

VALVE DESCRIPTION

The U.S. Series 9000 control valve is an ANSI Class 300 globe-style valve with bolted bonnet and post-guided innervalve. It is available in 1 in. (25 mm), 1-1/2 in. (38 mm) and 2 in. (50 mm) pipe size. The body, bonnet and innervalve are standard in 316SST or optional Alloy C. The standard body, configured in the Flangeless/NPT version, can be installed using NPT fittings or clamped between matching companion flanges. Each size valve is also available with conventional flanges in either the same nominal size as the valve body or oversized flanges that can be adapted to smaller bodies.

Each valve is available with several innervalve sizes, the largest having an integral seat for maximum Cv.

Reduced Cv innervalves fit a threaded body with replaceable seat rings. The unique packing/bonnet design provides high performance and quick easy maintenance when necessary. The Series 9000 control valve is also available with extended bonnets for hot or cold service. Optional double packing, in either PTFE or REK, for fugitive emission control is also available.

The high performance Model 9050 actuator, a multi-spring and diaphragm design, is field reversible from air-to-open to air-to-close without additional parts. The yoke and actuator housings are made of carbon steel and coated with epoxy for corrosion resistance.

Standard material for external hardware is 300 series stainless steel.

The 3...15 psi (0.2...1 bar) spring set is adjustable to 8...20 psi (0.5...1 bar) and the 6...30 psi (0.4...2 bar) spring set is adjustable to 16...40 psi (1...2 bar) to allow a wide range of shutoff capability.

Applications

The Series 9000 control valve is designed for modulating control of liquids and vapors in medium duty industrial applications where performance, quality and small physical size are important. The rugged design offers features and performance levels normally found in more expensive, larger valves.

The unit is designed to handle fluids and environments found in chemical plants, pulp and paper and textile mills, refineries and many other demanding industries.

Valve Materials

Body	316 stainless steel (CF8M ASTM A351)
Bonnet	316 stainless steel (ASTM A479)
Bonnet Flange	316 stainless steel (CF8M)
Bolting	Gr 5 with Xylan coating
Gasket	Grafoil Gr GTA
Innervalve	316 stainless steel (ASTM A479)
Packing	PTFE chevron ring



Valve Material Options

Body	Alloy C (CW-2M ASTM A494)
Bonnet	Alloy C276 barstock
Innervalve	Alloy C276, Stellite 316, 316 w/ Teflon PFA soft seat
Packing	Grafoil, Kalrez® (REK)
Bolting	Strain hardened 316 stainless steel

ACTUATOR DESCRIPTION

The Model 9050 actuator is available in either air-to-open/spring-to-close or air-to-close/spring-to-open and is field reversible. It comes with either 3 springs for a 3...15 psi (0.2...1 bar) signal range or 6 springs for a 6...30 psi (0.4...2 bar) signal range. Both ranges are adjustable to match bench loading with the requirements of the application.

Actuator Materials

Pressure cases	Steel/epoxy
Yoke	Steel/epoxy
Diaphragm	Nitrile/polyester
Springs	17-7PH stainless steel
Diaphragm Plate/Piston	High strength aluminum with hard anodized coating
Hardware	300 stainless steel
Pressure Cases & Yoke	Electroless nickel coating

Actuator Features

- Designed to ANSI and ISA standards
- Dual body mounting (NPT/Flangeless)
- Wide range of innervalves
- Linear, Equal Percent or On-Off
- ANSI Class IV seat leak standard
- Encapsulated body gasket
- MoS2 filled nylon stem bushings
- No brass or asbestos
- Epoxy coated steel parts
- Adjustable spring loading
- Replaceable seats (reduced Cv innervalves only)

Actuator Optional Features

- Stellite innervalue
- Teflon PFA soft seating
- Class V or VI seat test
- Graphite packing
- Extended bonnets, to 18 in. (457 mm), for hot or cryogenic service.
- Double stuffing box

Actuator Design Standards

Structural	ASME B16.34-1996
Bolting	ASME Section VIII, Appendix 2 and ASME B16.34
Seat leakage	ANSI/FCI 70-2-1991
Cv	ISA- 75.01, 75.02, and 75.11
Face-to-Face (Std)	ISA S75.04
Face-to-Face (Flanged)	ASME B16.10-1992 (Optional F/F dimensions available)
Flange finish	ASME B16.5-1996 (standard is concentric serrations)
Materials	ASTM designations
Code Welding	ASME Section VIII
Accessory Mount	IEC 534 (yoke)

Actuator Accessories

- Positioner
- i/P positioner
- i/P transducer
- Gauges
- Filter-regulator
- Solenoid
- Limit switches (1 or 2)
- Position transmitter

SPECIFICATIONS

Parts and Material List

Unless otherwise noted, standard material is 316 SST. (Item numbers refer to items in *Figure 1 on page 3.*)

Item No.	Description	Part Numbers		
		1 in. (DN 25)	1-1/2 in. (DN 40)	2 in. (DN 50)
1a	Body (for replaceable seat)	525966-0001	526149-0001	526151-0001
1b	Body (with integral seat)	525956-0001	526148-0001	526150-0001
2	Bonnet (standard length)	525949-0001	526152-0001	525952-0001
3a	Stem, innervalue	Innervalue part numbers vary with Cv and material. Consult the factory for complete innervalue set part numbers.		
3b	Innervalue and guide			
3c	Seat (if applicable)			
4	Gasket (Grafoil)	512711-0001	512702-0001	512726-001
5	Packing gland	525950-0001	525950-0001	525950-0001
6	Packing kit (PTFE)	543242-0001	543242-0001	543242-0001
7	Packing adapter	525951-0001	525951-0001	525951-0001
8	Hex screws (Gr 5 Steel)	526119-0001	526119-0003	526119-0004
9	Bonnet flange	512681-0001	512723-0001	512722-0001
10	Yoke locknut	525944-0001	525944-0001	525944-0001

Pressure vs Temperature Rating

psig	Temperature		barg	Notes
	°F	°C		
720	100	38	49.6	• Below -20° F (28° C) and above 500° F (260° C), use optional SST bonnet studs
620	200	93	42.7	
560	300	149	38.6	• Consult factory for cryogenic service
515	400	204	35.5	
480	500	260	33.1	• Max. temp for TFE packing is 450° F (232° C)
450	600	316	31.0	
430	700	371	29.6	• Consider extended bonnets for Grafoils packing above 450° F (232° C)
415	800	427	28.6	
395	900	482	27.2	• Consult factory for limits on TFE soft seat
365	1000	538	25.1	
• Consider Stellite for +600° F (315° C) service				

Above information taken from ANSI Class 300 pressure vs temperature data for CF8M 316SST. For information or part numbers on other materials, consult the factory.

Detailed actuator and valve assembly drawings are available on request from the factory.

DIMENSIONS

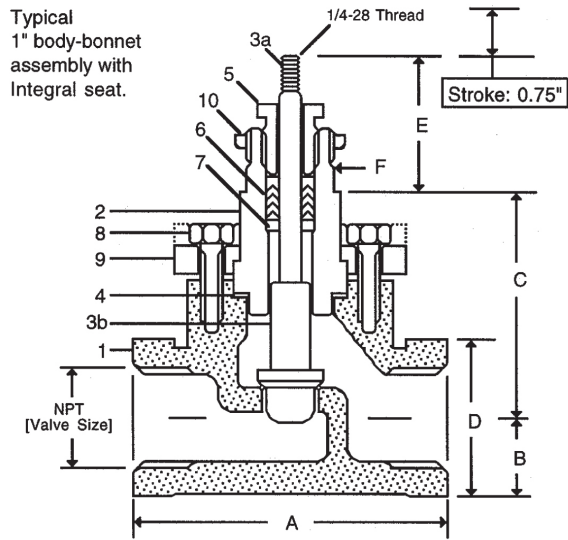
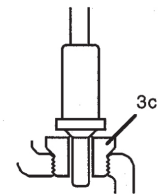


Figure 1: Dimensions

Body Assembly Dimensions

For complete valve dimensions, see "Outline Dimensions For Common Series 9000 Valves" on page 4.

Dim.	1 in. (25.4 mm) (DN 25)		1-1/2 in. (38.1 mm) (DN 40)		2 in. (50.8 mm) (DN 50)	
	in.	mm	in.	mm	in.	mm
A	4.0	102	4.5	115	4.875	124
B	1.0	25.4	1.5	38.1	1.75	44.5
C	3.2	81.3	3.46	87.9	3.59	91.2
D	2.0	50.8	2.88	73.1	3.625	92.1
E	1.68	42.7	1.68	42.7	1.68	42.7
F	1.125	28.6	1.125	28.6	1.125	28.6



Replaceable Seat Body Configuration

Figure 2: Seat configuration

Approximate Valve Weight
NPT Body with Size 35 Actuator

Size	lb	kg
1 in. (25.4 mm)	28	12.8
1-1/2 in. (38.1 mm)	31	14.1
2 in. (50.8 mm)	34	15.5

Stroke (All Sizes of M9000): 0.75 in.

Innervalue Information

Valve Size	Orific Dia. in. (mm)	Orif. area in. ² (mm ²)	F _L	Seat Config.	Cv (Linear)	Cv (%)	Max. Oper. ΔP psi (bar)	Max ΔP Shutoff
2 in. (50.8 mm)	1.500 (38.1)	1.77 (1141.9)	0.85	Integr.	25	20	150 (10.3)	300*
	1.125 (28.6)	1.00 (645.2)	0.86	Repl.	21	17	275 (19.0)	550*
	0.812 (20.9)	0.52 (335.5)	0.88	Repl.	15	14	540 (37.2)	720*
	0.625 (15.9)	0.31 (200.0)	0.90	Repl.	7	6.5	660 (45.5)	720
1-1/2 in. (38.1 mm)	1.250 (31.8)	1.23 (793.5)	0.85	Integr.	15.5	13	225 (15.5)	450*
	0.812 (20.9)	0.52 (335.5)	0.87	Repl.	11	10	540 (37.2)	720*
	0.625 (15.9)	0.31 (200.0)	0.90	Repl.	7	6.5	660 (45.5)	720
1 in. (25.4 mm)	0.625 (15.9)	0.31 (200.0)	0.92	Repl.	4	4	660 (45.5)	720
	0.812 (20.9)	0.52 (335.5)	0.85	Integr.	8.3	7.0	540 (37.2)	720*
	0.500 (12.7)	0.20 (129.0)	0.87	Repl.	5.3	4.5	660 (45.5)	720
	0.500 (12.7)	0.20 (129.0)	0.89	Repl.	2	2	660 (45.5)	720
	0.500 (12.7)	0.20 (129.0)	0.91	Repl.	1	1	660 (45.5)	720
	0.156 (4.0)	0.02 (12.9)	0.93	Repl.	0.5	0.5	720 (49.6)	720
	0.156 (4.0)	0.02 (12.9)	0.94	Repl.	0.2	0.2	720 (49.6)	720
	0.156 (4.0)	0.02 (12.9)	0.95	Repl.	0.1	0.1	720 (49.6)	720
0.156 (4.0)	0.02 (12.9)	0.96	Repl.	0.05	0.05	720 (49.6)	720	
0.156 (4.0)	0.02 (12.9)	0.97	Repl.	0.02	N/A	720 (49.6)	720	

The largest Cv in each valve size has an integral seat. All other Cv's have replaceable seats.

Typical Innervalue Rangeability

Linear: 50:1

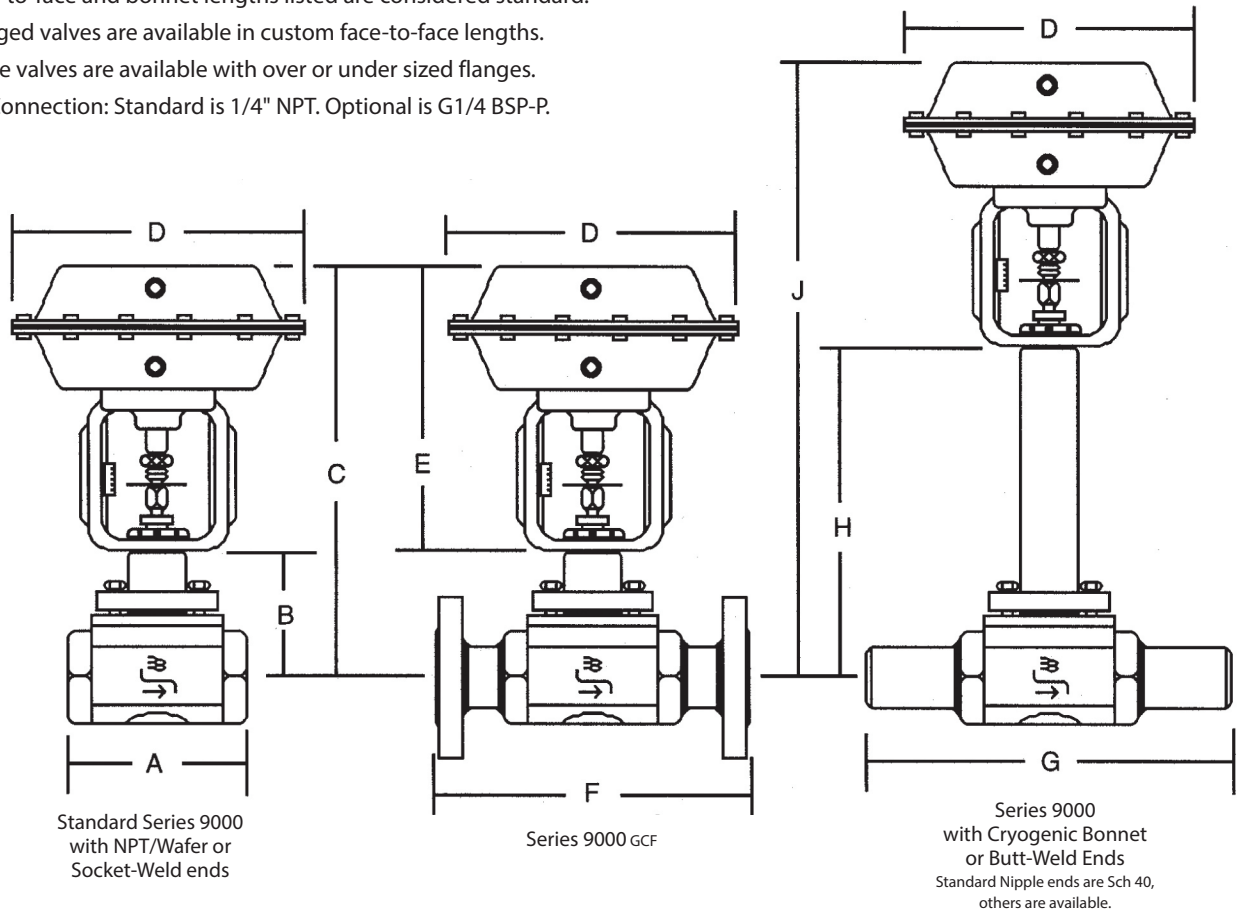
Equal Percent: 60:1

NOTES:

- Pressure drop limits for soft seated trims are 50% of those listed.
- Body recovery coefficient (FsubL) per ISA 75.02-1988 at maximum innervalue opening.
- Shutoff pressures marked with an asterisk (*) require six (6) actuator springs to obtain required preload.
- Pressures listed under *Max. Oper. DeltaP* or *Max. DeltaP Shutoff* relate to the actuator preload requirements and innervalue guide limits. Since fluid and application criteria have a bearing on innervalue performance, some applications may require hardened trim and/or extra preload. In certain applications, the pressures listed may wear or erode the innervalue material.

OUTLINE DIMENSIONS FOR COMMON SERIES 9000 VALVES

- Face-to-face and bonnet lengths listed are considered standard.
- Flanged valves are available in custom face-to-face lengths.
- Some valves are available with over or under sized flanges.
- Air Connection: Standard is 1/4" NPT. Optional is G1/4 BSP-P.



Description	Dimensions					
	1 in. (25.4 mm) DN 25		1-1/2 in. (38.1 mm) DN 40		2 in. (50.8 mm) DN 50	
	in.	mm	in.	mm	in.	mm
A	Standard body length (incl. Flangeless/NPT and Socket Weld)					
B1	Centerline of body to yoke mounting point (standard bonnet)					
B2	Centerline of body to yoke mounting point (1" ext. or Dbl. Pack.)					
C1	Centerline of body to top of actuator (standard bonnet)					
C2	Centerline of body to top of actuator (1" ext. or Dbl. Pack.)					
D	Size 35 actuator Diameter					
E	Size 35 actuator Height					
F1	Flanged body length (with ANSI CL 150 Flanges)					
F2	Flanged body length (with ANSI CL 300 Flanges)					
G	Butt-Weld body length (any pipe schedule, per ISA75.15-1993 Long Pattern)					
H1	Centerline of body to yoke mounting point (10" Cryo bonnet)					
H2	Centerline of body to yoke mounting point (14" Cryo bonnet)					
H3	Centerline of body to yoke mounting point (18" Cryo bonnet)					
J1	Centerline of body to top of actuator (10" Cryo bonnet)					
J2	Centerline of body to top of actuator (14" Cryo bonnet)					
J3	Centerline of body to top of actuator (18" Cryo bonnet)					

Dimensions are subject to change. Detailed engineering drawings of valves and actuators are available from the factory on request.

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DESCRIPTION

The Type NRMA Non-Rotating Manual Actuation design is used in applications where either our low-flow trims, cooling fins or bellows are needed and when applications demand human interaction. The manual actuator can be mounted on all RC series valves, including all "P" Trims and all Bonnets. Exchanging between electrical, pneumatic and manual actuators is therefore possible at any time with simple additions. The actuator is encapsulated and completely maintenance-free—designed for fine control.

APPLICATIONS

When you turn the hand wheel, the valve interior moves in a linear motion. This linear movement, from the hand wheel to the internal coupling, prevents damage to the trim and seat, distinguishing this design from conventional manual control valves.

FEATURES

- Hand drive, linear
- Suitable for Badger Meter® modular construction

MATERIALS

Case	1.4404 (316L)
Yoke	1.4404 (316L)
Hand Wheel	Duroplast

SPECIFICATIONS

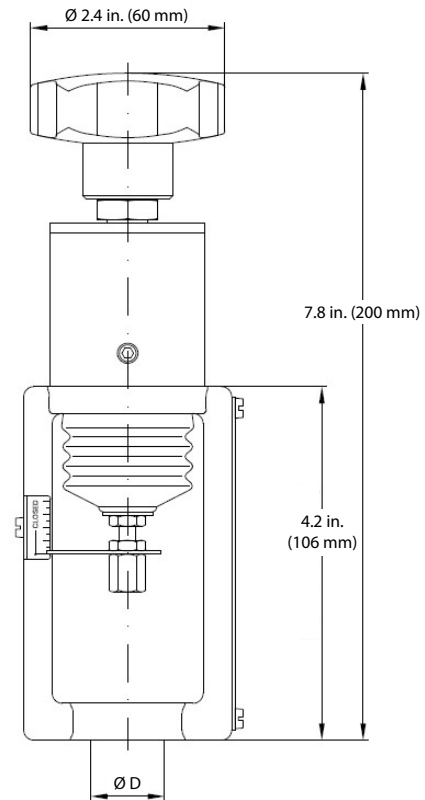
Weight	Approximately 3.3 lb (1.5 kg)
Temperature	-40...176° F (-40...80° C)
Valve Lift	0.04 in. (1 mm) / 360° turn

SIZES FOR RESEARCH CONTROL VALVES

Sizes	Ø Average	Stroke
1/4 in. standard	0.625 in.	11.1 mm
1/2 in., 3/4 in., 1 in. standard	0.875 in.	14.3 mm
1/2 in., 3/4 in., 1 in. heavy duty guiding	0.875 in.	14.3 mm



DIMENSIONS



RCV Valves		Trim Sizes Equal %															
% Lift	% Cv	6.0	5	4.5	4	3.5	A	B	C	D	E	F	G	H	I	J	% Lift
0%	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
5%	1.0%	0.06	0.05	0.04	0.04	0.03	0.02	0.02	0.01	0.008	0.005	0.003	0.002	0.001	0.001	0.000	5%
10%	1.9%	0.11	0.10	0.09	0.08	0.07	0.05	0.04	0.02	0.015	0.010	0.006	0.004	0.002	0.002	0.001	10%
20%	3.8%	0.23	0.19	0.17	0.15	0.13	0.10	0.08	0.05	0.031	0.019	0.012	0.008	0.005	0.003	0.002	20%
25%	4.8%	0.29	0.24	0.22	0.19	0.17	0.12	0.10	0.06	0.038	0.024	0.015	0.010	0.006	0.004	0.002	25%
30%	5.9%	0.35	0.29	0.26	0.23	0.20	0.15	0.12	0.07	0.047	0.029	0.019	0.012	0.008	0.005	0.003	30%
40%	8.8%	0.53	0.44	0.40	0.35	0.31	0.22	0.18	0.11	0.070	0.044	0.028	0.018	0.011	0.007	0.004	40%
50%	13.2%	0.79	0.66	0.59	0.53	0.46	0.33	0.26	0.16	0.105	0.066	0.042	0.026	0.017	0.011	0.007	50%
60%	19.8%	1.19	0.99	0.89	0.79	0.69	0.49	0.40	0.25	0.158	0.099	0.063	0.040	0.026	0.016	0.010	60%
70%	29.6%	1.78	1.48	1.33	1.19	1.04	0.74	0.59	0.37	0.237	0.148	0.095	0.059	0.039	0.024	0.015	70%
75%	36.3%	2.18	1.81	1.63	1.45	1.27	0.91	0.73	0.45	0.290	0.181	0.116	0.073	0.047	0.029	0.018	75%
80%	44.4%	2.67	2.22	2.00	1.78	1.56	1.11	0.89	0.56	0.356	0.222	0.142	0.089	0.058	0.036	0.022	80%
90%	66.7%	4.00	3.33	3.00	2.67	2.33	1.67	1.33	0.83	0.533	0.333	0.213	0.133	0.087	0.053	0.033	90%
100%	100%	6.00	5.00	4.50	4.00	3.50	2.50	2.00	1.25	0.800	0.500	0.320	0.200	0.130	0.080	0.050	100%
Valve Sizes		1"	1"	1"	1", 3/4"	1", 3/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	

Trim Sizes O through P-18 are available only in linear characteristic. See Product Data Sheets for maximum Cvs.

RCV Valves		Trim Sizes Equal %															
% Lift	% Cv	6.0	5	4.5	4	3.5	A	B	C	D	E	F	G	H	I	J	% Lift
0%	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
5%	1.0%	0.30	0.25	0.23	0.20	0.18	0.13	0.10	0.06	0.040	0.025	0.016	0.010	0.007	0.004	0.003	5%
10%	1.9%	0.60	0.50	0.45	0.40	0.35	0.25	0.20	0.13	0.080	0.050	0.032	0.020	0.013	0.008	0.005	10%
20%	3.8%	1.20	1.00	0.90	0.80	0.70	0.50	0.40	0.25	0.160	0.100	0.064	0.040	0.026	0.016	0.010	20%
25%	4.8%	1.50	1.25	1.13	1.00	0.88	0.63	0.50	0.31	0.200	0.125	0.080	0.050	0.033	0.020	0.013	25%
30%	5.9%	1.80	1.50	1.35	1.20	1.05	0.75	0.60	0.38	0.240	0.150	0.096	0.060	0.039	0.024	0.015	30%
40%	8.8%	2.40	2.00	1.80	1.60	1.40	1.00	0.80	0.50	0.320	0.200	0.128	0.080	0.052	0.032	0.020	40%
50%	13.2%	3.00	2.50	2.25	2.00	1.75	1.25	1.00	0.63	0.400	0.250	0.160	0.100	0.065	0.040	0.025	50%
60%	19.8%	3.60	3.00	2.70	2.40	2.10	1.50	1.20	0.75	0.480	0.300	0.192	0.120	0.078	0.048	0.030	60%
70%	29.6%	4.20	3.50	3.15	2.80	2.45	1.75	1.40	0.88	0.560	0.350	0.224	0.140	0.091	0.056	0.035	70%
75%	36.3%	4.50	3.75	3.38	3.00	2.63	1.88	1.50	0.94	0.600	0.375	0.240	0.150	0.098	0.060	0.038	75%
80%	44.4%	4.80	4.00	3.60	3.20	2.80	2.00	1.60	1.00	0.640	0.400	0.256	0.160	0.104	0.064	0.040	80%
90%	66.7%	5.40	4.50	4.05	3.60	3.15	2.25	1.80	1.13	0.720	0.450	0.288	0.180	0.117	0.072	0.045	90%
100%	100%	6.00	5.00	4.50	4.00	3.50	2.50	2.00	1.25	0.800	0.500	0.320	0.200	0.130	0.080	0.050	100%
Valve Sizes		1"	1"	1"	1", 3/4"	1", 3/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	

Numbers are for reference or comparison only.

% Lift	% Maximum Cv	
	Linear	Equal %
0%	0%	0%
5%	5%	1%
10%	10%	2%
20%	20%	4%
25%	25%	5%
30%	30%	6%
40%	40%	9%
50%	50%	13%
60%	60%	20%
70%	70%	30%
75%	75%	36%
80%	80%	44%
90%	90%	67%
100%	100%	100%

% Cv vs. % Lift

