33.43 A 95% efficient three-phase motor draws $50A$ at $480V$ with a power factor of 0.8. The motor drives a pump which distributes $300gpm$ of water with a differential pressure of $150psi$. What is the efficiency of the pump?

A. 27%

B. 62%

C. 79%

D. 83%

Calculate the Water Horsepower delivered by the pump.

$$whp = \frac{Q\Delta p}{1714}$$

$$whp = \frac{(300)\,(150)}{1714} = 26.25hp$$

Determine the input power by selecting the P_{kw} equation for a 3-phase motor from the Power for Different Motor Phases table.

$$P_{[KW]} = \frac{\sqrt{3}IV\,(pf)}{1000}$$

$$P_{[KW]} = \frac{\sqrt{3}\,(50A)\,(480V)\left(0.8\frac{KW}{KVA}\right)}{1000\frac{VA}{KVA}} = 33.25KW$$

To determine the brake horsepower out of the motor, convert from KW to hp and apply the motor efficiency.

$$bhp = P_{[KW]}\eta_{motor}$$

$$bhp = 33.25KW\left(\frac{1hp}{0.7457KW}\right)(0.95) = 42.37hp$$

The pump efficiency is the ratio of the water horsepower to the brake horsepower.

$$\eta_{pump} = \frac{whp}{bhp}$$

$$\eta_{pump} = \frac{26.25hp}{42.37hp} = 0.62$$

Answer B