7.48

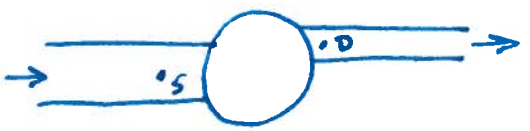
PUMP AS SHOWN
- SUCTION PIPE 12in.
- DISCHARGE PIPE 6in.

$Q = 3.0 cfs$

$p_s = 5 psi$

$p_d = 55 psi$

WHAT IS POWER SUPPLIED ?



EQUATIONS

ENERGY ACROSS PUMP, ASSUME NEGLIGIBLE Δz

$$\frac{p_s}{\gamma} + \frac{V_s^2}{2g} + \cancel{z_s} + h_p = \frac{p_d}{\gamma} + \frac{V_d^2}{2g} + \cancel{z_d} + \underbrace{h_F}_{0}$$

$z_s \approx z_d$

$$V_s = \frac{Q}{A_s} = \frac{3.0 cfs}{\frac{\pi (1 ft^2)}{4}} =$$

$= 3.82 ft/s$

$$\frac{V_s^2}{2g} = \frac{(3.82 ft/s)^2}{2(32.2 ft/s^2)} = 0.226 ft$$

$$V_d = \frac{Q}{A_d} = \frac{3.0 cfs}{\frac{\pi (0.5 ft)^2}{4}}$$

$= 15.27 ft/s$

$$\frac{V_d^2}{2g} = \frac{(15.27 ft/s)^2}{2(32.2 ft/s^2)} = 3.62 ft$$

7.48 (CONTINUED)

$$\frac{p_s}{\gamma} = \frac{5\ lbf/in^2 \cdot 144\ in^2/1\ ft^2}{62.4\ lbf/ft^3} = 11.54\ ft$$

$$\frac{p_d}{\gamma} = \frac{55\ lbf/in^2 \cdot 144\ in^2/1\ ft^2}{62.4\ lbf/ft^3} = 126.9\ ft$$

SUBSTITUTE SOLVE FOR h_p

$$h_p = \frac{p_d}{\gamma} - \frac{p_s}{\gamma} + \frac{V_d^2}{2g} - \frac{V_s^2}{2g}$$

$$= 126.9\ ft - 11.54\ ft + 3.62\ ft - 0.226\ ft = 118.77\ ft$$

$$P = Q\gamma h = \left(\frac{3\ ft^3}{s} \times \frac{62.4\ lbf}{ft^3}\right)(118.77\ ft)$$

$$= 22235.06\ \frac{lbf-ft}{sec} \times \frac{1\ hp}{550\ \frac{lbf-ft}{sec}}$$

$$= \underline{40.43\ hp} \leftarrow \text{Power}$$