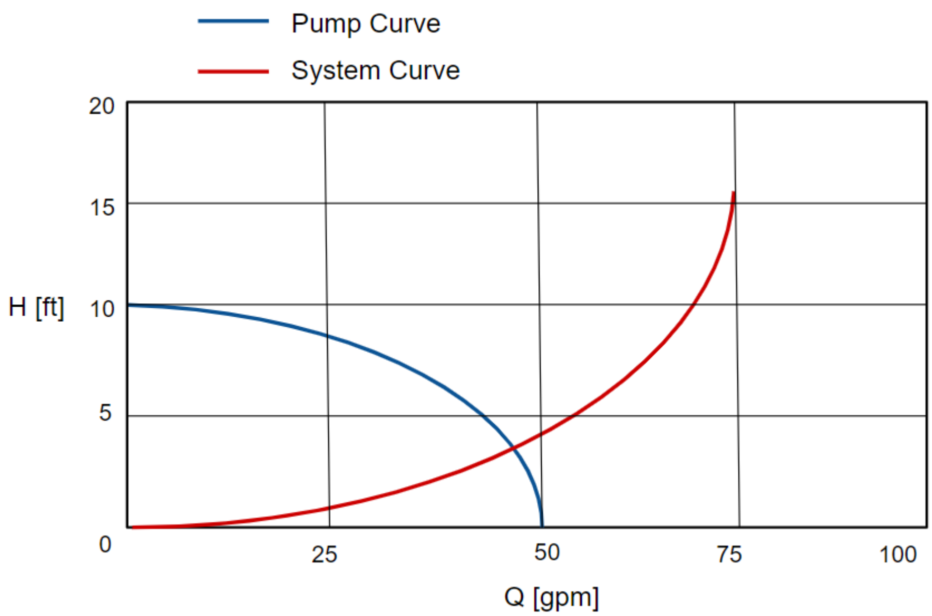
46.44 A hydronic system operates accorinding to the system curve shown below. The system is being designed to include two pumps in parallel, each with the characteristics of the pump curve shown below. What is the maximum hydraulic horsepower available to the system?

A. $0.05hp$

B. $0.13hp$

C. $0.19hp$

D. $0.29hp$



Reference the graph titled Operating Conditions for Parallel Operation and sketch a second pump in parallel. The curve for two pumps in parallel should connect $10ft$ on the vertical axis with $100gpm$ on the horizonatal axis, and roughly parallel the single pump curve. Make a best approximation of the volume flow rate and head at the intersection of the new parallel pump curve and the existing system curve.

$$Q \approx 63gpm$$

$$\Delta h \approx 8ft$$

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