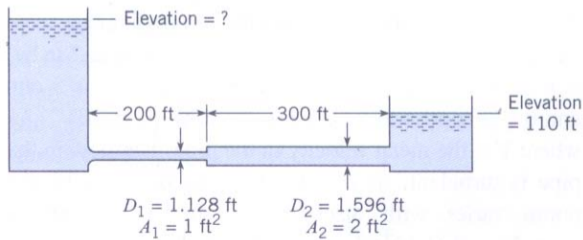


7.70 Water flows from the reservoir on the left to the reservoir on the right at a rate of 16 cfs. The formula for the head losses in the pipes is $h_L = 0.02(L/D)(V^2/2g)$. What elevation in the left reservoir is required to produce this flow? Also carefully sketch the HGL and the EGL for the system. *Note:* Assume the head-loss formula can be used for the smaller pipe and also for the larger pipe.



PROBLEM 7.70

7.70 Information and assumptions

provided in problem statement

Find

elevation in left reservoir.

Solution

Write the energy equation from the left reservoir to the right reservoir:

$$\begin{aligned}
 p_L/\gamma + V_L^2/2g + z_L &= p_R/\gamma + V_R^2/2g + z_R + h_L \\
 0 + 0 + z_L &= 0 + 0 + 110 + 0.02(200/1.128)(V_1^2/2g) \\
 &\quad + 0.02(300/1.596)(V_2^2/2g) + (V_1 - V_2)^2/2g + V_2^2/2g
 \end{aligned}$$

when

$$V_1 = Q/A_1 = 16/1 = 16 \text{ ft/s}$$

$$V_2 = 8 \text{ ft/s}$$

$$\begin{aligned}
 z_L &= 110 + (0.02/2g)((200/1.238)(16^2) + (300/1.596)(8^2)) + ((16 - 8)^2/64.4) + 8^2/64.4 \\
 &= 110 + 17.83 + 0.99 + 0.99
 \end{aligned}$$

$$z_L = \underline{\underline{129.8 \text{ ft}}}$$

