Flow Data

Importance of Valve Sizing

Improper sizing of a solenoid valve results in below-standard performance and can involve unnecessary cost.

The basic factors in valve sizing include:

- Maximum and minimum flows to be controlled
- Maximum and minimum pressure differential across the valve
- Specific gravity, temperature, and viscosity of fluids being controlled

The Cv method of valve sizing reduces all variables to a common denominator called the Flow Coefficient. After existing or projected conditions have been converted to this coefficient (the Cv), the proper valve size can be found in the catalog pages.

This section provides the complete procedure and reference data for accurate sizing of ASCO solenoid valves in liquid, gas services, and steam. The graphs provide the simplest means of finding the required Cv factor, and are based on the formula:

$$\mathbf{Cv} = \frac{\text{Flow Required}}{\text{Graph Factor}}$$

The graph factor can be determined by aligning known pressure conditions on the graphs.

Estimating Cv or Orifice Size:

The table below can be used to estimate a Cv if the orifice size is known or, conversely, to relate the approximate orifice size if the Cv is known. The chart is based on the ASCO designs of inline globe type valves.

The flow charts must be used for precise sizing and converting Cv factors to actual flow terms, and the catalog must be consulted for the actual Cv of a particular valve.

Approximate Orifice Size (ins.)	Approximate Cv	Approximate Orifice Size (ins.)	Approximate Cv
1/32	.02	1/2	3.5
3/64	.06	5/8	4.5
1/16	.09	11/16	5
3/32	.20	3/4	7.5
1/8	.30	1	13
9/64	.36	1 1/4	17
3/16	.53	1 1/2	25
1/4	.70	2	48
5/16	1.7	2 1/2	60
3/8	2	3	100

Sample Problems

Liquids: ①

To find Cv: What Cv is required to pass 20 GPM of oil, with a specific gravity of 0.9 and a pressure drop of 25 psi? The viscosity is less than 300 SSUs.②

Solution: Formula is:

$$\mathbf{Cv} = \frac{\text{GPM}}{\text{Fg x Fsg}}$$

To find Fg (Graph Factor), use Liquid Flow Graph on page 11.16. The Fg factor is that corresponding to 25 psi pressure drop and equals 5. The Fsg factor (Specific Gravity Factor) can be obtained from the Fsg Chart, and is that corresponding to .9 specific gravity and equals 1.05.

Therefore:

$$\mathbf{Cv} = \frac{20}{5 \text{ x } 1.05} = 3.81$$

Air and Gases:

To find Cv: A valve is required to pass 500 SCFH at an inlet pressure of 60 psig and a Δp③ of 10 psi. Find Cv if the fluid is carbon dioxide at room temperature.

Solution: Refer to 10-100 psig graph on page 11.17. The formula to be used is:

$$\mathbf{Cv} = \frac{\text{SCFH}}{\text{Fg x Fsg x Ft}}$$

Locate Fg at the intersection of 60 psig inlet pressure and 10 psi Δp③ (curved lines). Read down to Fg. Fg=1560.

Locate Fsg corresponding to specific gravity of carbon dioxide (S.G.=1.5). Fsg=0.81. (Refer to next page.) Since the gas is at room temperature, the Ft factor can be ignored.

Insert values into formula:

Steam:

To find Cv: A valve is required to pass 25 lb/hr of saturated steam at an inlet pressure of 7 psig and a Δp③ of 3 psi. What is the Cv?

Solution: Refer to the Steam Graph on page 11.18. Use formula:

$$\mathbf{Cv} = \frac{\text{lb / hr}}{\text{Fg}}$$

Locate Fg on graph corresponding to 7 psig inlet pressure and 3 psi Δp③ (curved lines). Fg = 23.5.

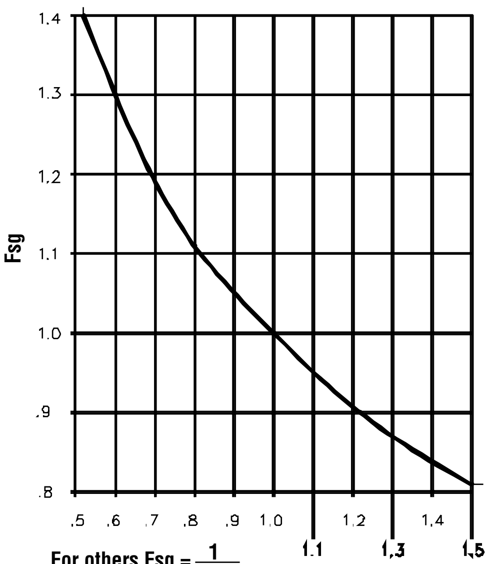
Insert values into formula:

$$\mathbf{Cv} = \frac{25}{23.5} = 1.06$$

For further information, consult your local ASCO sales office.

Notes:
① Liquid formulas and flow graphs are based on US gallons.
② If viscosity is less than 300 SSU, correction factors are not necessary.
③ Δp stands for pressure drop.

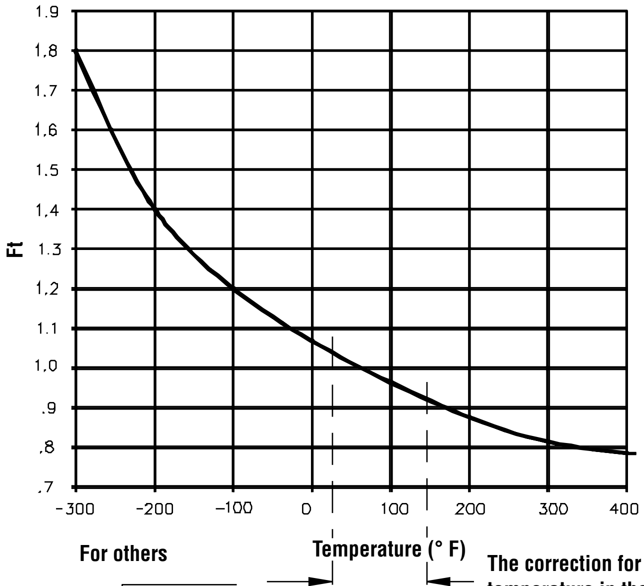
Fsg Chart



For others $Fsg = \frac{1}{\sqrt{SG}}$

Specific Gravity @ 14.7 PSIA and 60°F.

Ft Chart

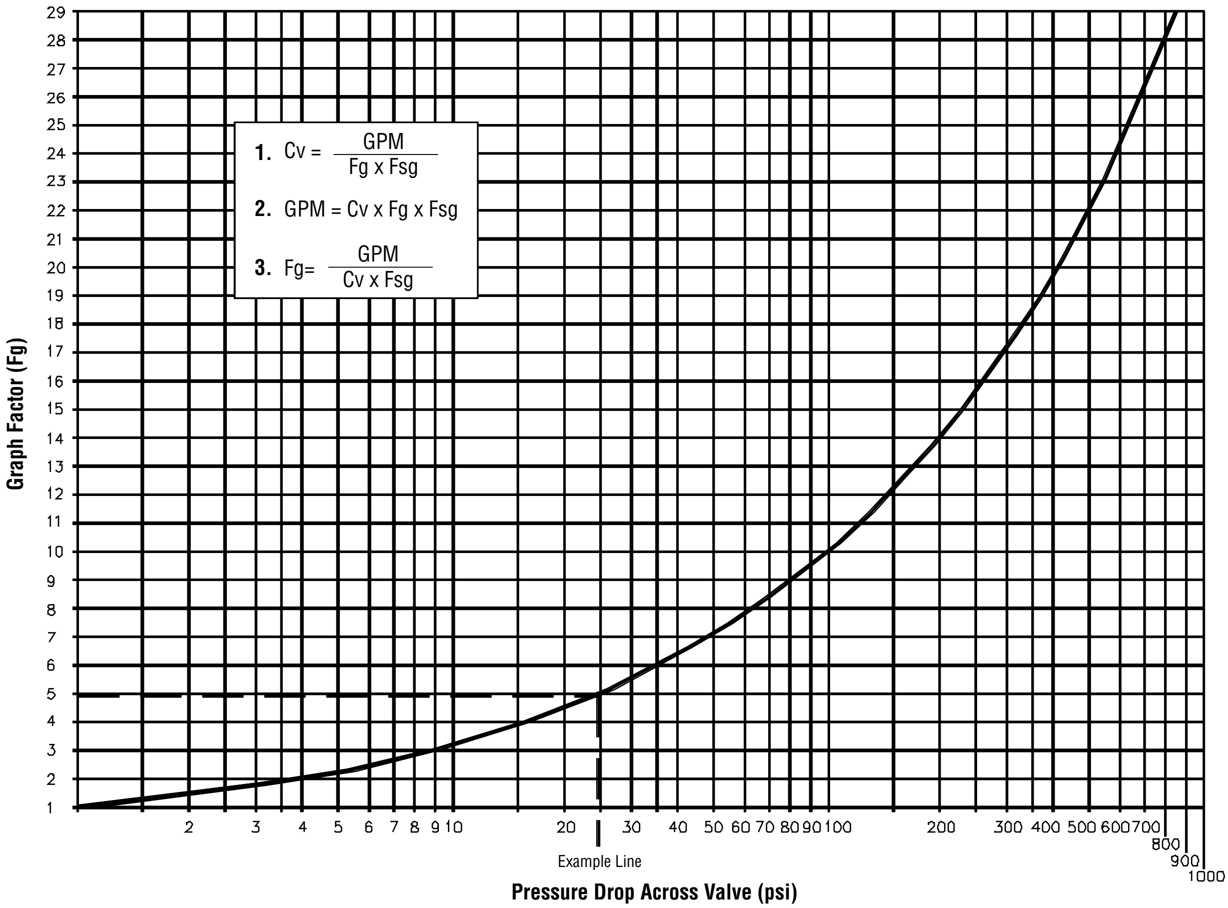


For others

$$Ft = \sqrt{\frac{530}{(460^{\circ} + {}^{\circ}F.)}}$$

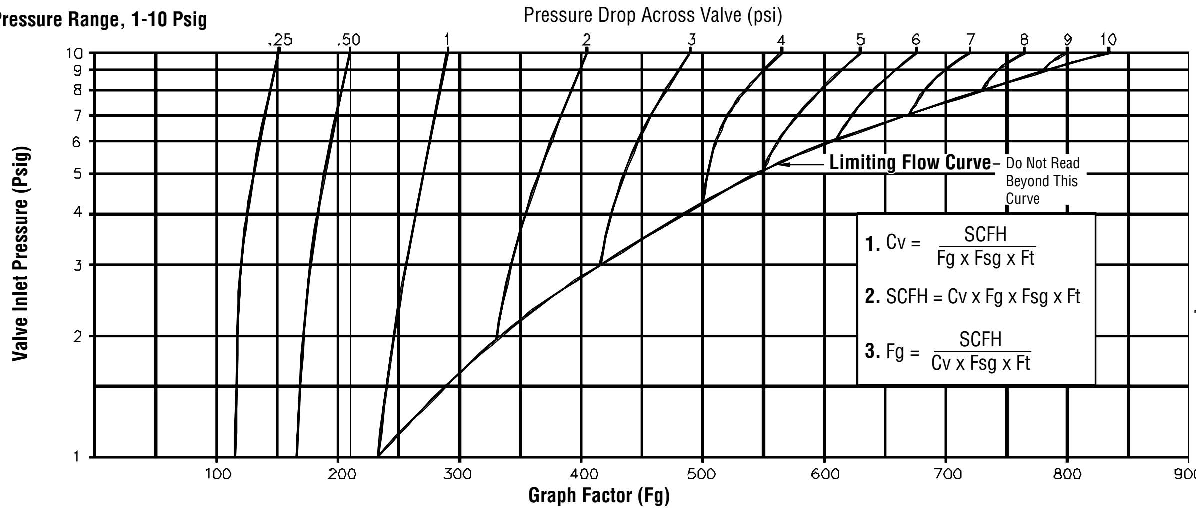
The correction for temperature in the range of 20°F to 150°F is very small and, therefore, can be ignored in ordinary applications.

Liquid Flow Graph

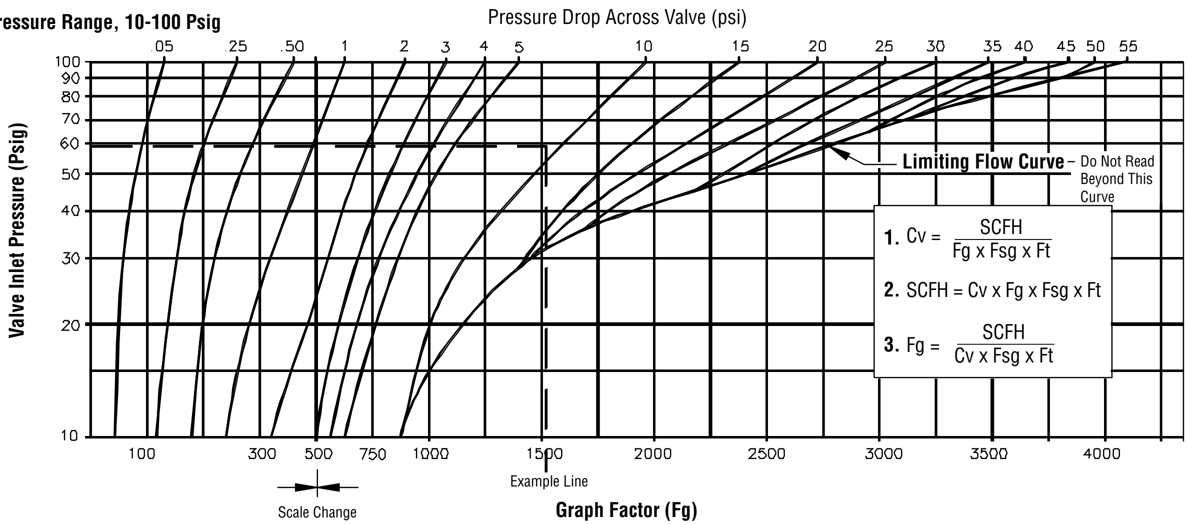


Air and Gas Flow Graphs

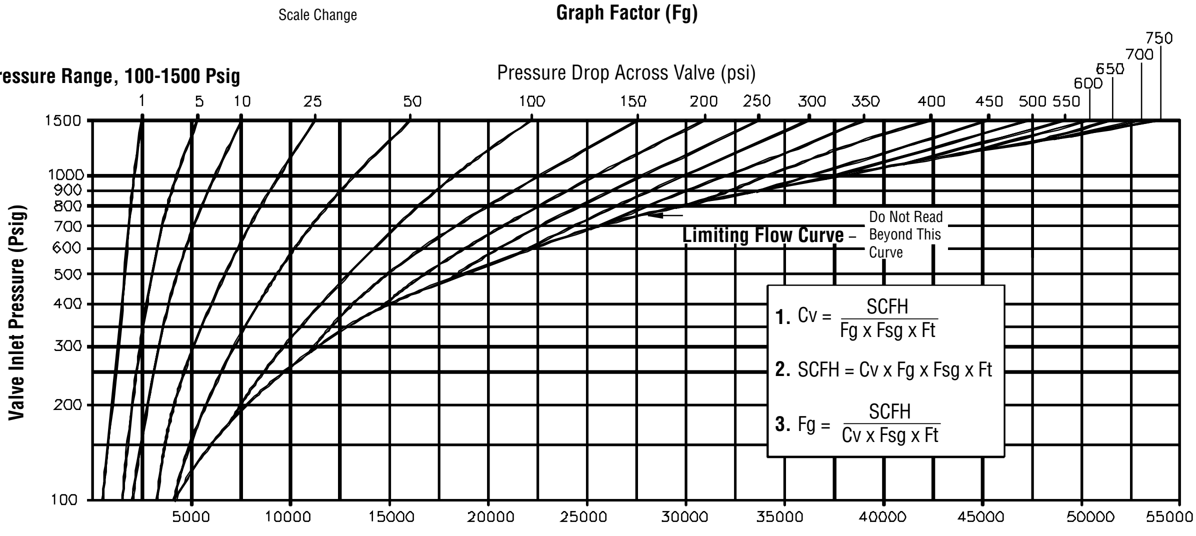
Pressure Range, 1-10 Psig



Pressure Range, 10-100 Psig



Pressure Range, 100-1500 Psig



Note: Charts above are useful in temperature range of 20°F to 150°F. Refer to Ft chart on previous page.

Steam Flow Graphs