Calculate the maximum hydraulic horsepower by assuming 100% pumping efficiency. For the Water Horsepower formula selected, the units for the flow rate, Q, must be gpm. The units for head, h, must be ft.

$$whp = \frac{Q\Delta h}{3960}$$

$$whp = \frac{(63)\,(8)}{3960} = 0.13hp$$

Answer B

46.45 A 70% efficient pump driven by a 93% efficient motor delivers $150gpm$ of $120°F$ hot water at a head of $40ft$ with a rotational speed of $1800rpm$. The pump runs from 7am-7pm Monday-Friday year round. The average cost of electricity is \$0.12/kWh. What is the annual cost to run the pump?

A. \$275

B. \$300

C. \$650

D. \$700

Calculate the Water Horsepower.

$$whp = \frac{Q\Delta h}{3960}$$

$$whp = \frac{(150)\,(40)}{3960} = 1.5hp$$

Calculate the electrical power required to drive the pump by dividing by the pump efficiency and motor efficiency. Convert units from hp to KW.

$$\dot{W} = \frac{whp}{\eta_{pump}\eta_{motor}} = \frac{1.5hp}{(0.7)\,(0.93)} = 1.7KW$$

Calculate the cost of running based on the power, the annual run time, and the cost of electricity.

$$C = (1.7KW)\left(\frac{12hr}{day}\right)\left(\frac{5days}{wk}\right)(52wks)\left(\frac{\$0.12}{kWh}\right) = \$636$$

Answer C

46.46 A condenser water pump is located $5ft$ below the top of the waterline of a cooling tower basin. The leaving water temperature is $75°F$. The friction loss on the suction side of the pump is $9ft$ of head. What is the net positive suction head available?

A. $4ft$

B. $9ft$

C. $29ft$

D. $37ft$

Refer to the first formula in the Reference Handbook for Net Positive Suction Head Available. Calculate the NPSHA by taking the sum of the atmospheric pressure, h_p, and the height of the fluid column on the suction side of the pump, h_z, minus the vapor pressor, h_{vpa}, and the losses on the suction side, h_f. The vapor pressure is the saturation pressure at the temperature of the water and can be found using the Properties of Saturated Water and Steam table by temperature.

$$h_{vpa} = P_{sat@75°F} = 0.43psi\left(2.31\frac{ft}{psi}\right) \approx 1ft$$

$$NPSH_A = h_p + h_z - h_{vpa} - h_f$$

$$NPSH_A = 34ft + 5ft - 1ft - 9ft = 29ft$$

Answer C