

Problem No. 3

The 9.75 in. impeller option of the Taco Model 4013 F1 series centrifugal pump (pump curve given by Figure P3-2) is used to pump 200 GPM of water at 25 C from an open reservoir whose surface is above the centerline of the pump inlet (Figure P3-1). The piping system from the reservoir to the pump consists of 10.0 ft of cast iron pipe with an ID of 2.0 in. and an average roughness of 0.02 in. There are several minor losses: a sharp-edge inlet ($K_c = 0.5$), three flanged smooth 90 degree elbows ($K_e = 0.3$ each) and a fully open flanged globe valve ($K_v = 6.0$).

Estimate the minimum elevation of the liquid surface above the pump inlet required to operate the pump without cavitation.

Hint: Recall that the NPSH is the difference between the head at the pump inlet and the vapor pressure head (Equation 1).

Data: Vapor pressure of water at 25 C = 3.169 kPa

Density of water = 997.0 kg /m³

Viscosity of water = 8.91 X 10⁻⁴ km / m s

P_{atm} = 101.3 kPa

$$NPSH = \left(\frac{P}{\rho g} + \frac{V^2}{2g} \right)_{Pump\ Inlet} - \frac{P_{vap}}{\rho g} \quad \text{Equation 1}$$

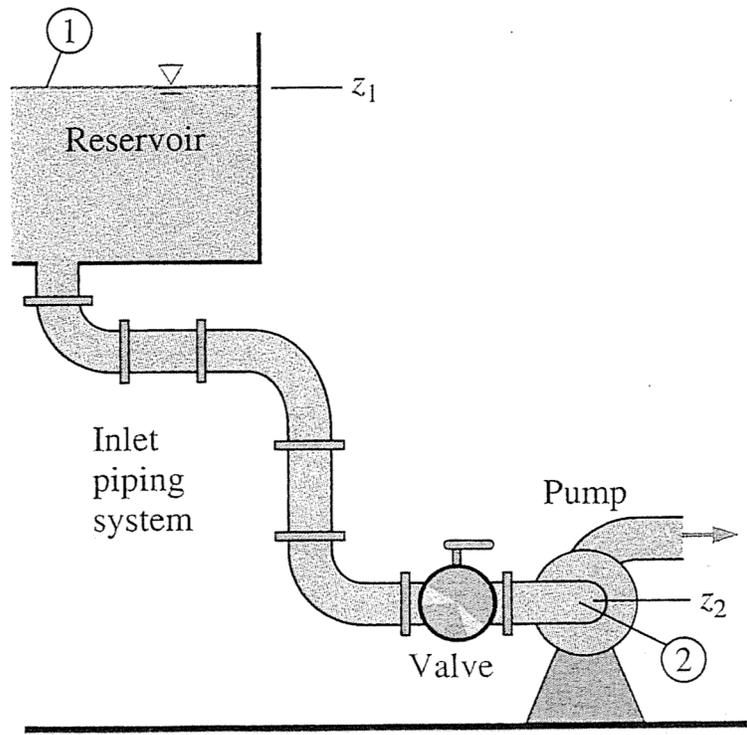


Figure P3 -1

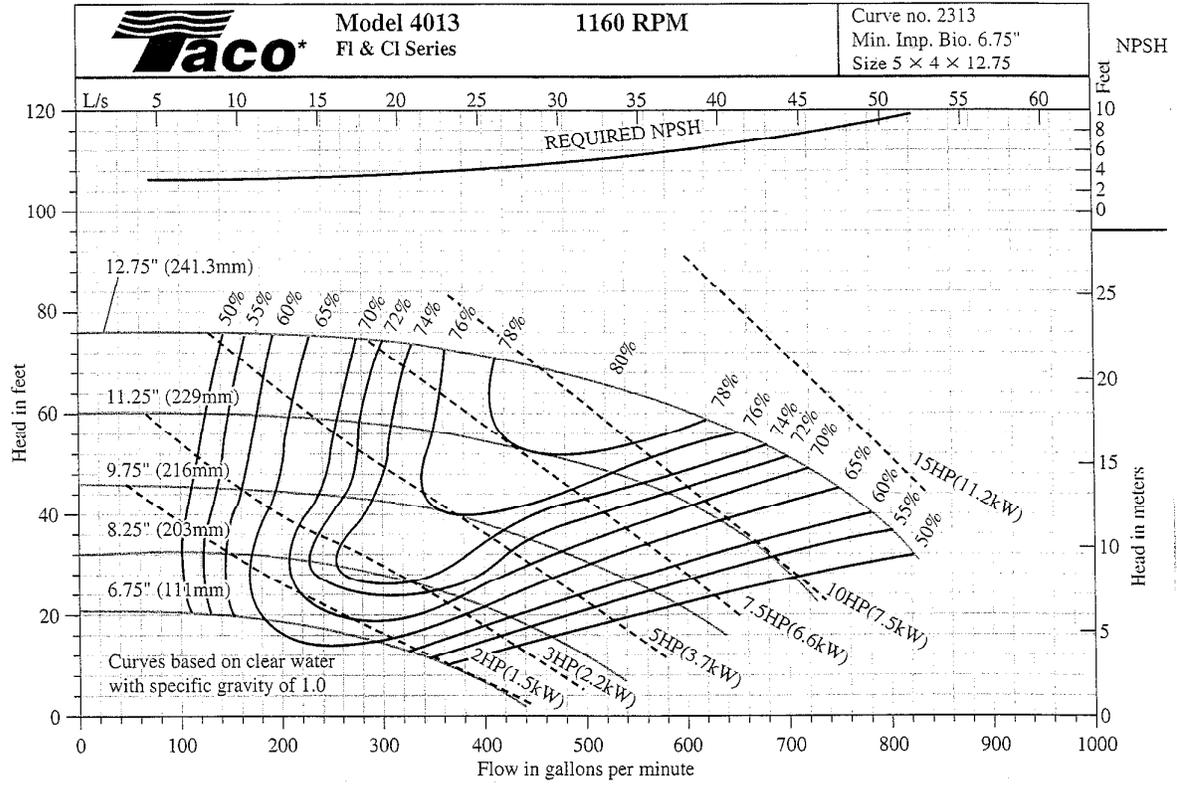


Figure P3-2