

Technical Data Gate Globe & Check Valve

Flow Formulation Using Cv Factors

English Units

TYPE FLOW	FLOW RATE	PRESSURE DROP
LIQUID	$Q = C_v \sqrt{\frac{\Delta P}{S}}$	$\Delta P = S \left(\frac{Q}{C_v} \right)^2$
GAS WHEN $\Delta P < 0.5P_1$	$q' m = 22.6 C_v \sqrt{\frac{\Delta P \times P_1}{T_1 S_g}}$	$\Delta P = \frac{0.00195 T_1 S_g}{P_1} \left(\frac{q' m}{C_v} \right)^2$
WHEN $\Delta P \geq 0.5P_1$	$q' m = \frac{13.9 P_1 C_v}{\sqrt{T_1 S_g}}$	
DRY SATURATED STEAM WHEN $\Delta P < 0.5P_1$	$W = 2.97 C_v \sqrt{\Delta P \times P_1}$	$\Delta P = \frac{0.113}{P_1} \left(\frac{W}{C_v} \right)^2$
WHEN $\Delta P \geq 0.5P_1$	$W = 1.82 C_v P_1$	
SUPERHEATED STEAM WHEN $\Delta P < 0.5P_1$	$W = \frac{2.97 C_v \sqrt{\Delta P \times P_1}}{(1 + 0.0007s)}$	$\Delta P = \frac{0.113}{P_1} \left(\frac{W (1 + .0007s)}{C_v} \right)^2$
WHEN $\Delta P \geq 0.5P_1$	$W = \frac{1.82 C_v P_1}{(1 + 0.0007s)}$	

Fluid Flow Nomenclature

- Cv - Flow coefficient for valves and fittings
- P₁ - Absolute inlet pressure (PSIA)
- P₂ - Absolute outlet pressure (PSIA)
- ΔP - Pressure drop in pounds per square inch (PSI)
- Q - Liquid flow in gallons per minute. (GPM)
- q'm - Rate of gas flow in cubic feet per minute at standard conditions, 14.7 psia and 60°F (SCFM)
- S - Specific gravity of flowing liquid relative to water at 60°F
- Sg - Specific gravity of gas relative to air
- s - Number of degrees of superheat for steam in °F
- T₁ - Absolute inlet temperature in degrees Rankine (°R)
- W - Steam of vapor flow rate in pounds per hour (LBS/HR)

Metric Units

TYPE FLOW	FLOW RATE	PRESSURE DROP
LIQUID	$Q = 0.865 C_v \sqrt{\frac{\Delta P}{S}}$	$\Delta P = 1.34 S \left(\frac{Q}{C_v} \right)^2$
GAS WHEN $\Delta P < 0.5P_1$	$q'_H = 414.97 C_v \sqrt{\frac{\Delta P \times P_1}{T_1 S_g}}$	$\Delta P = \frac{5.8 \times 10^{-6} T_1 S_g}{P_1} \left(\frac{q'_H}{C_v} \right)^2$
WHEN $\Delta P \geq 0.5P_1$	$q'_H = \frac{255.2 P_1 C_v}{\sqrt{T_1 S_g}}$	
DRY SATURATED STEAM WHEN $\Delta P < 0.5P_1$	$W = 19.53 C_v \sqrt{\Delta P \times P_1}$	$\Delta P = \frac{0.00262}{P_1} \left(\frac{W}{C_v} \right)^2$
WHEN $\Delta P \geq 0.5P_1$	$W = 11.97 C_v P_1$	
SUPERHEATED STEAM WHEN $\Delta P < 0.5P_1$	$W = \frac{19.1 C_v \sqrt{\Delta P \times P_1}}{(1 + 0.00123s)}$	$\Delta P = \frac{0.00274}{P_1} \left(\frac{W (1 + .00123s)}{C_v} \right)^2$
WHEN $\Delta P \geq 0.5P_1$	$W = \frac{11.71 C_v \times P_1}{(1 + 0.00123s)}$	

Fluid Flow Nomenclature

- Cv - Flow coefficient for valves and fittings
- P₁ - Absolute inlet pressure (BAR)
- P₂ - Absolute outlet pressure (BAR)
- ΔP - Pressure drop in bars
- Q - Liquid flow in cubic meters Per hour
- q'm - Rate of gas flow in cubic Meters per hour at Standard conditions, 1.01 BAR @ 15.6°C
- q'm - Rate of gas flow in cubic feet per minute at standard conditions, 14.7 psia and 60°F (SCFM)
- S - Specific gravity of flowing liquid relative to water at 60°F
- Sg - Specific gravity of gas relative to air
- s - Number of degrees of superheat for steam in °F
- T₁ - Absolute inlet temperature in degrees Rankine (°R)
- W - Steam of vapor flow rate in pounds per hour (LBS/HR)

Flow coefficients

Flow coefficients for API 602 type Valves

VALVE SIZE	GATE		GLOBE			CHECK LIFT TYPE		
	Regular Port	Full Port	Regular Port	Full Port	Y Pattern	Regular Port	Full Port	Y Pattern
1/4	-	2.5	-	1.1	2.9	-	0.9	2.3
3/8	-	4.3	-	1.4	3.8	-	1.1	3.5
1/2	5.5	11.6	1.5	3.6	4.5	1	2.1	4.8
3/4	12	26.6	3.8	6.6	10.1	2.8	5.8	7.8
1	27	54.6	6.8	10.9	16.0	6	7	11.2
1 1/4	55	79.8	11	14	23.1	9.5	9.2	18.0
1 1/2	80	87	14.3	24.3	47.1	11	15.4	37.8
2	105.0	203	25	39.7	80.2	18	32	69.2

Flow coefficients for 150 & 300 class Bolted Bonnet API 600 type valves

VALVE SIZE	GATE	GLOBE & STOP CHECK			SWING CHECK		TILTING DISC CHECK	
	Full Port Cv	Regular Port Cv	Full Port Cv	Y Pattern Cv	Full Port Cv	Min. Flow velocity for fully open(1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open(1) ft/sec (water 60°F)
1 1/2	170	30	38	57	101	7.82	60	5.69
2	311	55	69	104	183	7.90	109	5.75
2 1/2	495	87	110	166	292	7.96	174	5.80
3	724	127	160	242	427	8.02	254	5.84
4	1320	232	292	441	778	8.10	463	5.9
6	3076	539	682	1026	1814	8.22	1079	5.99
8	5608	982	1242	1867	3307	8.31	1967	6.05
10	8834	1563	1979	2970	5269	8.38	3134	6.10
12	13071	2285	2896	4341	7709	8.43	4586	6.14
14	16074	2809	----	5335	9480	8.25	5639	6.01
16	21554	3765	----	7148	12712	8.32	7562	6.06
18	27876	----	----	9237	16440	8.38	9780	6.10
20	35048	----	----	11605	20670	8.43	12296	6.14
22	43078	----	----	14255	25406	8.47	15113	6.17
24	51973	----	----	17188	30652	8.51	18233	6.20
26	61714	----	----	----	36413	8.55	21660	6.22
28	72387	----	----	----	42692	8.58	25395	6.25
30	83919	----	----	----	49462	8.72	29441	6.35
36	119333	----	----	----	70379	8.48	41865	6.91
42(2)	163380	----	----	----	96356	10.22	57318	7.45
48(2)	215888	----	----	----	127324	10.93	75739	7.96
54(2)	278938	----	----	----	----	----	----	----

NOTES:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

(2) Class 150 only.

Flow coefficients

Flow coefficients for 600 class Bolted Bonnet API 600 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Full Port Cv	T Pattern Cv	Y Pattern Cv	Full Port Cv	Min. Flow velocity for fully open (1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open(1) ft/sec (water 60°F)
1 1/2	170	30	57	101	9.2	60	6.7
2	311	55	104	183	8.85	109	6.45
2 1/2	495	87	166	292	8.59	174	6.26
3	724	127	242	427	8.39	254	6.11
4	1320	232	441	778	8.08	463	5.88
6	3076	539	1026	1814	7.65	1079	5.57
8	5434	952	1809	3205	7.31	1906	5.32
10	8474	1483	2818	4998	7.60	2973	5.53
12	12509	2187	4155	7377	8.34	4388	6.07
14	15151	2648	5030	8936	8.73	5315	6.36
16	20106	3512	6669	11858	9.34	7054	6.81
18	25406	----	8421	14948	9.88	8913	7.20
20	31355	----	10368	18492	10.39	11000	7.57
22	38435	----	12723	22668	10.91	13484	7.95
24	46312	----	15321	27313	11.41	16247	8.31
26	54333	----	17966	32044	11.86	19061	8.64
28	63023	----	----	37169	12.30	27110	8.95
30	73110	----	----	43118	12.73	25649	9.27
36	114881	----	----	----	----	40303	10.33

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients for 900 class Bolted Bonnet API 600 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Full Port Cv	T Pattern Cv	Y Pattern Cv	Full Port Cv	Min. Flow velocity for fully open (1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open(1) ft/sec (water 60°F)
1 1/2	141	25	47	83	8.87	49	6.46
2	273	48	92	161	8.84	96	6.44
2 1/2	397	70	133	234	8.54	139	6.22
3	665	117	233	392	8.73	233	6.35
4	1239	218	414	731	8.62	435	6.28
6	2815	494	939	1660	8.37	988	6.09
8	4901	859	1632	2891	8.14	1719	5.93
10	7817	1368	2600	4610	8.25	2742	6.01
12	11171	1954	3712	6588	8.98	3919	6.54
14	13646	2386	4531	8048	9.42	4787	6.86
16	18031	3150	5983	10634	10.07	6326	7.34
18	23056	----	7644	13597	10.69	8088	7.78
20	28726	----	9518	16942	11.26	10078	8.20
22	35048	----	11605	20670	11.81	12296	8.60
24	42027	----	13908	24786	12.34	14744	8.99
26	49668	----	16428	----	----	17425	9.35

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients

Flow coefficients for 1500 class Bolted Bonnet API 600 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Full Port Cv	T Pattern Cv	Y Pattern Cv	Full Port Cv	Min. Flow velocity for fully open (1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open (1) ft/sec (water 60°F)
1 1/2	141	25	47	83	10.08	49	7.34
2	273	48	92	161	10.05	96	7.32
2 1/2	397	70	133	234	9.71	139	7.07
3	604	106	202	356	9.69	212	7.06
4	1078	189	360	636	5.83	378	4.25
6	2450	430	817	1445	7.10	860	5.17
8	4244	744	1414	2503	8.10	1489	5.90
10	6761	1184	2250	3988	9.05	2372	6.59
12	9657	1690	3210	5696	9.86	3388	7.18
14	11701	----	3887	6901	10.32	4105	7.52
16	15447	----	5128	9110	11.03	5919	8.04
18	19766	----	6556	11657	11.70	6932	8.53
20	25022	----	8294	----	----	8778	9.02
22	30465	----	10092	----	----	10688	9.46
24	36507	----	12087	----	----	12808	9.87

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients for 2500 class Bolted Bonnet API 600 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Full Port Cv	T Pattern Cv	Y Pattern Cv	Full Port Cv	Min. Flow velocity for fully open (1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open(1) ft/sec (water 60°F)
1 1/2	93	16	31	55	9.89	32	7.20
2	170	30	57	101	9.43	60	6.87
2 1/2	273	48	92	161	9.08	96	6.62
3	397	70	133	234	8.79	139	6.40
4	660	116	221	389	5.89	232	4.29
6	1588	279	530	936	7.27	557	5.29
8	2815	494	939	1660	8.34	988	6.07
10	4566	800	1521	2693	9.36	1602	6.82
12	6553	1147	2181	3865	10.21	2299	7.43
14	8027	----	2670	4734	10.71	2816	7.80
16	10633	----	3533	----	----	3730	8.35
18	13646	----	4531	----	----	4787	8.86
20	16713	----	5547	----	----	5863	9.30
22	20449	----	6782	----	----	7174	9.76
24	24610	----	8158	----	----	8634	10.21

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients

Flow coefficients for 600 class Pressure Seal ASME B16.34 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Regular Port Cv	T Pattern Cv	Y Pattern Cv	Regular Port Cv	Min. Flow velocity for fully open(1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open (1) ft/sec (water 60 F)
2	217	55	104	109	8.85	109	6.45
2 1/2	343	87	166	174	8.59	174	6.26
3	499	127	242	254	8.39	254	6.11
4	900	232	441	463	8.08	463	5.88
6	2070	539	1026	1079	7.65	1079	5.57
8	3622	952	1809	1906	7.31	1906	5.32
10	5606	1483	2818	2973	7.60	2973	5.53
12	8219	2187	4155	4388	8.34	4388	6.07
14	9921	2648	5030	5315	8.73	5315	6.36
16	13099	3512	6669	7054	9.34	7054	6.81
18	16489	----	8421	8913	9.88	8913	7.20
20	20264	----	10368	11000	10.39	11000	7.57
22	24746	----	12723	13484	10.91	13484	7.95
24	29714	----	15321	16247	11.41	16247	8.31
26	34755	----	17966	19061	11.86	19061	8.64
28	40201	----	----	27110	12.30	27110	8.95
30	46503	----	----	25649	12.73	25649	9.27
36	72438	----	----	----	----	40303	10.33

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients for 900 class Pressure Seal ASME B 16.34 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Regular Port Cv	T Pattern Cv	Y Pattern Cv	Regular Port Cv	Min. Flow velocity for fully open(1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open (1) ft/sec (water 60°F)
2	191	48	92	96	8.84	96	6.44
2 1/2	276	70	133	139	8.54	139	6.22
3	458	117	233	233	8.73	233	6.35
4	846	218	414	435	8.62	435	6.28
6	1897	494	939	988	8.37	988	6.09
8	3273	859	1632	1719	8.14	1719	5.93
10	5178	1368	2600	2742	8.25	2742	6.01
12	7355	1954	3712	3919	8.98	3919	6.54
14	8952	2386	4531	4787	9.42	4787	6.86
16	11771	3150	5983	6326	10.07	6326	7.34
18	14984	----	7644	8088	10.69	8088	7.78
20	18594	----	9518	10078	11.26	10078	8.20
22	22604	----	11605	12296	11.81	12296	8.60
24	27013	----	13908	14744	12.34	14744	8.99
26	31825	----	16428	----	----	17425	9.35

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients

Flow coefficients for 1500 class Pressure Seal ASME B16.34 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Regular Port Cv	T Pattern Cv	Y Pattern Cv	Regular Port Cv	Min. Flow velocity for fully open(1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open(1) ft/sec (water 60°F)
2	191	48	92	96	10.05	96	7.32
2 1/2	276	70	133	139	9.71	139	7.07
3	417	106	202	212	9.69	212	7.06
4	738	189	360	378	5.83	378	4.25
6	1655	430	817	860	7.10	860	5.17
8	2841	744	1414	1489	8.10	1489	5.90
10	4490	1184	2250	2372	9.05	2372	6.59
12	6374	1690	3210	3388	9.86	3388	7.18
14	7697	----	3887	4105	10.32	4105	7.52
16	10112	----	5128	5919	11.03	5919	8.04
18	12882	----	6556	6932	11.70	6932	8.53
20	16238	----	8294	----	----	8778	9.02
22	19699	----	10092	----	----	10688	9.46
24	23527	----	12087	----	----	12808	9.87

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet.

Flow coefficients for 2500 class Pressure Seal ASME B16.34 type valves

VALVE SIZE	GATE	GLOBE, STOP CHECK AND LIFT CHECK		SWING CHECK		TILTING DISC CHECK	
	Regular Port Cv	T Pattern Cv	Y Pattern Cv	Regular Port Cv	Min. Flow velocity for fully open (1) ft/sec (water 60°F)	Regular Port Cv	Flow velocity for fully open(1) ft/sec (water 60°F)
2	120	30	57	60	9.43	60	6.87
2 1/2	191	48	92	96	9.08	96	6.62
3	276	70	133	139	8.79	139	6.40
4	455	116	221	232	5.89	232	4.29
6	1080	279	530	557	7.27	557	5.29
8	1897	494	939	988	8.34	988	6.07
10	3053	800	1521	1602	9.36	1602	6.82
12	4354	1147	2181	2299	10.21	2299	7.43
14	5315	----	2670	2816	10.71	2816	7.80
16	7007	----	3533	----	----	3730	8.35
18	8952	----	4531	----	----	4787	8.86
20	10925	----	5547	----	----	5863	9.30
22	13319	----	6782	----	----	7174	9.76
24	15975	----	8158	----	----	8634	10.21

NOTE:

(1) Required flow velocity for other fluid different than water = Flow velocity on table x 7.9 SQRT(1/ density of the fluid), density in lbs per cubic feet. lbs