Practical tips

Valves and actuators

Valve rating for water

Important notes

When measuring valve size using a media other than water, please note that the media properties
- Specific heat
- Density
- Kinematic viscosity
differ from water. All measured values depend on temperature.

Water without antifreeze

\[ V_{\text{wap}} = \frac{Q_{\text{wap}}}{1163 \times \Delta T} \ [\text{m}^3/\text{h}] \]

Water with antifreeze

The design temperature is the lowest medium temperature occurring in the valve.

\[ V_{\text{awp}} = \frac{Q_{\text{awp}}}{1163 \times \Delta T \times f_1} \ [\text{m}^3/\text{h}] \]

or

\[ V_{\text{awp}} = \frac{Q_{\text{awp}}}{1.163 \times \Delta T \times f_1} \ [\text{m}^3/\text{h}] \]

For glycol portion > 20 %, use the corrective factor \( f_1 \) per table in the formula for determining volume flow.

Corrective factor \( f_1 \) for Antifrogen N

<table>
<thead>
<tr>
<th>( x )</th>
<th>-40</th>
<th>-20</th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>Temp. [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.60</td>
<td>0.62</td>
<td>0.63</td>
<td>0.65</td>
<td>0.67</td>
<td>0.68</td>
<td>0.69</td>
<td>0.71</td>
<td>40</td>
</tr>
<tr>
<td>80</td>
<td>0.71</td>
<td>0.73</td>
<td>0.74</td>
<td>0.75</td>
<td>0.77</td>
<td>0.78</td>
<td>0.79</td>
<td>0.80</td>
<td>40</td>
</tr>
<tr>
<td>60</td>
<td>0.79</td>
<td>0.80</td>
<td>0.81</td>
<td>0.82</td>
<td>0.84</td>
<td>0.85</td>
<td>0.86</td>
<td>0.86</td>
<td>40</td>
</tr>
<tr>
<td>52</td>
<td>0.82</td>
<td>0.83</td>
<td>0.84</td>
<td>0.85</td>
<td>0.86</td>
<td>0.87</td>
<td>0.88</td>
<td>0.88</td>
<td>40</td>
</tr>
<tr>
<td>44</td>
<td>0.87</td>
<td>0.88</td>
<td>0.88</td>
<td>0.89</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>40</td>
</tr>
<tr>
<td>34</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.93</td>
<td>0.93</td>
<td>0.93</td>
<td>40</td>
</tr>
<tr>
<td>20</td>
<td>0.97</td>
<td>0.97</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
<td>0.95</td>
<td>40</td>
</tr>
</tbody>
</table>

The data and application notes of the glycol manufacturer are binding.

\( x \) = percentage of Antifrogen N

Determine the corrective factor \( f_1 \)

Entry: \( c; \rho \)

Output: Corrective factor \( f_1 \)

Kinematic viscosity

No corrections required for kinematic viscosity – of up to 10 mm²/s. Please contact your local representative on selecting control actuating devices equipment at other kinematic viscosity –.

Cavitation

High medium velocity in the narrowest section of the valve results in localized underpressure (p2). If the underpressure falls below the boiling pressure (vapor pressure) of the medium, cavitation (vapor bubbles) takes place and, in extreme circumstances, Valve body material is removed from the surfaces. Furthermore, the noise level increases dramatically as cavitation develops. Cavitation can be prevented by limiting the differential pressure across the valve as a function of the medium temperature and upstream pressure, provided the valves differential pressure as provided for in flow chart 1 for a valve is not exceeded and the static pressures listed in diagram 2 are maintained.

To prevent cavitation sufficient static counterpressure at the valve’s outlet must also be ensured for domestic hot water and cold water circuits. A throttling valve, for example, downstream from the heat exchanger would ensure this. In this case, the maximum pressure drop across the control valve should be selected according to the 80 °C curve from the chart on page 19-18.
Example – Flow diagram for VVF61..
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Cavitation

Ensure there is sufficient static counter pressure \( p_2 \) at the valve outlet to prevent cavitation. This can be accomplished, for example, with a throttling valve after the heat exchanger. Pressure loss across the control valve should be selected per the 80 °C curve from the following diagram.

Pressure chart 2

\[ \Delta p_{\text{max}} = \text{differential pressure with valve almost fully closed, at which cavitation can nearly be completely avoided} \]

\( p_1 \) = static pressure at inlet
\( p_2 \) = static pressure at outlet
\( M \) = pump
\( T \) = water temperature

Example: Hot water
Pressure \( p_1 \) upstream of the valve: 500 kPa (5 bar)
Water temperature: 120 °C

The above chart 2 shows that when the valve is nearly fully closed, a maximum differential pressure \( \Delta p_{\text{max}} \) of 200 kPa (2 bar) is permitted.

Example: Cold water
Prevention of cavitation using the example of well-water cooling:

Cold water = 12 °C
\( p_1 \) = 500 kPa (5 bar)
\( p_4 \) = 100 kPa (1 bar) (atmospheric pressure)
\( \Delta p_{\text{max}} \) = 300 kPa (3 bar)
\( \Delta p_3 \cdot 2 \) = 20 kPa (0.2 bar)
\( \Delta p_5 \) (throttle) = 80 kPa (0.8 bar)
\( p_5 \) = pressure downstream from consumer in kPa

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