Flow Coefficients, Cv for Smith Valves

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NPS	DN	Conventional Port Gate	Full Port Gate	Globe	Piston Check	Ball Check	Swing Check
1/4	8	1.7	1.7	1	0.9	0.8	-
3/8	10	4.2	5.7	1.2	1	0.9	-
1/2	15	5.7	8.2	1.5	1.3	1.2	11
3/4	20	8.2	22	2.4	2.1	1.9	17.6
1	25	26	34	5.6	5	4.4	31.4
1-1/4	32	37	60	15	-	-	-
1-1/2	40	60	92	21	12.6	10.5	57.6
2	50	92	200	29	17.4	14.5	80.1
3	80	200	-	-	-	-	-

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Cv – Flow Coefficient = Index of Flow Capacity equivalent to the gallons per minute of water at standard temperature (60°F = 16°C) which will flow through a valve or fitting at a pressure differential across the valve of 1 psi.

FLOW COEFFICIENT, FLOW RATE, PRESSURE DROP EQUATIONS

TYPE OF FLUID	Cv	Flow Rate	Pressure Drop
INCOMPRESSIBLE	$Cv = Q \bullet \sqrt{\frac{Gf}{DP}}$	$Q = Cv \bullet \sqrt{\frac{DP}{Gf}}$	$DP = Gf \bullet \left(\frac{Q}{Cv}\right)^2$
COMPRESSIBLE	$Cv = \frac{q}{1{,}360 \bullet Y} \bullet \sqrt{\frac{T1 \bullet Gg}{DP \bullet P1}}$	$q = 1{,}360 \bullet Y \bullet Cv \bullet \sqrt{\frac{DP \bullet P1}{T1 \bullet Gg}}$	$DP = \frac{T1 \bullet Gg}{P1} \bullet \left(\frac{q}{1{,}360 \bullet Cv \bullet Y}\right)^2$

NOMENCLATURE

- Cv = Valve flow coefficient, dimensionless
- Q = Volumetric flow rate, gpm
- q = Volumetric flow rate, scfh
- Gf = Liquid specific gravity at upstream conditions [ratio of density of liquid at flowing temperature to density of water at 15.6°C (60°F)], dimensionless
- Gg = Gas specific gravity (ratio of flowing gas to density of air with both at standard conditions, which is equal to the ratio of the molecular weight of gas to the molecular weight of air), dimensionless
- DP = Pressure differential, psi
- T1 = Absolute upstream temperatures (in °R)
- P1 = Upstream absolute static pressure, psia
- P2 = Downstream absolute static pressure, psia
- Y = Expansion factor, ratio of flow coefficient for a gas to that for a liquid at the same Reynolds Number, dimensionless (Y = 0.667 when P2 <= 0.5 times P1 for choked or critical flow, Y = 1.000 when P2 > 0.5 times P1 for very low pressure differential)

DISCLAIMER

The above sizing equations are provided as courtesy and are derived from ISA-75.01 and ISA-75.02.
They have been simplified to include a piping geometry factor of 1.0.
Refer back to ISA-75 in case actual application differ from the assumptions taken in the herein.

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