

Valve Sizing Precautions

Back pressure, rate of flow control, and two stage electric valves can often be sized by using the simple guideline of choosing a valve size that will result in 15 to 25 feet/second velocity through the valve at nominal to maximum flowrates. This guideline typically results in the valve size being equal to the main line size; leading one to assume that selecting the proper size valve is merely a matter of matching the line size.

This assumption is incorrect! Appropriate valve sizing is extremely important, especially when the requirement is for a pressure reducing valve. Matching the line size for pressure reduction or relief valve applications often results in a valve that is too large for the application or with a valve that does not provide acceptable performance. **Daniel does not recommend operation at less than five percent rated C_v or less than twenty percent stroke for modulating, pilot controlled, and pressure regulating valves. Operation in this range almost always results in an unstable control valve.**

The following is a real example of valve size selection for a pressure reducing application where the customer specified the control valve as being 8" in size, same as the main line:

Specifications

- Product Specific Gravity
 - Gasoline 0.7587
- Flow Rate
 - 1000 US gpm (227.1 m³/hr)

Inlet Pressure

- Minimum, 700 psi (49.2 kg/cm²)
- Maximum, 1100 psi (77.3 kg/cm²)

Outlet pressure (set point)

- 100 psi (7.0 kg/cm²)

Pressure drop across valve

- Minimum
700 psi - 100 psi = 600 psi
- Maximum
1100 psi - 100 psi = 1000 psi

Using the formula on Page 3-6 of the *Daniel Handbook on Pressure Loss and Valve Sizing* (available for download on www.Daniel.com), the required C_v of the valve can be calculated as follows:

a.) C_v with minimum pressure drop across valve:

$$C_v = \frac{1000 \text{ US gpm}}{\sqrt{\frac{600 \text{ psid}}{0.7587 \text{ sp gr}}}} = \frac{1000}{28.12} = 35.56$$

Which is: 2.7% of C_v rating of 8" valve (1296)
9% of stroke of 8" valve
- or -
11.5% of C_v rating of 4" valve (309)
23% of stroke of 4" valve

b.) C_v with maximum pressure drop across valve:

$$C_v = \frac{1000 \text{ US gpm}}{\sqrt{\frac{1000 \text{ psid}}{0.7587 \text{ sp gr}}}} = \frac{1000}{36.30} = 27.55$$

Which is: 2.1% of C_v rating of 8" valve (1296)
9% of stroke of 8" valve
- or -
8.9% of C_v rating of 4" valve (309)
23% of stroke of 4" valve

Maximum C_v rating by valve size is shown on Page 3-6 of the handbook; reference Figure 3-5 to view the relationship of percent rated C_v versus percent stroke. **In conclusion, if an 8" valve were used, it would operate below 5% rated C_v and less than 20% stroke. Therefore, a 4" size valve is the largest size that can be used for this application and be assured that the valve will provide stable pressure control.**

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