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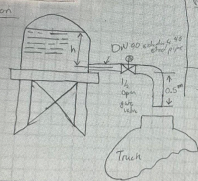
Problem 23

MET 330 | HW 3.1

Problem # 23

Given



Required

Determine the required depth h in tank to produce a flow of 1500 L/min into the truck

flow = 1500 L/min

spec grav = 0.68

T = 25°C

Answer

h = 3.35

Solution

$A = \frac{\pi}{4} D^2 = 0.001683$

$1500 \, L/m \cdot \frac{1 \, m^3/s}{60{,}000 \, L/m}$

$Q = 0.025 \, m^3/s$

$Q = AV$

$V = \frac{Q}{A}$

$V = \frac{.025}{.001683}$

$V = 14.85 \, m/s$

$h = \frac{V}{\sqrt{2g}}$

$h = \frac{14.85}{\sqrt{2g}} = \frac{14.85 \, m/s}{\sqrt{2 \cdot 9.81 \, m/s^2}}$

$h = 3.35 \, m$

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MET 330

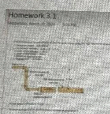
HW 3.1

Team Vortex

3/21/2024

Chapter 11

Problem 5



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$Q = V_A \cdot \frac{0.015}{0.076^2 \cdot \frac{\pi}{4}}$ $\quad$ $\frac{0.015}{0.0025^2 \frac{\pi}{4}} = 7.634$ m/s

$V_A = 0.8488$ m/s

$$\frac{P_A}{\gamma} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma} + \frac{V_B^2}{2g} + z_B + h$$

$$\frac{P_A}{8.80\ kN/m^3} + \frac{(0.8488\ m/s)^2}{2(9.8\ m/s)} + 0 = \frac{12{,}500\ kPa}{8.80\ kN/m^3} + \frac{7.634^2\ m/s}{2 \cdot 9.8\ m/s} + 4.5m + h$$

$$h = f\frac{L}{D} \cdot \frac{v^2}{2g} + k\frac{v^2}{2g} + 2\left(\frac{v^2}{2g}\right)k$$

↑length $\quad$ ↑sudden retraction $\quad$ ↑elbow

$$N_{RA} = \frac{0.892 \cdot 0.1463}{2.12 \cdot 10^{-5}} = 6.15 \cdot 10^3$$

$$\frac{D}{\varepsilon} = \frac{0.1463}{4.6 \cdot 10^{-5}} = 3180$$

$f_A = 0.035$

$$N_R = \frac{7.87 \cdot 0.0493}{2.12 \cdot 10^{-5}}$$

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