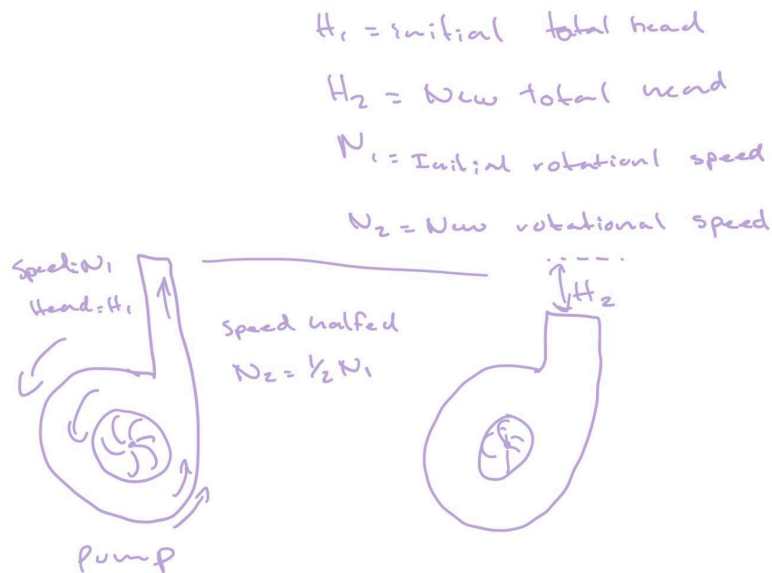


13.17 For a given centrifugal pump, if the speed of rotation of the impeller is cut in half, how does the total head capability change?



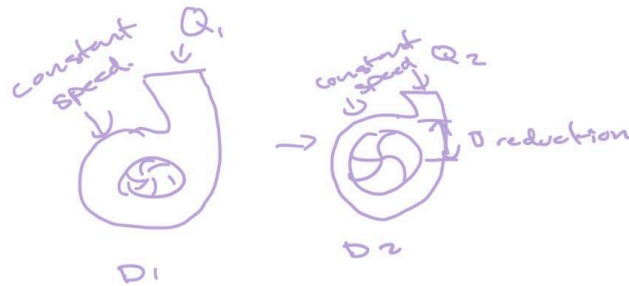
$$\frac{H_2}{H_1} = \left(\frac{N_2}{N_1} \right)^2$$

$$\frac{H_2}{H_1} = (0.5)^2$$

$$\frac{H_2}{H_1} = 0.25 \text{ or } \frac{1}{4}$$

reduced by $\frac{1}{4}$

13.19 For a given size of centrifugal pump casing, if the diameter of the impeller is reduced by 25 percent, how much does the capacity change?



$$\frac{Q_2}{Q_1} = \frac{D_2}{D_1} \rightarrow \frac{Q_2}{Q_1} = \frac{0.75 D_1}{D_1} = 0.75$$

Capacity reduced by 25%

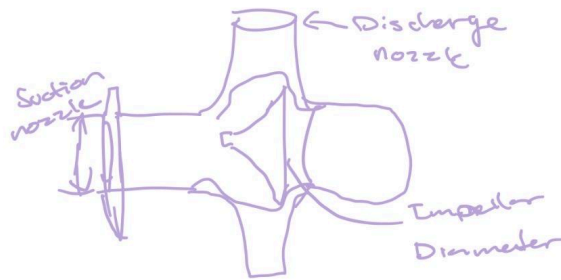
Q_1 = Initial capacity

Q_2 = New Capacity

D_1 = Initial Diameter

D_2 = New Diameter

13.22 Describe each part of this centrifugal pump designation: 1 1/2 x 3 - 6

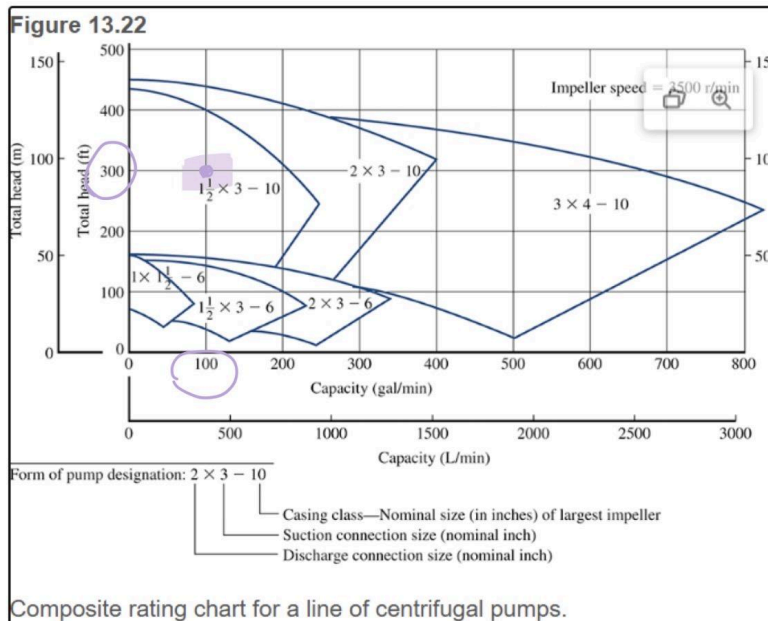


1 1/2 is discharge port: diameter of pump discharge nozzle, in inches

3 is Suction Port: diameter of pump suction nozzle in inches

6 is Max Impeller Diameter: refers to nominal maximum diameter of impeller to fit into pump casing. in inches.

13.23 For the line of pumps shown in Fig. 13.22, specify a suitable size for delivering 100 gal/min of water at a total head of 300 ft.

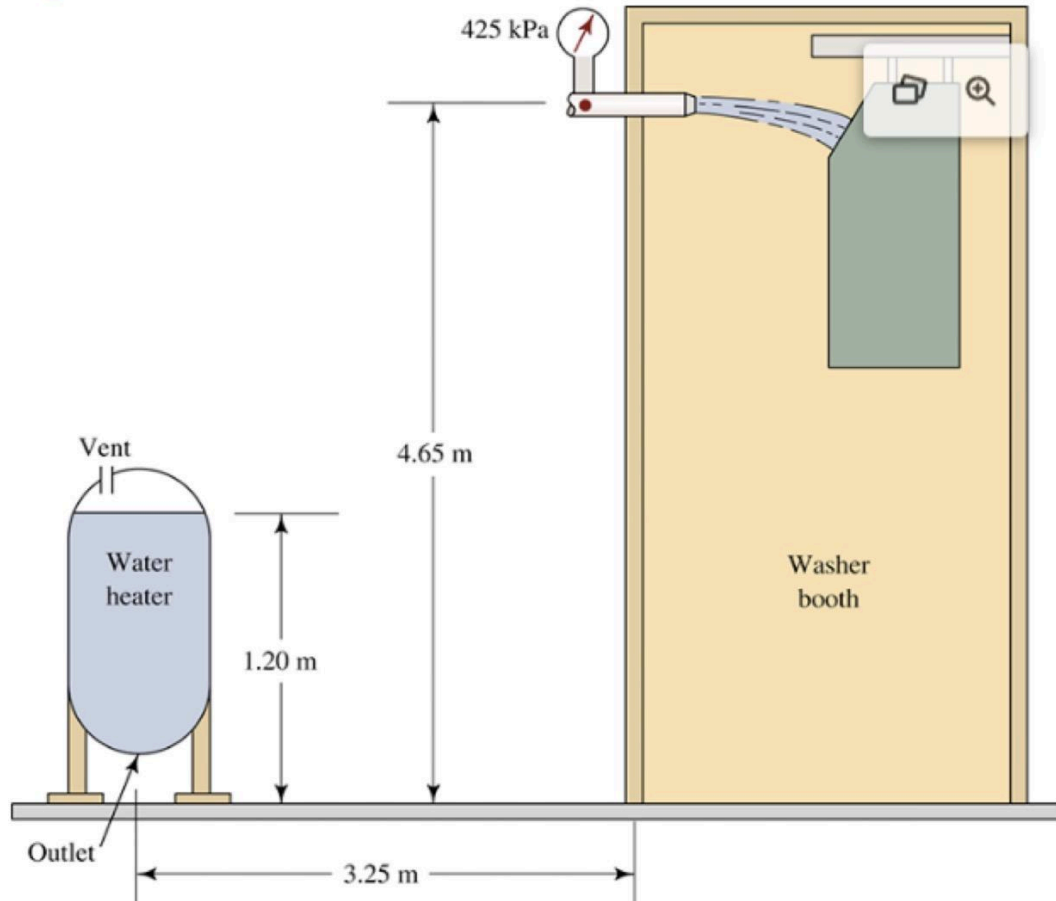


pump 1 1/2 x 3 - 10



DP 2. Design a system to pump water at 80°C from a water heater to a washing system, as shown in Fig. 13.56. The desired minimum flow rate is 750 L/min (198 gal/min). A cylindrical elevated and vented water heater with a closed shell holds water up to a level of 1.20 meters from the ground. A tall rectangular washed booth is placed besides the heater at distance 3.25 meters. A horizontal pipe fit with a gauge that reads 425 kilo Pascal of pressure at height 4.65 meters from the ground level enters the booth on the top-left side. The water flows with a pressure on to the cut plane of a rectangular block suspended inside the bath from a horizontal rod.

Figure 13.56



water at 80°C $\rho = 972 \text{ kg/m}^3$

$$Q : 250 \text{ L/min} = 0.0125 \text{ m}^3/\text{s}$$

$$z_1 = 1.20 \text{ m}$$

$$z_2 = 4.65 \text{ m}$$

$$\Delta z = z_2 - z_1$$

$$P_1 = 0$$

$$P_2 = 425000 \text{ Pa}$$

$$\frac{P_1}{\rho} + \frac{V_1^2}{2g} + z_1 + h_p = \frac{P_2}{\rho} + \frac{V_2^2}{2g} + z_2 + h_L$$

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

$$= \frac{425000}{972 \times 9.81} + 4.65 - 1.20 + \frac{2.5^2}{2 \times 9.81}$$

$$= 48.34 \text{ m}$$
