GAS FLOW RATE THROUGH FULL-OPEN CONTROL VALVE OR REGULATOR
Version 1.04   7 Feb 2005

Note: User must fill in shaded cells.

Plant Name:	
Location:	
Engineering Job No.	
Vessel / Equipment No.	
Service:	
Manufacturer:	
Model No.	
Nominal Size (Inches):	
Relief Device Designer:	

Input Data:

Upstream Pressure	P_1	264.70	psia	
Downstream Pressure	P_2	146.70	psia	
Upstream Temperature	T_1	0.0	° C	
Gas Molecular Weight	MW	28.013		
Compressibility	Z	1.000		(See Notes Below)
Provide two of the four valve parameters				
Valve Flow Coefficient	C_v	60.00		
Valve Type Parameter	x_t	1.0		(See Notes Below)
Valve gas coefficient	C_g			
Fisher valve parameter	C_1			

Results:

Valve Flow Coefficient	C_v	60.00	
Valve Type Parameter	x_t	1.0	
Upstream Temperature	T_1	492.0	° R
Gas Density	ρ_1	1.4046	lbs/ft^3
Difference Between P_1 and P_2	ΔP	118.00	psi
Valve Type Parameter X Upstream Pressure	$x_t P_1$	264.70	psi
Pressure Drop Through Valve	ΔP_x	118.00	psi
Expansion Factor	Y	0.851	
Gas Flow Rate	W	**41630.26**	lbs/hr

Notes:

$$\rho_1 = \frac{P_1 \, MW}{10.72 \, T_1}$$

$$\Delta P_x = lesser\ of\ \Delta P\ or\ x_t P_1$$

$$Y = 1 - \frac{\Delta P_x}{3 \, x_t \, P_1}$$

$$W = 63.3 \, C_v \, Y \sqrt{\Delta P_x \, \rho_1}$$

$$C = C / C$$

Valve Type	x_t
Venturi Angle	0.2
90° Butterfly	0.2
60° Butterfly	0.5
Globe	0.9
Default	1.0

$$C_v = C_g / C_1$$

$$x_t = 0.00063\, C_1^2$$

Xt

Using the default value (1.0) is conservative but **flow will never choke**.

If the Xt is 0.8 then the valve will choke when the pressure drops by 80%. If the Xt is 0.2 the valve will choke when the pressure drops by 20%.

Xt values are generally available in vendor literature

The rule-of-thumb value for Xt is 0.5. Note that this is not such a "safe" number to choose since this valve varies greatly depending on the style of valve. If you estimated a 0.5 valve and have a globe valve , for example, you are actually going to get much more flow than you estimated.

Z

Compressibility is a function of temperature and pressure. Note that the flow rate increases when the Z value is reduced from 1.0. So, to be conservative you need to estimate a low Z value of look it up by doing a quick SafSiz run (SafSiz reports this value).