ADD FRICTION from system flow resistance TO "A.H." figure

Also known as "Viscous drag" "Scrubbing action" "Rotary flow" "Reynolds effect".

1. INPUT DATA

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		Example	
GPM Steady state	$Q\ gpm :=$	41	Volumetric flow rate
mm	$D :=$	38	Inside diameter of the pipe
m²/sec	$\nu :=$	$1{,}9 \times 10^{-6}$	Kinematic viscosity — (Approximation cP "centePiose" to m²/sec, multiply by 1 million (for water))
m	$L :=$	218	Length of the pipe
kg/m³	$\rho :=$	980	Density (SG, Specific Gravity x 1000)

Pipe Fitting Component	Fittings
Round the corner of a Tee	$T1 := 1$
Past a side opening of a Tee	$T2 := 3$
Back into line from a side opening in a Tee	$T3 := 1$
Rounded corner 90° elbow (Long Rad. or L.R. 90)	$E1 := 2$
Abrupt 90° elbow ("Hard" 90 or Machined "L")	$E2 := 9$
Gentle 45° elbow (Bends & or "5D" 90)	$E3 := 2$

Estimating : dP @ peak of Flow Fluctuations

To find the increase in pulsation from flow fluctuation, assume max. fluctuation from simplex pump is 3.25 x steady state Q. Divide 3.25 Q by "F" nbr. for your pump type. Add the result to your steady state Q Run the formula with your increased Q Deduct steady state dP from this new dP The difference is pulsation dP.

Effective Length of Pipe System

$$L_{eff} := L+(0.0667xDxT1)+(0.0209xDxT2)+(0.0667xDxT3)+(0.0327xDxE1)+(0.0681xDxE2)+(0.0144xDxE3)$$

figures applied for E and T are averages from tests

2. CALCULATIONS

2.1. Velocity V of the flow in the pipe:

$$Q1 := \frac{Q\ gpm \times 3.7853}{60} \quad \text{(l/sec)} \quad Q1 = 2.587$$

$$Q := \frac{Q1}{1000} \quad \text{(l/sec)} \quad Q = 0.003$$

$$F := \frac{0.7854 \times D^2}{10^6} \quad (m^2) \quad F = 0.001$$

$$Dm := \frac{D}{10^3} \quad (m^2) \quad Dm = 0.038$$

$$V := \frac{Q}{F} \quad \text{(m/sec)} \quad V = 2.281$$

2.2. Reynolds Number:

$$Re := \frac{V \times Dm}{\nu} \quad Re = 4.561 \cdot 10^4$$

2.3. Friction factor: (cold drawn pipe)

$$\lambda := 0.3164 \times Re^{-0.25} \quad \lambda = 0.022$$

2.4. Pressure loss:

$$DPpa := \lambda \times \frac{L_{eff}}{Dm} \times \frac{\rho \times V^2}{2} \quad \text{(Pa)}$$

$$DPpa = 3.664 \cdot 10^5 \quad \text{(Pa)}$$

$$dP := \frac{DPpa}{10^5} \quad \text{(Convert Pa to bar)} \quad dP = 3.664 \quad \text{(bar - loss)}$$

$$dPpsi := dP \times 14.51 \quad \text{(Convert Bar to psi)}$$

ESTIMATED $dPpsi = 53.167$ (psi - loss)

Scientific Units
- Pa = Pascals
- Q = Mass Flow Cubic Meters
- d = delta difference
- Dm = Diameter Meters