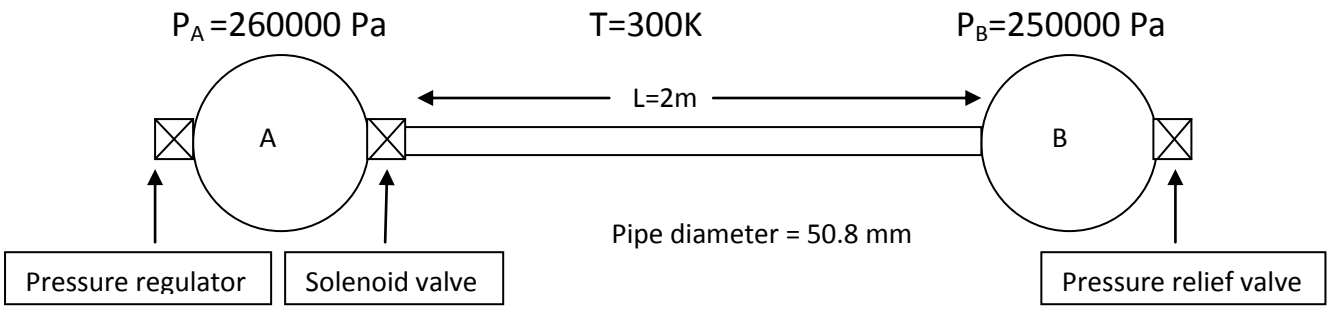

With no flow condition: pressure in Tank A is 26000Pa Tank B and pipe is 250000Pa as shown above

Then activated solenoid valve fully open, compressed air will flow from A through Pipe to B

My goal is to calculate flow rate from Tank A to B for selecting size of two pressure control device (pressure regulator and pressure relief) to keep constant of pressure in the two tanks

Density: For dP = 10000 Pa then the pressure drop is (10000/260000) x100=3.8%

The density used for fluid can based upon either the upstream or downstream conditions.(page12 in pipe-flo pro)

From ideal gas law with constant volume

$$P = \rho R_{air} T$$

$$(260000+101326) = \rho\,(287.04)(300)$$

So $\rho = 4.196$ kg/m^3

Reynolds's number

$$Re = \rho v D / \mu \qquad \text{for air, } \mu = 1.98e^{-5}$$

So $Re=4.196(0.0508)\, v/1.98e^{-5}$

$$Re=10765.5v$$

From Darcy-Weisbach Eqn. (Eq1 in pipe-flo pro with gravitational cancel out)

$$dP = f\rho(L/D)v^2/2$$

$$10000 = f\ (4.196)\ (2/0.0508)\ v^2 / 2$$

$$f = 121.0677/\ v^2$$

$$f^{1/2} = 11.003/v$$

Assume Re>2100

Calculate for Colebrook Eqn. (Eq.6 in pipe-flo pro)

$$1/\ (f^{1/2}) = -0.869\ln\ [(e/D)/3.7 + 2.523/\ (Ref^{1/2})]$$

For copper tube type M, roughness (e) = 0.0015 mm

Pipe Diameter=50.8mm

$$v / 11.003 = -0.869\ln[\ (0.0015/3.7(50.8)) + 2.523/(10765.5v)(11.003/v)]$$

Then $v = 99.77$ m/s

$f = 121.0677/v^2 = 0.0122$

$Re = 10765.5v = 1.07e^{06}$