Application Notes for Valve Sizing

Sizing valves for steam service with the aid of sizing charts

**Application**
These application notes allow the variables (nominal valve size, steam flow rate) for self-operated pressure regulators for steam service to be selected with the aid of sizing charts using the known upstream pressure $p_1$ and downstream pressure $p_2$.

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**General information**
The required flow rate charts for saturated steam (diagram 1 and diagram 4) can be found on pages 2 to 5.
The diagrams 1 and 2 apply to metric units (DIN) bar and kg/h.
The diagrams 3 and 4 apply to imperial units (ANSI) psi and lb/hr.
These charts provide a schematic approach to selecting the nominal valve size and steam flow rate (saturated steam) for a valve suitable for a special application quick and easily.
The pressures relevant for valve sizing, upstream pressure $p_1$ and downstream pressure $p_2$, are stated in bar or psi (gauge) as is usually the case. Diagrams 1 to 4 provide you with the specifications for the nominal valve size and the steam flow rate in kg/h or lb/hr.
For the valve sizing, diagrams 1 and 3 need to be used to take into account the valve load, while diagrams 2 and 4 are required for the flow velocity. The highest value of all the determined values is used as the nominal valve size.
The corresponding principle applies on determining the steam flow rate when the pressures $p_1$ and $p_2$ as well the nominal valve sizes are known.
The sizing example on page 6 demonstrates the general way to proceed. In this example, the appropriate nominal valve size is determined using the known steam flow rate in kg/h.
Diagram 1 - Sizing the valve according to valve load - DIN valves
Valve sizing according to flow velocity · DIN valves

Diagram 2 · Valve sizing according to flow velocity · DIN valves

All pressures specified in bar (gauge) · Steam flow rate in kg/h
All pressures specified in psi (gauge) · Steam flow rate in lb/hr

Diagram 3 - Sizing the valve according to valve load · ANSI valves
Valve sizing according to flow velocity · ANSI valves

Diagram 4 · Valve sizing according to flow velocity · ANSI valves

All pressures specified in psi (gauge) · Steam flow rate in lb/hr

- **Sizing characteristic**
- **Valve characteristic**

- **NPS 4, Cv 145**
- **NPS 3, Cv 94**
- **NPS 2 1/2, Cv 60**
- **NPS 2, Cv 37**
- **NPS 1 1/2, Cv 23**
- **NPS 1, Cv 9,4**
- **NPS 3/4, Cv 7,5**
- **NPS 1/2, Cv 5**
Example for valve sizing with the aid of charts

Upstream pressure $p_1$ and downstream pressure $p_2$ are known.
Upstream pressure $p_1 = 7$ bar
Downstream pressure $p_2 = 4$ bar

The suitable valves (nominal size, $K_{VS}$ coefficient) need to be determined for the steam flow rates of 6000 kg/h and 400 kg/h.

Diagram 1 - Valve load
All pressures specified in bar (gauge)

Diagram 2 - Flow velocity
All pressures specified in bar (gauge)

Determining the nominal valve size
Find the flow rate at the vertical axis on the left and draw a horizontal line until it intersects the line for the sizing characteristic.
Select the nominal valve size whose valve characteristic is located nearest above the point of intersection.

Example 1 (W = 6000 kg/h):
Valve DN 100, $K_{VS}$ 125

Example 2 (W = 400 kg/h):
Valve DN 20, $K_{VS}$ 6.3

Select the largest value for the nominal size determined in diagrams 1 and 2.

Example 1 (6000 kg/h): DN 100 > DN 80
Valve DN 100, $K_{VS}$ = 125

Example 2 (400 kg/h): DN 20 = DN 20
Valve DN 20, $K_{VS}$ = 6.3