$$\eta_{pump} = \frac{\dot{W}_{pump,u}}{\dot{W}_{shaft,in}} = \frac{\Delta \dot{E}_{mech,fluid}}{\dot{W}_{shaft,in}}$$

$$V_1 = \frac{\dot{V}}{A_1} = \frac{0,1 \; m^3/s}{\frac{\pi \cdot (0,08 \; m)^2}{4}} = 19,9 \; m/s$$

$$\eta_{motor} = \frac{\dot{W}_{shaft,out}}{\dot{W}_{elect,in}}$$

$\dot{W}_{elect,in} = 50 \; kW$

$\rho = 800 \; kg/m^3$

$\dot{V} = 0,1 \; m^3/s$

$$V_2 = \frac{\dot{V}}{A_2} = \frac{0,1 \; m^3/s}{\frac{\pi \cdot (0,12)^2}{4}} = 8,84 \; m/s$$

$$\dot{m} = \rho \cdot \dot{V}$$

We need to know the increase in mechanical energy of the fluid as it flows through the pump. Flow energy and kinetic energy should be changed. No elevation change mentioned and thus zero change in potential energy should be considered.

$$\Delta \dot{E}_{mech,fluid} = \dot{m}\left(\frac{P_2}{\rho} + \frac{V_2^2}{2}\right) - \dot{m}\left(\frac{P_1}{\rho} + \frac{V_1^2}{2}\right) = \dot{V}\left((P_2 - P_1) + \rho \frac{V_2^2 - V_1^2}{2}\right)$$

$$\dot{W}_{pump,u} = \Delta \dot{E}_{mech,fluid}$$

$$= (0,1 \; m^3/s)\left(500 \; \frac{kN}{m^2} + 800 \; \frac{kg}{m^3} \cdot \frac{(8,84 \; m/s)^2 - (19,9 \; m/s)^2}{2}\left(\frac{1 \; kN}{1000 \; kg \cdot m/s^2}\right)\right)\left(\frac{1 \; kW}{1 \; kN \cdot m/s}\right)$$

$$= 37,28 \; kW$$

For electrical motor,

$$\dot{W}_{shaft,out} = \eta_{motor} \cdot \dot{W}_{elect,in} = 0,8 \cdot 50 \; kW = 40 \; kW$$

$$\eta_{pump} = \frac{\dot{W}_{pump,u}}{\dot{W}_{shaft,in}} = \frac{37,28 \; kW}{40 \; kW} = 0,93 = \%93$$