Service Inputs

Enter your Service

Service = "Water"

Enter Vapour pressure of Service abs

$P_v = 30\ \mathrm{psi}$

Enter Critical Pressure of Service abs

$P_c = 3206.2\ \mathrm{psi}$

Enter flow rate of service gpm

$$Q = 500\ \frac{\mathrm{gal}}{\mathrm{min}} = 0.0315\ \frac{\mathrm{m}^3}{\mathrm{s}}$$

Enter Temperature of Service °F

$T_1 = 250\ °\mathrm{F}$

Enter Specific Gravity of Service

$\rho_{specific\_gravity} = 0.94$

Valve Properties from Vendor

Enter Size of valve from Vendor

$Valve_{Size} = 4\ \mathrm{in}$

Enter Valve Cv from Vendor

$Valve_{CV} = 121$

Enter Rated Liquid Pressure Recovery factor

$F_L = 0.89$

Line Inputs

Enter Line Size

$Line\_Size = 7.98\ \mathrm{in}$

Enter Upsteam Absolute Static Pressure abs

$P_1 = 314.7\ \mathrm{psi}$

Enter Downstream Absolute Static Pressure abs

$P_2 = 104.7\ \mathrm{psi}$

Pressure drop across valve

$\Delta P = P_1 - P_2 = 210\ \mathrm{psi}$

Constant Selection

Equation Constants							
	N	w	q	P2	Gamma	T	d,D
N1	0.0865	---	m3/h	kPa	---	---	
	0.865	---	m3/h	bar	---	---	
	1	---	gpm	psia	---	---	
N2	0.00214	---	---	---	---	---	mm
	890	---	---	---	---	---	inch

Select N1 From Table

$N_1 = 1$

Select N2 From Table

$N_2 = 890$

Parameter Calculations

Resistance coefficient of up-stream fittings

$$K_1 = 0.5 \cdot \left(\left(1 - \left(\frac{{Valve_{Size}}^2}{{Line\_Size}^2} \right) \right)^2 \right) = 0.2803$$

Resistance coefficient of downstream fittings

$$K_2 = 1 \cdot \left(\left(1 - \left(\frac{{Valve_{Size}}^2}{{Line\_Size}^2} \right) \right)^2 \right) = 0.5606$$

Inlet Bernoulli coefficient

$$K_{B1} = 1 - \left(\frac{Valve_{Size}}{Line\_Size} \right)^4 = 0.9369$$

Outlet Bernoulli coefficient

$$K_{B2} = 1 - \left(\frac{Valve_{Size}}{Line\_Size} \right)^4 = 0.9369$$

Head loss coefficient of a device

$$K_{sum} = K_1 + K_2 + K_{B1} - K_{B2} = 0.8409$$

Piping geometry factor

$$F_P = \left(1 + \left(\left(\frac{K_{sum}}{N_2}\right) \cdot \left(\frac{Valve_{CV}\ in^2}{Valve_{Size}^2}\right)^2\right)\right)^{-\frac{1}{2}} = 0.974$$

Combined liquid pressure recovery factor and piping geometry factor of valve with attached fittings

$$F_{LP} = \left(\frac{K_1 + K_{B1}}{N_2} \cdot \left(\frac{Valve_{CV}\ in^2}{Valve_{Size}^2}\right)^2 + \frac{1}{F_L^2}\right)^{-\frac{1}{2}} = 0.8636$$

Liquid critical pressure ratio factor

$$F_F = 0.96 - \left(0.28 \cdot \left(\sqrt{\frac{P_v}{P_c}}\right)\right) = 0.9329$$

Chocked Pressure Drop

$$\Delta P_{Chocked} = \left(\frac{F_{LP}}{F_P}\right)^2 \cdot \left(\left(P_1 + 1\ bar\right) - \left(F_F \cdot \left(P_v + 1\ bar\right)\right)\right) = 226.1769\ psi$$

ΔP Sizing Selection

$$\Delta P_{sizing} = \text{if } \Delta P_{Chocked} > \Delta P = 210\ psi$$

$$\Delta P$$

else

$$\Delta P_{Chocked}$$

Output

Valve sizing coefficient

$$C_v = \frac{\frac{Q}{\frac{gal}{min}}}{F_P} \cdot \sqrt{\frac{\rho_{specific\_gravity}}{\frac{\Delta P_{sizing}}{psi}}} = 34.3441$$

Actual Cv Selection

$$Actual\_C_v = \text{if } Valve_{CV} < C_v$$

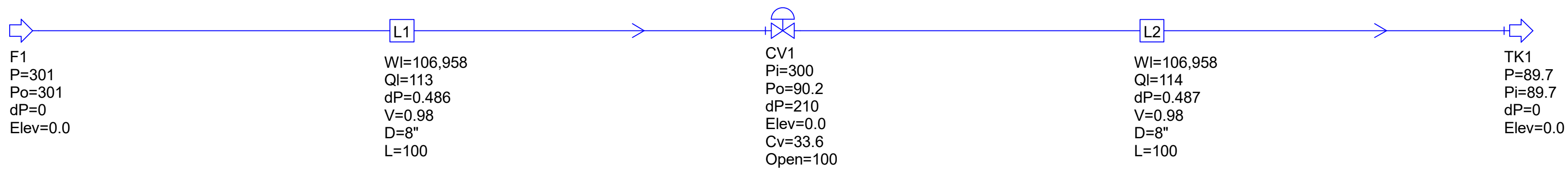
"Increase valve Cv contact vendor"

else

$$C_v$$

Actual Cv Required

$$Actual\_C_v = 34.3441$$



Viraj Desai
Process Engineer

Control Valve Sizing
For Incompressible Fluid
Project - 0001

Eng	Chkd	Apvd	Date	Project	Rev
DV			04-06-2022	0001	0

Korf File	Control Valve Sizing for Incompressible Fluid.kdf	Units	Custom;W=kg/h; P=psig; L=m; dP/L=kPa/100m; V=m/s