

13.22) Given: $1\frac{1}{2} \times 3-6$ centrifugal pump

Determine: Describe each part of pump designation

Solution:

 $1\frac{1}{2} \times 3-6$ Diameter of
flange for
pump outletDiameter of
flange for
pump inletDiameter of
propeller
(Casing size)

13.34) b) Given: 500 gal/min of water at 800ft of total head

Determine: list at least one appropriate type of pump

Solution: Using Pump Selection Chart from the textbook (Fig. 13.52)

the appropriate type of pump is Reciprocating

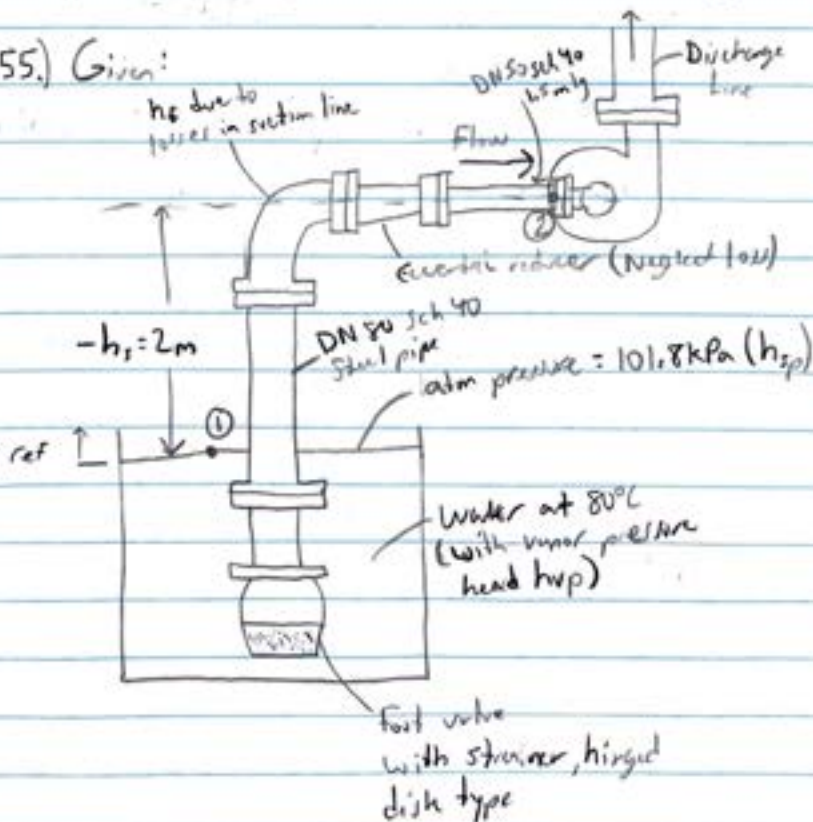
f.) Given: 8000 gal/min of water at 200ft of head

Determine: list at least one appropriate type of pump

Solution: Using Pump Selection Chart from the textbook (Fig. 13.52)

the appropriate type of pump is Centrifugal 1750 RPM

13.55) Given:



$$Q = 300 \text{ L/min}$$

$$\gamma = 9.57 \text{ kN/m}^3$$

$$V = 3.60 \times 10^{-7} \text{ m}^3/\text{s}$$

$$D_{80} = 77.9 \text{ mm} = .0779 \text{ m}$$

$$A_{80} = 4.768 \times 10^{-3} \text{ m}^2$$

$$D_{50} = 52.5 \text{ mm} = .0525 \text{ m}$$

$$A_{50} = 2.168 \times 10^{-3} \text{ m}^2$$

$$E = 4.6 \times 10^{-5} \text{ m}$$

Determine: Available NPSH for the system

Solution:

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + Z_2 + h_{L1-2}$$

$$h_{L1-2} = h_{L \text{ Entrance}} + h_{L \text{ DN80}} + h_{L \text{ Elbow}} + h_{L \text{ DN50}}$$

$$h_{sp} = \frac{P}{\gamma} = \frac{101.8 \text{ kPa}}{9.53 \text{ kN/m}^3} = 10.68 \text{ m}$$

DN 80 Pipe:

$$V_{80} = \frac{Q}{A_{80}} = \frac{300 \text{ L/min}}{4.768 \times 10^{-3} \text{ m}^2} = \frac{0.005 \text{ m}^3/\text{s}}{4.768 \times 10^{-3} \text{ m}^2} = 1.049 \text{ m/s}$$

$$N_R = \frac{V_{80} D_{80}}{\nu} = \frac{(1.049 \text{ m/s})(0.0779 \text{ m})}{3.60 \times 10^{-7} \text{ m}^2/\text{s}} = 226991.94$$

$$\frac{D_{80}}{\epsilon} = \frac{0.0779 \text{ m}}{4.6 \times 10^{-5} \text{ m}} = 1693.48$$

$$f_{80} = \frac{0.25}{\left[\log \left(\frac{1}{3.7(D/\epsilon)} + \frac{5.74}{N_R^{0.9}} \right) \right]^2} = \frac{0.25}{\left[\log \left(\frac{1}{3.7(1693.48)} + \frac{5.74}{(226991.94)^{0.9}} \right) \right]^2} = 0.01920$$

DN 50 Pipe:

$$V_{50} = \frac{Q}{A_{50}} = \frac{300 \text{ L/min}}{2.168 \times 10^{-3} \text{ m}^2} = \frac{0.005 \text{ m}^3/\text{s}}{2.168 \times 10^{-3} \text{ m}^2} = 2.306 \text{ m/s}$$

$$N_R = \frac{V_{50} D_{50}}{\nu} = \frac{(2.306 \text{ m/s})(0.0525 \text{ m})}{3.60 \times 10^{-7} \text{ m}^2/\text{s}} = 336291.67$$

$$\frac{D_{50}}{\epsilon} = \frac{0.0525 \text{ m}}{4.6 \times 10^{-5} \text{ m}} = 1141.30$$

$$f_s = \frac{0.25}{\left[\log \left(\frac{1}{3.7(D/\epsilon)} + \frac{5.74}{\text{Re}^{0.9}} \right) \right]^2} = \frac{0.25}{\left[\log \left(\frac{1}{3.7(1141.30)} + \frac{5.74}{336291.67^{0.9}} \right) \right]^2} = .0201$$

$$h_{L_{\text{valve}}} = K \frac{V^2}{2g} = \frac{75 f_s V^2}{2g} = \frac{75(.0201)(1.049)^2}{2(9.81)} = .0715 \text{ m}$$

$$h_{L_{\text{pipe}}} = f \times \frac{L}{D} \times \frac{V^2}{2g} = \frac{.01920 \times 2}{.0779} \times \frac{1.049^2}{2(9.81)} = .0276 \text{ m}$$

$$h_{L_{\text{DN50}}} = f \times \frac{L}{D} \times \frac{V^2}{2g} = \frac{.0201 \times 1.5}{.0525} \times \frac{2.306^2}{2(9.81)} = .1557 \text{ m}$$

$$h_{L_{\text{elbow}}} = K \frac{V^2}{2g} = \frac{20 f_s V^2}{2g} = \frac{20(.0201)(1.049)^2}{2(9.81)} = .0191 \text{ m}$$

$$h_{vp} = \frac{P_{vp}}{\gamma} = \frac{47.34}{9.53} = 4.967 \text{ m}$$

$$h_{L_{1-2}} = h_{L_{\text{valve}}} + h_{L_{\text{DN20}}} + h_{L_{\text{elbow}}} + h_{L_{\text{DN50}}}$$

$$h_{L_{1-2}} = .0715 \text{ m} + .0276 \text{ m} + .0191 \text{ m} + .1557 \text{ m}$$

$$h_{L_{1-2}} = .2739 \text{ m}$$

$$\text{NPSH}_{\text{avail}} = \frac{P_{\text{svt}} - P_v}{\gamma} = \frac{P_1 - P_v}{\gamma} + (z_1 - z_{\text{svt}}) - h_{L_{\text{svt}}}$$

$$\text{NPSH}_{\text{avail}} = \frac{101.8 - 47.34}{9.53} + (-2) - .2739 \text{ m}$$

$$\text{NPSH}_{\text{avail}} = 3.441 \text{ m}$$