rightarrow 0,195 \text{ m}$$

$$r_2 = 2,25 \text{ cm} \rightarrow 0,0225 \text{ m}$$

$$r_1 = 0,72 \text{ cm} \rightarrow 0,0072 \text{ m}$$

$$23000 \frac{\text{rev}}{\text{min}} \cdot \frac{1 \text{ min}}{60 \text{ s}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} = 2408,55 \text{ rad/s}$$

a) Determinar el diámetro de partícula crítica

$$\varepsilon_T = \frac{\pi \cdot \omega^2 \cdot h \cdot (3 \cdot r_2^4 + r_1^4)}{2g}$$

$$\varepsilon_T = \frac{\pi \cdot (2408,55)^2 \cdot 0,195 \cdot (3 \cdot 0,0225^4 + 0,0072^4)}{2 \cdot 9,8} = 265,976$$

$$v_{TG} = 2,94 \cdot 10^{-9}$$

$$v_{TG} = \frac{Q}{\varepsilon_T}$$

$$D_p = 9,04 \cdot 10^{-7}$$

$$v_{TG} = \frac{D_p^3 \cdot (\rho_p - \rho_f) \cdot g}{18\mu}$$

WUOLAH

b) centrifuga discos 50 discos $\alpha = 45^\circ$

$$r_1 = 4,77 \text{ cm} \rightarrow 0,0477$$

$$r_2 = 14,5 \text{ cm} \rightarrow 0,145 \text{ m}$$

$$6000 \text{ rpm} \cdot \frac{1 \text{ min}}{60 \text{ s}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} = 628,318 \text{ rad/s}$$

caudal?

$$\alpha = 45^\circ \quad \text{---} \quad x$$

$$180^\circ \quad \text{---} \quad \pi \text{ rad}$$

$$x = \frac{\pi \text{ rad} \cdot 45}{180} = \frac{1}{4} \pi = 0,785 \text{ rad}$$

$$\Sigma_1' = 12154,827$$

$$\frac{Q}{Q'} = \frac{E}{E'} \rightarrow Q' = \frac{Q \cdot E'}{E} = \frac{731,4 \cdot 10^{-9} \cdot 12154,827}{265,976} = 35,71 \cdot 10^{-6}$$