

Maximum allowable pressure PS of a valves

Maximum allowable pressure PS of a valves:

Maximum allowable pressure PS must be based on the most stringent conditions, which act on the valve. According to the maximum allowable pressure, the PN valve must be selected.

$$PS \leq PN$$

$$PS \geq H_{v=0} + \Delta P + P_{atm}$$

PS	maximum allowable pressure	[MPa]
$H_{v=0}$	static pressure before valve in closed position at zero flow	[MPa]
ΔP	increasing pressure on water hammer	[MPa]
P_{atm}	under-pressure behind the valves (atmospheric pressure)	[MPa]

Under-pressure behind the valves:

For non-perfect aerated space behind the valve

$$P_{atm} = 0,1MPa$$

For perfect aerated space behind the valve

$$P_{atm} = 0MPa$$

Example:

We have to determine maximum allowable pressure PS of a valves (Butterfly valve DN2000 the valve is controlled by a gearbox with a drive) with the following parameters:

Static pressure before valve in closed position at zero flow $H_{v=0} = 1,2MPa$; the length of the pipeline before the valve $L = 1000m$; steel pipe $D = 2000mm$; thickness of the pipe wall $e = 30mm$; max. flow $Q = 30 m^3/s$; density water $\rho = 998,8Kg/m^3$; medium compressibility factor $\beta = 477,1 \cdot 10^{-12}$; closing time 45s; local loss factor for an open valve $\zeta = 0,106$; the space behind the valve is non-perfect aerated $P_{atm} = 0,1MPa$

Increasing pressure on water hammer:

$$\Delta P = 0,39MPa$$

was calculated by

[https://met-calc.com/soubory/clanky/Effective%20closing%20time%20factor%20\[EN\].pdf](https://met-calc.com/soubory/clanky/Effective%20closing%20time%20factor%20[EN].pdf)

[https://met-calc.com/soubory/clanky/Water%20hammer%20\[EN\].pdf](https://met-calc.com/soubory/clanky/Water%20hammer%20[EN].pdf)

maximum allowable pressure:

$$PS \geq H_{v=0} + \Delta P + P_{atm} = 1,2 + 0,39 + 0,1 = 1,69MPa$$

$$PS \leq PN \rightarrow PN25$$

Literature:

ČSN EN 13445-3: Netopené tlakové nádoby – část 3: Konstrukce a výpočet.

MET-Calc: Effective closing time factor

[https://met-calc.com/soubory/clanky/Effective%20closing%20time%20factor%20\[EN\].pdf](https://met-calc.com/soubory/clanky/Effective%20closing%20time%20factor%20[EN].pdf)

MET-Calc: Water hammer

[https://met-calc.com/soubory/clanky/Water%20hammer%20\[EN\].pdf](https://met-calc.com/soubory/clanky/Water%20hammer%20[EN].pdf)