Formulas and Cv Factors

General Information about valve sizing:

Valves with a “Full Port” have an internal seat diameter that is the same as the nominal pipe size, i.e. a 1 inch pipe size valve with a full port has a 1 inch diameter seat. Valves with a “Reduced Port” have an internal seat diameter that is smaller than the nominal pipe size.

The valve’s flow coefficient, Cv, is a value that is determined by flow testing for each valve size. Full port valves will have a higher Cv than reduced port valves. The Cv rating for each valve is listed in the tables found in the valve catalog.

The definition of Cv is the # of gallons of water that will flow through the valve with a 1 PSI pressure differential when the valve is open.

The equations below can be used to determine:

- Flow Rate, given the Cv and ΔP
- Cv, given the Flow Rate and ΔP
- ΔP, given the Flow Rate and Cv

\[ \text{Cv} = \text{Valve’s flow coefficient (dimensionless value)} \]
\[ S = \text{Specific Gravity (1.0 for air or water)} \]
\[ T = \text{Absolute Temperature in °R (°R = °F + 460)} \]
\[ P_i = \text{Inlet Pressure in PSIG} \]
\[ \Delta P = \text{Pressure Differential in PSI across valve in the open position} \]
\[ V = \text{Specific Volume in Cubic Feet per Pound} \]

For Liquids:

\[ \text{GPM} = \text{Cv} \sqrt{\frac{\Delta P}{S}} \]
\[ \text{Cv} = \text{GPM} \sqrt{\frac{S}{\Delta P}} \]
\[ \Delta P = \left( \frac{\text{GPM}}{\text{Cv}} \right)^2 \left( \frac{S}{\Delta P} \right) \]

For Air and Gasses:

\[ \text{SCFH} = 1380 \text{ Cv} \sqrt{\frac{(P_i + \text{15}) \Delta P}{T S}} \]
\[ \text{Cv} = \frac{\text{SCFH}}{1380} \sqrt{\frac{T S}{(P_i + \text{15}) \Delta P}} \]
\[ \Delta P = \left( \frac{T S}{P_i + \text{15}} \right) \left( \frac{\text{SCFH}}{1380 \text{ Cv}} \right)^2 \]

For Steam:

\[ \text{LB/HR.} = 63 \text{ Cv} \sqrt{\frac{\Delta P}{V}} \]
\[ \text{Cv} = \frac{\text{LB/HR.}}{63} \sqrt{\frac{V}{\Delta P}} \]
\[ \Delta P = \left( \frac{\text{LB/HR.}}{63 \text{ Cv}} \right)^2 \]

Cv Factors:
The Cv factor is the number of U.S. gallons per minute that will pass through a valve with a pressure drop of (1) psi.

<table>
<thead>
<tr>
<th>Port Size in Inches</th>
<th>3/32&quot;</th>
<th>1/8&quot;</th>
<th>5/32&quot;</th>
<th>3/16&quot;</th>
<th>1/4&quot;</th>
<th>5/16&quot;</th>
<th>3/8&quot;</th>
<th>1/2&quot;</th>
<th>3/4&quot;</th>
<th>1&quot;</th>
<th>1- 1/4&quot;</th>
<th>1- 1/2&quot;</th>
<th>2&quot;</th>
<th>2- 1/2&quot;</th>
<th>3&quot;</th>
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<tr>
<td>Cv Factor</td>
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<td>0.53</td>
<td>0.7</td>
<td>1.7</td>
<td>2.0</td>
<td>3.5</td>
<td>7.5</td>
<td>13.0</td>
<td>17.0</td>
<td>25.0</td>
<td>48.0</td>
<td>60.0</td>
<td>100.0</td>
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