

Calculation and Selection - Three-way control valve

Initial data

10.00 m³/h	Estimated water flow rate	7.00 bar	Pressure before the control valve
90 °C	Maximum water temperature at the installation place	0.30 bar	Pressure loss on other elements of the controlled section excluding pressure loss on the valve

Calculation results

$(0.3 * [0.30 \text{ bar}]) / (1 - 0.3) = 0.13 \text{ [bar]}$	The lower threshold of pressure loss on the control valve, which will provide optimal regulation if the flow characteristic of the valve is logarithmic-linear
$(0.5 * [0.30 \text{ bar}]) / (1 - 0.5) = 0.30 \text{ [bar]}$	Upper threshold of pressure loss on the control valve, which will ensure optimal regulation
$dP_{\text{max}} = [0.30 \text{ bar} + 0.30 \text{ bar}] = 0.6 \text{ [bar]}$	The maximum possible pressure drop across the valve
$K_v \text{ max} = [10.00 \text{ m}^3/\text{h}] / [0.13 \text{ bar}]^{0.5} = 27.7 \text{ [m}^3/\text{h}]$	The maximum Kvs of the control valve
$K_v \text{ min} = [10.00 \text{ m}^3/\text{h}] / [0.30 \text{ bar}]^{0.5} = 18.3 \text{ [m}^3/\text{h}]$	The minimum Kvs of the control valve
$([G \text{ 10.00 m}^3/\text{h}] / [K_{vs} \text{ 25 m}^3/\text{h}])^2 = 0.16 \text{ [bar]}$	Pressure drop on a fully open valve with Kvs=25 at flow rate 10.00 m ³ /h
$0.00000005 * [90 \text{ °C}]^{3.658} = 0.70 \text{ [bar]}$	Absolute saturation vapor pressure of water at temperature 90°C
$0.2 * (7.00 + 1 - 0.70) = 1.46 \text{ [bar]}$	Lower limit without cavitation pressure loss at the valve
$0.6 * (7.00 + 1 - 0.70) = 4.38 \text{ [bar]}$	Upper limit without cavitation pressure loss at the valve
$dP_{\text{max}} \text{ 0.6 [bar]} \leq 1.46 \text{ [bar]}$	There will be no cavitation on the valve
$[10.00 \text{ m}^3/\text{h}] / \{3600 * 3.14 * ([DN40] * 0.001)^2 * 0.25\} = 2.2 \text{ [m/s]}$	The flow rate is within normal limits $V < 3.0 \text{ [m/s]}$

Selection result : 3 way control valve

Danfoss : VRG 3

Denmark

DN 40 [mm]	Nominal valve diameter
Kvs 25 [m³/h]	Flow coefficient
PN 16 [bar]	Nominal pressure
logarithmic-linear	Flow characteristic
dT -10 ... 130°C	Operating temperature
cast iron	Body material



Selection result : Electric actuator

Danfoss : AME 435, AMV 435

4 / 1 [bar]	Maximum pressure difference between the inlet and outlet ports of a valve at which the electric actuator can close the valve
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AME435 ::: Control signal [analog] : Force [400 N] : IP 54
Stroke [20 mm] : Speed [7,5 / 15 sec/mm] : Limit switches [equipped]
Supply voltage [~24V | ~ 50 / 60 Hz | 4.5 VA]

AMV435 ::: Control signal [three-point] : Force [400 N] : IP 54
Stroke [20 mm] : Speed [7,5 / 15 sec/mm] : Limit switches [equipped]
Supply voltage [~24/ 230V | ~ 50 / 60 Hz | 2 VA]

