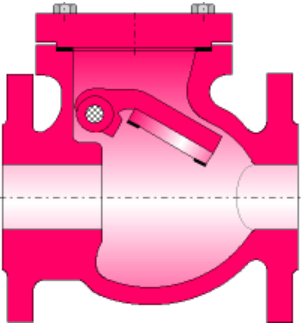# Swing Check Valve
(User defined)

Model description:

This model of component calculates the minor head loss (pressure drop) generated by the flow in a swing check valve installed in a straight pipe.

The swing check valve characteristics are defined by the user. The pressure drop of the valve is characterized by a flow coefficient "Kvs", "Cvs" or "Avs" at full opening. The model also takes into account the partial opening of the valve, the opening is partial when the pressure at the inlet of the valve is between the pressure at the begin of opening and the minimum pressure for full opening.

Model formulation:

Cross-sectional area (m²):

$$A = \pi \cdot \frac{D^2}{4}$$

Mean velocity (m/s):

$$U = \frac{Q}{A}$$

Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

Reynolds number:

$$Re = \frac{U \cdot D}{\nu}$$

● check valve at full opening:

Local resistance coefficient:

$$K_{turb} = \frac{2 \cdot A^2}{\left(Kvs\middle/36023\right)^2}$$

$$K_{turb} = \frac{2 \cdot A^2}{\left(Cvs\middle/41650\right)^2}$$

$$K_{turb} = \frac{2 \cdot A^2}{Avs^2}$$

Total pressure loss coefficient (based on mean velocity):

$$K = K_{turb}$$

Total pressure loss (Pa):
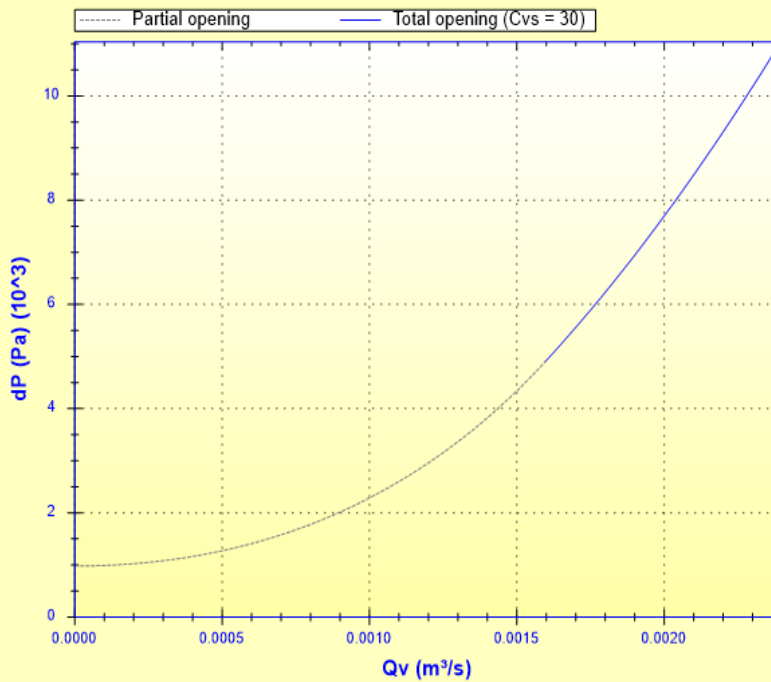
$$\Delta P = K \cdot \frac{\rho \cdot U^2}{2}$$

● check valve at partial opening:

The pressure drop at partial opening is estimated by curvilinear interpolation between the pressure at the begin of opening "Pbo" and the minimum pressure for full opening "Pto".

$$\Delta P = f\left(Qv, Pbo, Pto\right)$$

The figure below shows an example of the pressure drop of a check valve with partial opening.

Swing check valve
Pressure loss

Flow coefficient:

$$Kv = 36023 \cdot Q \cdot \sqrt{\frac{\rho}{\Delta P}}$$

$$Cv = 41650 \cdot Q \cdot \sqrt{\frac{\rho}{\Delta P}}$$

$$Av = Q \cdot \sqrt{\frac{\rho}{\Delta P}}$$

Total pressure loss coefficient (based on mean velocity):

$$K = \frac{2 \cdot \Delta P}{\rho \cdot U^2}$$

Total head loss of fluid (m):

$$\Delta H = K \cdot \frac{U^2}{2 \cdot g}$$

Hydraulic power loss (W):

$$Wh = \Delta P \cdot Q$$

Symbols, Definitions, SI Units:

D	Internal diameter (m)
A	Cross-sectional area (m²)
Q	Volume flow rate (m³/s)
U	Mean velocity (m/s)

G	Mass flow rate (kg/s)
Re	Reynolds number ()
α	Opening angle (°)
Kvs	Full opening flow coefficient (m³/h)
Cvs	Full opening flow coefficient (USG/min)
Avs	Full opening flow coefficient (m²)
K_{turb}	Local resistance coefficient for Re ≥ 10^4 ()
K	Total pressure loss coefficient (based on mean velocity) ()
ΔP	Total pressure loss (Pa)
Kv	Partial opening flow coefficient (m³/h)
Cv	Partial opening flow coefficient (USG/min)
Av	Partial opening flow coefficient (m²)
Pbo	Pressure at the begin of opening (Pa)
Pto	Minimum pressure for full opening (Pa)
ΔH	Total head loss of fluid (m)
Wh	Hydraulic power loss (W)
ρ	Fluid density (kg/m³)
ν	Fluid kinematic viscosity (m²/s)
g	Gravitational acceleration (m/s²)

Validity range:

- flow regime: turbulent

  note: for laminar flow regime (Re < 10^4) and for operation in partial opening, the pressure loss coefficient "K" is estimated

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Example of application:

File   Edit   Preferences   Calculation method   Database   Tools   Help

Fluid characteristics

Fluid :   Water @ 1 atm [HC]

Ref.: IAPWS IF97

Temperature :   T   20   °C

Pressure :   P   1.013   bar

Density :   ρ   998.2061   kg/m³
Dynamic Viscosity :   μ   0.00100159   N.s/m²
Kinematic Viscosity :   ν   1.00340E-06   m²/s

○ Density   ○ Dyn. Visc.   ○ Kin. Visc.

☐ logY

Geometrical characteristics

○ Kv   ● Cv   ○ Av

Flow coefficient
at full opening
100

G   4.9910 kg/s
Q   0.005
m³/s

9.868 m/s
(Turbulent)

Definition of partial opening
☐ Define opening pressures

D
0.0254
m

Pressure loss
0.04329062   bar
0.4422 m of fluid

Calculate
Help
Info

Complementary results

Designation	Symbol	Value	Unit
Pipe cross-section area	A	0.0005067075	m²
Reynolds number	Re	249789.2	
Fully open flow coefficient 'Cvs	Cvs	100	
Flow coefficient 'Cv	Cv	100	
Coefficient of local resistance	Kturb	0.08907958	
Pressure loss coefficient (based on the mean valve velocity)	K	0.08907958	
Pressure loss	ΔP	0.04329062	bar
Hydraulic power loss	Wh	21.64531	W

Divers

HydrauCalc

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Edition: January 2022