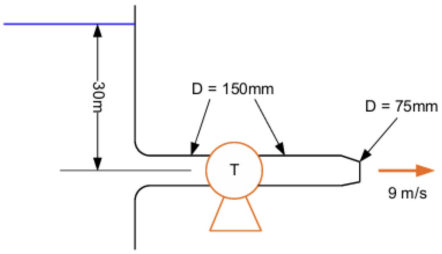
//QUESTION4



//Given
z_1=30[m]
z_2=0[m]
D=150[mm]*convert(mm;m)
D_E=75[mm]*convert(mm;m)
V_E=9[m/s]
V_I=0[m/s] //Velocity of water in the reservour is zero , there is no flow

P_atm=101,325[kPa]*convert(kPa;Pa)
P_1=P_atm
P_2=P_atm
rho=1000[kg/m^3]
g=9,81[m/s^2]

A_E=pi*(D_E^2)/4
V_dot=V_E*A_E
m_dot=rho*V_dot

//Volumetric flow rate at exit is the same at the D150mm

Q_dot_in=0[W]
Q_dot_out=0[W]
W_dot_in=0[W] //No work done into the system
m_dot_in=m_dot
m_dot_out=m_dot

//Assuming Steady State operation dE/dt=0
W_dot_in-W_dot_out+Q_dot_in-Q_dot_out+m_dot_in*(P_1/rho+V_I^2/2 +g*z_1)-m_dot_out*(P_2/rho+V_E^2/2+g*z_2)=0

$z_1 = 30\ [m]$

$z_2 = 0\ [m]$

$D = 150\ [mm] \cdot \left| 0{,}001 \cdot \frac{m}{mm} \right|$

$D_E = 75\ [mm] \cdot \left| 0{,}001 \cdot \frac{m}{mm} \right|$

$V_E = 9\ [m/s]$

$V_I = 0\ [m/s]$

$$P_{atm} = 101{,}325\ [kPa] \cdot \left| 1000 \cdot \frac{Pa}{kPa} \right|$$

$$P_1 = P_{atm}$$

$$P_2 = P_{atm}$$

$$\rho = 1000\ [kg/m^3]$$

$$g = 9{,}81\ [m/s^2]$$

$$A_E = \pi \cdot \frac{D_E^{\,2}}{4}$$

$$\dot{V} = V_E \cdot A_E$$

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

$$\dot{Q}_{in} = 0\ [W]$$

$$\dot{Q}_{out} = 0\ [W]$$

$$\dot{W}_{in} = 0\ [W]$$

$$\dot{m}_{in} = \dot{m}$$

$$\dot{m}_{out} = \dot{m}$$

$$\dot{W}_{in} - \dot{W}_{out} + \dot{Q}_{in} - \dot{Q}_{out} + \dot{m}_{in} \cdot \left[\frac{P_1}{\rho} + \frac{V_l^{\,2}}{2} + g \cdot z_1 \right] - \dot{m}_{out} \cdot \left[\frac{P_2}{\rho} + \frac{V_E^{\,2}}{2} + g \cdot z_2 \right] = 0$$

SOLUTION

Unit Settings: SI C kPa kJ mass deg

$A_E = 0{,}004418\ [m^2]$	$D = 0{,}15\ [m]$	$D_E = 0{,}075\ [m]$
$g = 9{,}81\ [m/s^2]$	$\dot{m} = 39{,}76\ [kg/s]$	$\dot{m}_{in} = 39{,}76\ [kg/s]$
$\dot{m}_{out} = 39{,}76\ [kg/s]$	$P_1 = 101325\ [Pa]$	$P_2 = 101325\ [Pa]$
$P_{atm} = 101325\ [Pa]$	$\dot{Q}_{in} = 0\ [W]$	$\dot{Q}_{out} = 0\ [W]$
$\rho = 1000\ [kg/m^3]$	$\dot{V} = 0{,}03976\ [m^3/s]$	$V_E = 9\ [m/s]$
$V_l = 0\ [m/s]$	$\dot{W}_{in} = 0\ [W]$	$\dot{W}_{out} = 10091\ [W]$
$z_1 = 30\ [m]$	$z_2 = 0\ [m]$	

No unit problems were detected.