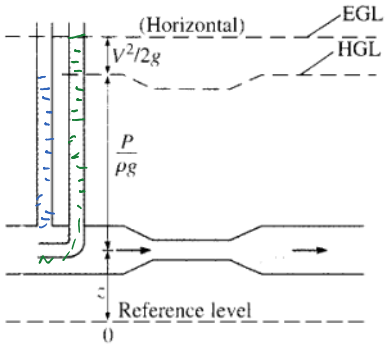
Meeting_021

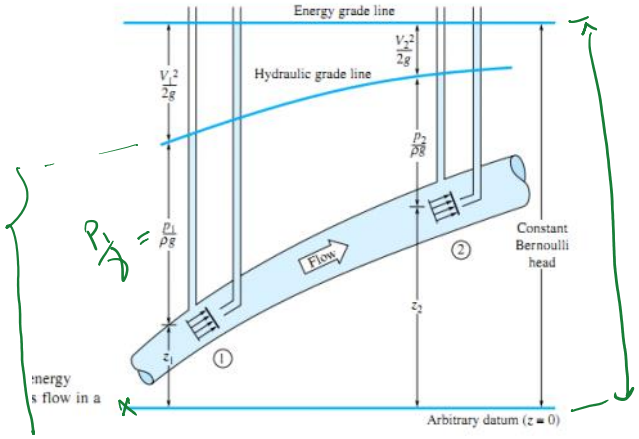
Wednesday, December 23, 2020 8:57 AM

خط شیب هیدرولیکی HGL = z + P/γ

~ ~ انرژی EGL = z + P/γ + V²/2g

$z_1 + P_1/\gamma + V_1^2/2g = z_2 + P_2/\gamma + V_2^2/2g$

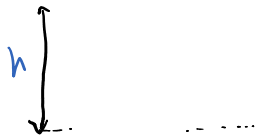


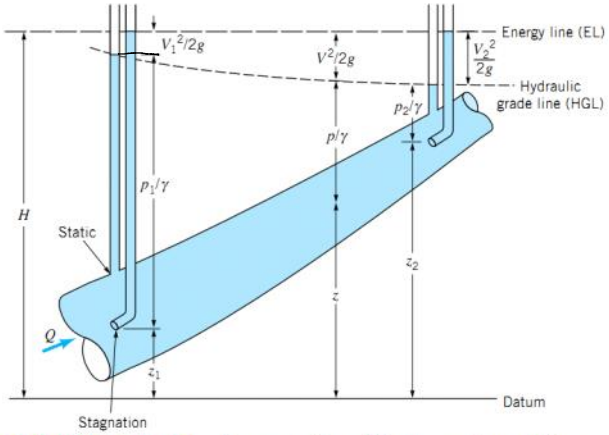


① ⇒ $P_1/\gamma = 0$

$V_1^2/2g = 0$

$z = h$





■ FIGURE 3.21 Representation of the energy line and the hydraulic grade line.

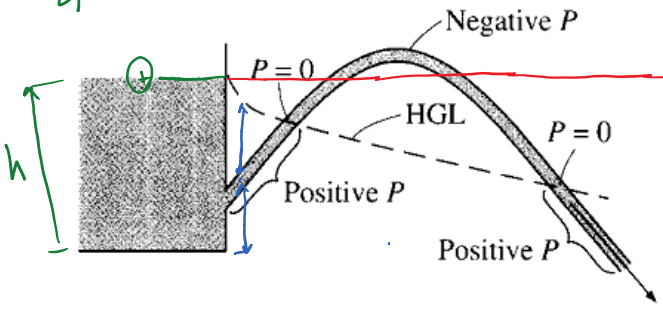
① $\begin{cases} P_1/\gamma = 0 \\ V_1^2/2g = 0 \\ z_1 = h \end{cases}$

$H = P_1/\gamma + z_1 = 0 + h = h$

$E = P_1/\gamma + z_1 + V_1^2/2g = 0 + h + 0 = h$

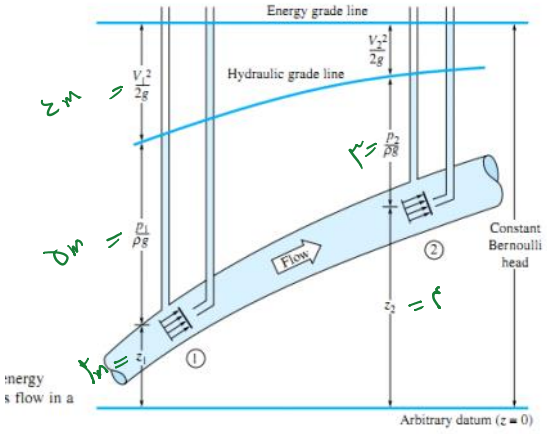
$H = P/\gamma + z$

$E = P/\gamma + z + V^2/2g$



خط انرژی E

با توجه به اطلاعات داده شده سوال برای به کنید



$z_1 = 2m$ $\quad p_1/\gamma = 5m$ $\quad v_1^2/2g = 2m$

$z_2 = 4$ $\quad p_2/\gamma = 3m$ $\quad v_2^2/2g = ?$

$$z_1 + \frac{p_1}{\gamma} + \frac{v_1^2}{2g} = z_2 + \frac{p_2}{\gamma} + \frac{v_2^2}{2g} \Rightarrow 2+5+4 = 4+3+\frac{v_2^2}{2g}$$

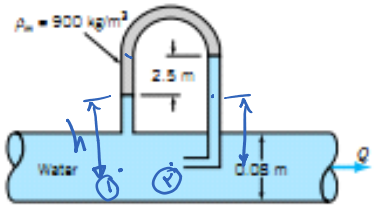
$\bar{V}_2 = ?$

$\gamma_m = \rho_m g = 900 \times 10 = 9000 \frac{N}{m^3} = 9 \frac{KN}{m^3} \rightarrow S_m = \frac{\gamma_m}{\gamma_w} = \frac{9}{10} = 0.9$

$Q = A\bar{V}$

$= \pi/4 (0.08)^2 \cdot \bar{V}_2$

دبی عبوری از لوله را به کنید



■ FIGURE P3.47

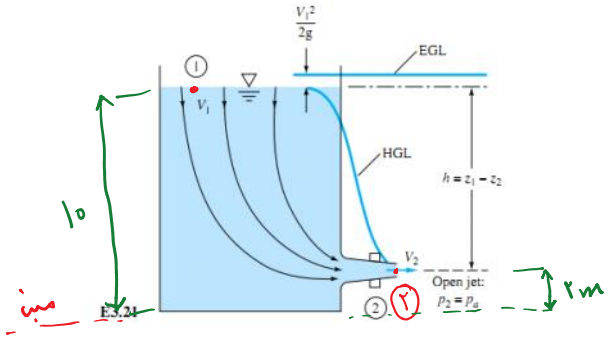
$\begin{cases} \bar{V}_1 = \bar{V}_2 \\ z_1 = z_2 \end{cases}$ $\quad p_1 = p_2$

$$\frac{p_1}{\gamma} - h \cdot S_w - 2.5 \times (0.9) + 2.5 \times S_w + h \times S_w = \frac{p_2}{\gamma} + \frac{v_2^2}{2g}$$

$$\Rightarrow -2.5 \times 0.9 + 2.5 \times 1 = \frac{v_2^2}{2g} \Rightarrow 2.5(1-0.9) = \frac{v_2^2}{2g}$$

$0.125 \times 20 = \bar{V}_2^2 \rightarrow \bar{V}_2 = \sqrt{2.5 \times 25}$

مثال: با فرض اینکه سطح آب در داخل تانک ۱۰ متر است و سطح آب در داخل تانک ثابت باقی می ماند سرعت آب در نقطه (۲) را به کنید؟



جایی که آب وارد اتمسفر می شود را مبنا قرار می دهیم.

$$\frac{p_1}{\gamma} + \frac{v_1^2}{2g} = z_2 + \frac{p_2}{\gamma} + \frac{v_2^2}{2g}$$

مبنا

$$\textcircled{1}\begin{cases} z_1 = 10\,m \\ (P_1/\gamma)_g = 0 \\ V_1^2/2g = 0 \end{cases}$$

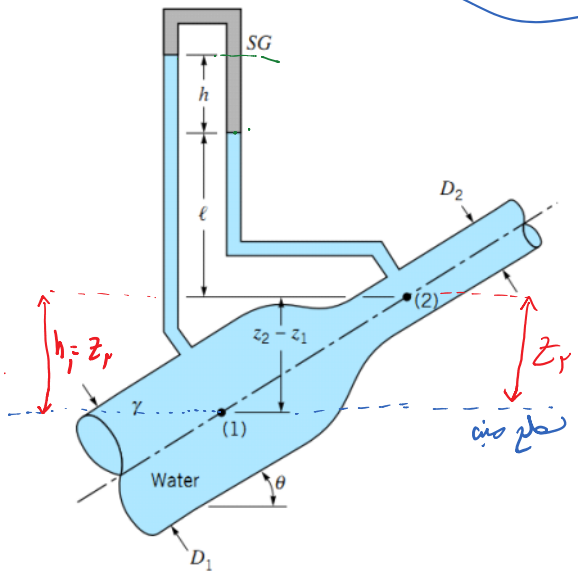
$$\textcircled{2}\begin{cases} z_2 = 4\,m \\ (P_2/\gamma)_g = 0 \\ V_2^2/2g = ? \end{cases}$$

$$z_1 + P_1/\gamma + V_1^2/2g = z_2 + P_2/\gamma + V_2^2/2g$$

$$10 + 0 + 0 = 4 + 0 + V_2^2/2g$$

$$6 = V_2^2/2g \rightarrow V_2^2 = 14g$$

$$\boxed{V_2 = \sqrt{14g}}$$



دبی سنج

$$Q_1 = Q_2 = Q$$

$$Q_1 = A_1 V_1 \rightarrow V_1 = Q/A_1 \quad (1)$$

$$Q_2 = A_2 V_2 \rightarrow V_2 = Q/A_2 \quad (2)$$

$$P_1/\gamma - h_1 \times S_w - \ell \cdot S_w - h S_w + h \cdot S_g + \ell \cdot S_w = P_2/\gamma$$

$$\frac{P_2}{\gamma} - \frac{P_1}{\gamma} = h[S_g - S_w] - h_1 S_w \quad *** (3)$$

رابطه مانومتر

رابطه برنولی $\rightarrow$ $z_1 + \frac{P_1}{\gamma} + \frac{V_1^2}{2g} = z_2 + P_2/\gamma + \frac{V_2^2}{2g}$

$$\frac{V_1^2}{2g} - \frac{V_2^2}{2g} = \left(\frac{P_2}{\gamma} - \frac{P_1}{\gamma}\right) + (z_2 - z_1)$$

$$\frac{V_1^2}{2g} - \frac{V_2^2}{2g} = (\ \ \frac{}{\gamma}\ \ \frac{}{\gamma}$$

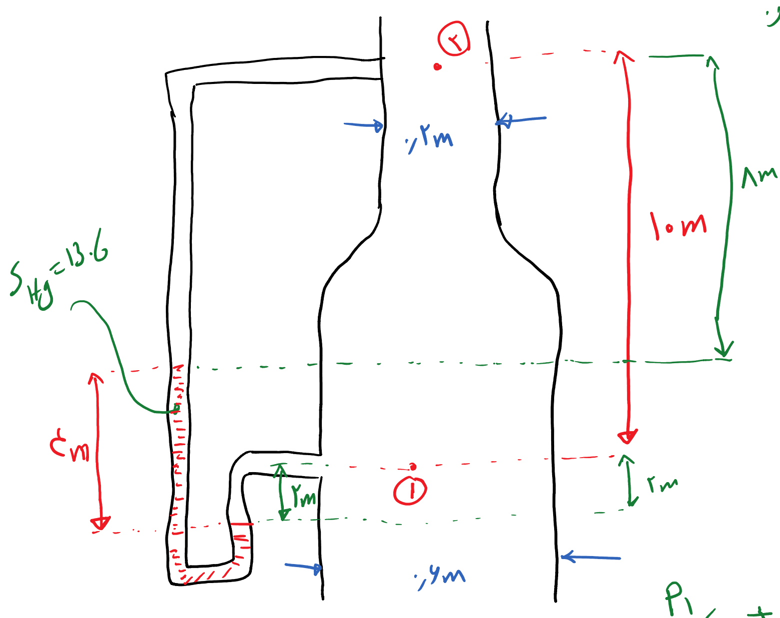
$$\frac{Q^2}{2g A_1^2} - \frac{Q^2}{2g A_2^2} = \left(\frac{P_2}{\gamma} - \frac{P_1}{\gamma}\right) + (Z_2 - Z_1)$$

$$\frac{Q^2}{2g}\left[\frac{1}{A_1^2} - \frac{1}{A_2^2}\right] = \left[\frac{P_2}{\gamma} + \frac{P_1}{\gamma}\right] + \left[Z_2 - Z_1\right]$$

از رابطه فوق که فقط دبی در آن مجهول است استفاده کنیم تا مقدار دبی حاصل شود.

$$S_p = \frac{\gamma_p}{\gamma_w} \Longrightarrow \gamma_p = S_p \cdot \gamma_w = ۰/۸۲ \times ۱۰ = ۸/۲\ \frac{kN}{m^3}$$

در این لوله عمودی بنزین با $S_p = ۰/۸۲$ جریان دارد.
دبی عبوری بنزین را حساب کنید.



$$A_1 = \frac{\pi}{4}(۰/۶)^2 = ۰/۲۷\ m^2$$

$$A_2 = \frac{\pi}{4}(۰/۲)^2 = ۰/۰۳\ m^2$$

$$V_1 = \frac{Q}{A_1} = \frac{Q}{۰/۲۷} = ۳/۷Q$$

$$V_2 = \frac{Q}{A_2} = \frac{Q}{۰/۰۳} = ۳۳/۳Q$$

$$\frac{P_1}{\gamma_w} + ۲\times S_p - ۴\times S_{Hg} - ۸\cdot S_p = \frac{P_2}{\gamma_w}$$

$$\frac{P_2}{\gamma_w} - \frac{P_1}{\gamma_w} = \left[۲\times S_p - ۴ S_{Hg} - ۸ S_p\right] = (۲\times ۰/۸۲ - ۴\times 13.6 - ۸\times ۰/۸۲)$$

$$۱/۶۴ - ۵۴/۴ - ۶/۵۶ = -۵۹/۳۲$$

$$\frac{P_2}{\gamma_w} - \frac{P_1}{\gamma_w} = -59.49 \rightarrow \frac{P_2}{\gamma_p} - \frac{P_1}{\gamma_p} = -59.49 \times \frac{\gamma_w}{\gamma_p}$$

$$\frac{P_2}{\gamma_p} - \frac{P_1}{\gamma_p} = -59.49 \times \frac{10}{13.2} = -72 \text{ m}$$

$$z_1 + \frac{P_1}{\gamma_p} + \frac{(3.7Q)^2}{2g} = z_2 + \frac{P_2}{\gamma_p} + \frac{(2.2Q)^2}{2g}$$

$$\frac{P_2}{\gamma_p} - \frac{P_1}{\gamma_p} + (z_2 - z_1) = \frac{(3.7)^2 Q^2}{2g} - \frac{(2.2)^2 Q^2}{2g}$$

$$-72 + 10 = \frac{(3.7)^2 - (2.2)^2}{20} Q^2 \rightarrow Q = ?$$