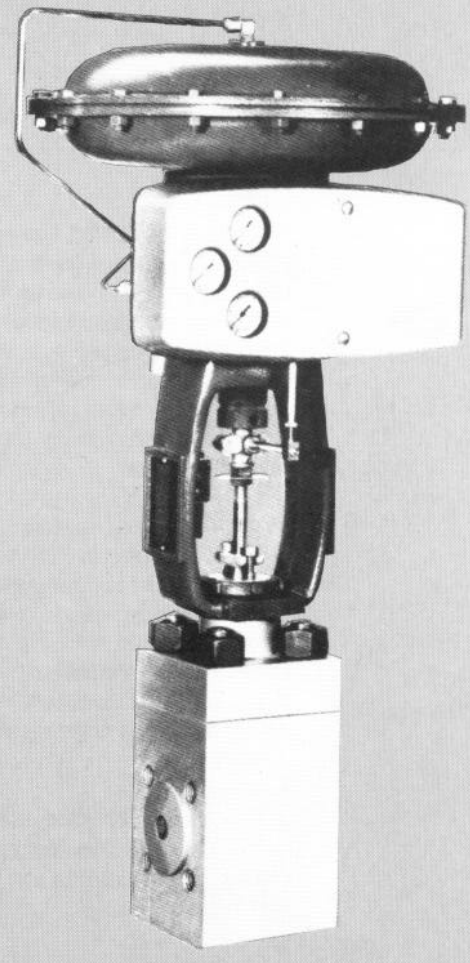
Specification Data CP6000E
Rev. A 10/86

78000 and 78011 Series High Pressure Control Valves

Anti-Cavitation & Low Noise Multiple Stage Control Valves



Masoneilan DRESSER

Table of Contents

Numbering System 3
Ratings (ANSI Class) 3
General Data 3
Temperature Ranges/Seat Leakages 4
Connections 4
Flow Coefficients—rated C_v 4
C_v vs. Travel 5
Materials 7
Allowable Pressure Drops 8
Optional Materials 9
Optional Designs 10-11
Dimensions & Weights 12
Line Bolting 13
Availability 14
Options and Accessories 14
How to Specify 15

Foreword

The 78000 and 78011 Series valves provide control of high pressure fluids without the erosion, vibration and high noise levels associated with conventionally designed control valves. Because of their relatively large flow passages and a shearing action provided by their multiple step plug and cage designs, these valves are particularly well suited for applications involving fluids with entrained particles.

The 78000 Series multiple step plug and cage design uses the principal of "Adiabatic Flow With Friction" to reduce pressure, much like pressure loss occurring in a pipe line. When type "A" or "B" trim is utilized, an additional variable restriction feature is provided to minimize pressure drop in the last pressure reducing stages. In these ways, cavitation, velocity and noise are effectively controlled.

specialty valves
A wide variety of engineered valve products based on the multi step trim design can be provided to satisfy specific process conditions. See pages 10 and 11 for examples.

low pressure recovery
Low pressure recovery, as indicated by the high critical flow factors shown on page 4, minimizes potential for cavitation of liquids and contributes toward reduction of noise for all fluids.

tight shutoff
Protection from seat erosion is insured by provision of ANSI B16.104, Class V Seat Leakage when standard metal seats are furnished and Class VI Seat Leakage when optional soft seats are supplied.

high allowable pressure drops
With a balanced trim option for valve sizes 2" through 4", a wide range of allowable pressure drops are available with conventional spring diaphram or positioning cylinder actuators.

variation of body configuration offerings
A standard angle body and optional in-line body styles are offered to accommodate a variety of piping requirements.

simple trim maintenance
The multiple step trim, made from specially chosen hard materials gives maximum service life and the quick change seat ring design provides ease of trim replacement.

For additional information, contact your local Masoneilan representative. A list of the various locations is provided on the back cover.

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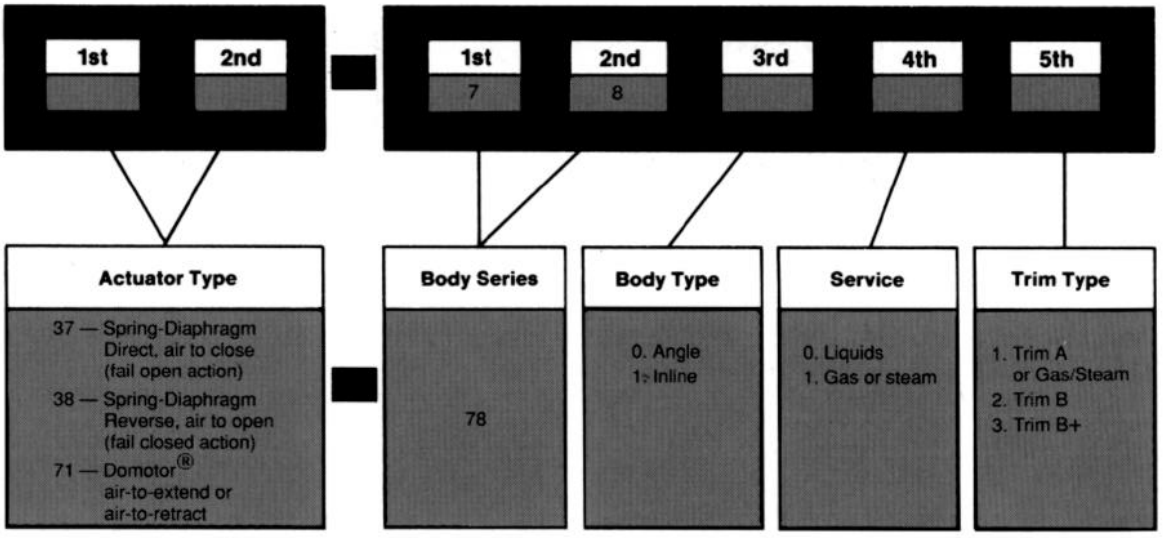
Numbering System



Ratings (ANSI Class)

Valve Size in.	ANSI class body ratings			
	600	900	1500	2500
1	•	•	•	•
1 1/2	•	•	•	•
2	•	•	•	•
3	•	•	•	•
4	•	•	•①	•①

① Only available with butt weld line connections.

General Data

body

type: 1″ – 4″ forged angle or in-line

flow direction: flow-to-open

C_v ratio: See Flow Coefficient Table page 4.

bonnet

type: stud bolted

trim

type: multiple step

flow characteristic: linear

actuator

type: Conventional spring diaphragm or throttling piston (Domotor®)

* For other types of actuators please consult Masoneilan.

Temperature Range / Seat Leakage

Valve Size in.	Design	Temperature Range min.	Temperature Range max.	Seat Leakage ANSI B16.104 Class
1 thru 4	Standard unbalanced metal seat	−20°F	+500°F	V
	optional balanced	−20°F	+450°F	
	optional soft seat	−20°F	+400°F	VI

Contact Masoneilan for operating temperatures not shown.

Connections

▲ Threaded
● Socket Weld
■ Butt Weld
□ RF Flange ①
△ RTJ Flange ①

Valve Size in.	ANSI Class 600	900	1500	2500
1 & 1 1/2	▲●■□△	—	■□△	■□△
2	▲●■□△	—	■□△	■□△
3	■□△	□△	■□△	■□△
4	■□△	□△	■	■

①Mates with ANSI bolting and gasketing

Flow Coefficients — Rated C_v, Critical Flow Factor — C_f

Valve Size in.	Orifice Dia. in.	Travel in.	Trim Type: Liquid (78000) A C_v	A C_f	B C_v	B C_f	B+ ② C_v	B+ ② C_f	Gas or Steam (78011) C_v	Gas or Steam (78011) C_f	Minimum Operable C_v
1	0.500	0.13	0.3	.998	0.6	.992	0.9	.985	—	—	0.03
1 1/2	1.000	0.25	1.2	.997	2.4	.991	3.6	.982	3.5	.970	0.06
2	1.875	0.50	4	.997	8	.991	12	.982	13	.970	0.12
3	3.250	0.88	15	.997	30	.988	45	.978	40	.970	0.61
4	3.250	0.88	15	.997	30	.988	45	.978	40	.970	0.61

② Consult Masoneilan for greater capacities or higher turndown ratios.

C_v vs. Travel

Trim Type A, Liquid

Percent of Plug Travel			10	20	30	40	50	60	70	80	90	100
Valve Size in.	Orifice Diameter in.	Travel in.	Rated C_v									
1	.500	0.13	.03	.06	.09	.12	.15	.18	.21	.24	.27	.30
1 1/2	1.000	0.25	.12	.24	.36	.48	.60	.72	.84	.96	1.08	1.2
2	1.875	0.50	.40	.80	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
3	3.250	0.88	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15
4	3.250	0.88	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15

Trim Type B, Liquid

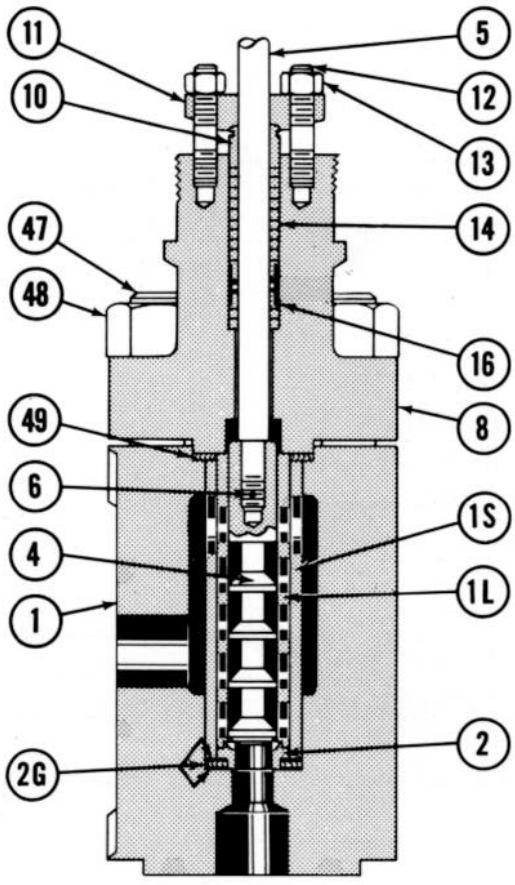
Percent of Plug Travel			10	20	30	40	50	60	70	80	90	100
Valve Size in.	Orifice Diameter in.	Travel in.	Rated C_v									
1	.500	0.13	.06	.12	.18	.24	.30	.36	.42	.48	.54	.60
1 1/2	1.000	0.25	.24	.48	.72	.96	1.2	1.4	1.7	1.9	2.2	2.4
2	1.875	0.50	.80	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0
3	3.250	0.88	3	6	9	12	15	18	21	24	27	30
4	3.250	0.88	3	6	9	12	15	18	21	24	27	30

Trim Type B+, Liquid

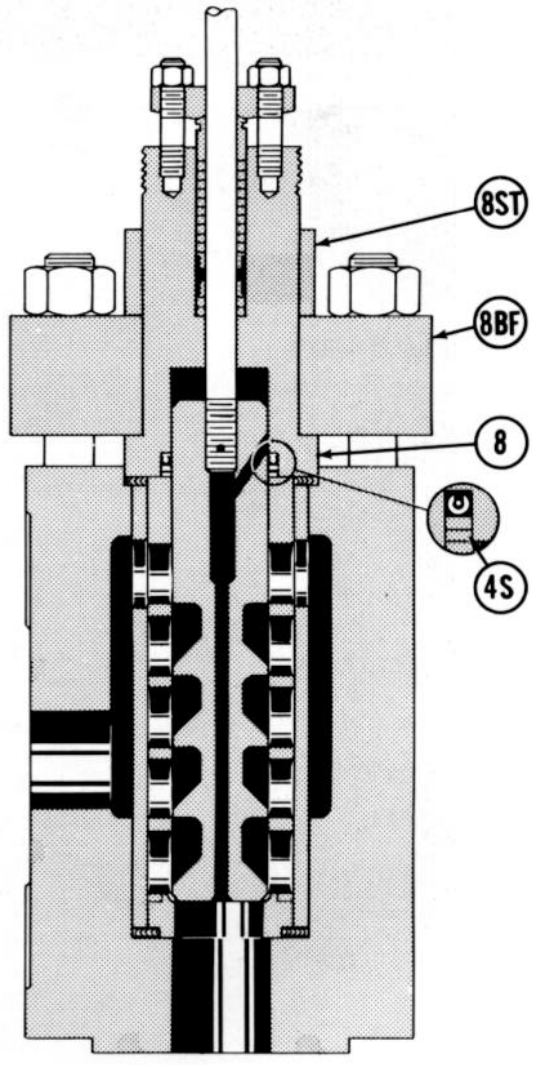
Percent of Plug Travel			10	20	30	40	50	60	70	80	90	100
Valve Size in.	Orifice Diameter in.	Travel in.	Rated C_v									
1	.500	0.13	.09	.18	.27	.36	.45	.54	.63	.72	.81	.90
1 1/2	1.000	0.25	.36	.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.6
2	1.875	0.50	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12
3	3.250	0.88	5	9	14	18	23	27	32	36	41	45
4	3.250	0.88	5	9	14	18	23	27	32	36	41	45

Trim Type — Gas or Steam

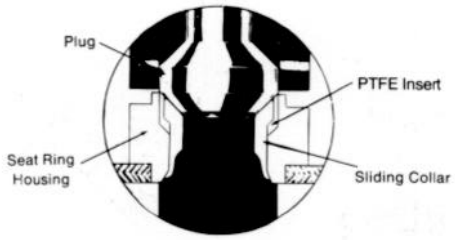
Percent of Plug Travel			10	20	30	40	50	60	70	80	90	100
Valve Size in.	Orifice Diameter in.	Travel in.	Rated C_v									
1 1/2	1.000	0.25	.35	.70	1.05	1.40	1.75	2.10	2.45	2.80	3.15	3.5
2	1.875	0.50	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7	13
3	3.250	0.88	4	8	12	16	20	24	28	32	36	40
4	3.250	0.88	4	8	12	16	20	24	28	32	36	40



Standard Valve Construction



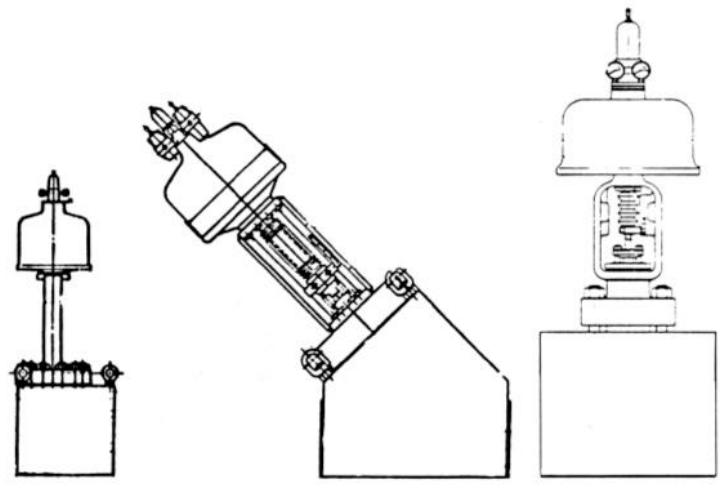
Optional Pressure Balanced Valve Construction 2", 3" & 4" valves



Optional Soft Seat Seat Ring

Materials

Part No.	Temperature / Part Name	−20°F / Standard Materials	450°F +500°F
1	Body	Carbon Steel ASTM A105 Chrome Moly ASTM A182 Gr F-5a (5% chrome - 0.5% moly)	
8	Bonnet	316 St. ASTM A182 Gr F-316	
1L	Liner	17-4 PH St. St. ASTM A564 Gr 630 Cond. H 1075	
1S	Spacer Tube		
2	Seat Ring	316 St. St. with Hard Faced Seat	
		316 St. St. with PTFE Seat	
2G	Seat Ring Gasket	304 St. St. with Asbestos or Grafoil or TFE Filler (Spiral Wound)	
4	Plug	440-C St. St. ASTM A276 Type 440C Hardened	
4S	Balancing Seal Set	Carbon-Graphite Filled PTFE (spring energized)	
5	Valve Plug Stem	17-4 PH St. St. ASTM A564 Gr 630 Cond. H1075	
6	Plug Pin	316 St. St. ASTM A276 Type 316	
8BF	Bonnet Flange (2" thru 4" only)	Carbon Steel ASTM A515 Gr 70	
8ST	Bonnet Spacer (2" thru 4" only)	Carbon Steel ASTM A106 Gr B	
10	Packing Follower	303 St. St. ASTM A582 Type 303	
11	Package Flange	Carbon Steel ASTM A668CL B Cadmium Plated	
12	Packing Flange Stud	Alloy Steel ASTM A193 Gr B7	
13	Packing Flange Nut	304 St. St. ASTM A194 Gr 8	
14	Packing	PTFE Aramid Fibre-Crane 285K	
16	Packing Spacer	303 St. St. ASTM A582 Type 303	
47	Body Stud	Alloy Steel ASTM A193 Gr B7	
48	Body Stud Nut	Alloy Steel ASTM A194 Gr 2H	
49	Bonnet Gasket	304 St. St. with Asbestos or Grafoil or TFE Filler (Spiral Wound)	



Angle Connections

In-Line Connections
Y Pattern or T-Block

Allowable Pressure Drops (psi)

Trim: metal seat, unbalanced
Temperature: −20°F to + 500°F
Flow Direction: flow to open

Seat Leakage: ANSI B16.104, Class V

Valve Size In.	Maximum Rating ANSI Class	Stroke In.	Spring-Diaphragm Actuator					Domotor®			
			Size	air to close			air to open				
				Spring Range psig	Supply psig	Allowable③ Pressure Drop psi	Spring Range psig	Allowable③ Pressure Drop psi	Series	Supply Pressure psig	Loading Pressure psig	Allowable③ Pressure Drop psi
1①	2500	0.13	13	6-10	25	3000	12-16	3000	A	50	40	3000
				6-10	30	6000	18-22	6000	A	70	60	6000
1½	2500	0.25	15	6-12	30	3000	14-20	2500	C	50	40	3000
				6-12	50	6000	24-31	4500	C	70	60	6000
2	2500	0.50	15	6-16	40	1000	16-25	500	C	100	90	2500
				6-16	60	2000	23-33	850	D	80	70	4000
3	2500	0.88	18	3-15	30	400	15-25	250	D	100	90	1500
				3-15	60	1000	18-29	400	DD	80	70	3000
4	2500②	0.88	18	3-15	30	400	15-25	250	D	100	90	1500
				3-15	60	1000	18-29	400	DD	80	50	3000

with balanced trim, Temperature: −20°F to + 450°F

2	2500	0.50	15	6-16	25	3000	16-25	3000	B	80	70	3000
				6-16	40	6000	23-33	5500	B	100	90	6000
3	2500	0.88	18	3-15	35	3000	15-25	2000	C	80	70	3000
				3-15	50	6000	18-29	3250	C	100	90	6000
4	2500②	0.88	18	3-15	35	3000	15-25	2000	C	80	70	2160
				3-15	50	6000	18-29	3250	C	100	90	6000

Trim: soft seat, unbalanced
Temperature: −20°F to + 400°F
Flow Direction: flow to open

Seat Leakage: ANSI B16.104, Class VI

Valve Size In.	Maximum Rating ANSI Class	Stroke In.	Spring-Diaphragm Actuator					Domotor®			
			Size	air to close			air to open				
				Spring Range psig	Supply psig	Allowable③ Pressure Drop psi	Spring Range psig	Allowable③ Pressure Drop psi	Series	Supply Pressure psig	Loading Pressure psig	Allowable③ Pressure Drop psi
1①	2500	0.13	13	6-10	25	3000	12-16	3000	A	50	40	3000
				6-10	30	6000	18-22	6000	A	70	60	6000
1½	2500	0.25	15	6-12	30	3000	14-20	2500	C	50	40	3000
				6-12	50	6000	24-31	4500	C	75	65	6000
2	2500	0.50	15	6-16	40	1000	16-25	500	C	100	90	2500
				6-16	60	2000	23-33	850	D	85	75	4000
3	2500	0.88	18	3-15	40	400	15-25	200	D	100	90	1500
				3-15	60	900	18-29	300	DD	90	80	3000
4	2500②	0.88	18	3-15	40	400	15-25	200	D	100	90	1500
				3-15	60	900	18-29	300	DD	70	60	3000

with balanced trim, Temperature: −20°F to + 400°F

2	2500	0.50	15	6-16	35	3000	16-25	3000	B	80	70	3000
				6-16	45	6000	23-33	4900	C	65	55	6000
3	2500	0.88	18	3-15	50	3000	15-25	1100	C	90	80	3000
				3-15	60	4700	18-29	1550	D	85	75	6000
4	2500②	0.88	18	3-15	50	3000	15-25	1100	C	90	80	3000
				3-15	60	4700	18-29	1550	D	85	75	6000

① 78011 series gas and steam valves are not available in 1" size.
② Flange mating end connections are only available up to ANSI CLass 900 Rating.
③ Pressure drops must not exceed the ANSI body or end connection rating.

Optional Materials

Part No.	Part Name	Standard Materials
	Temperature	−20°F +450°F +500°F
1	Body	Carbon Steel ASTM A105 (HRC 22 max) Chrome Moly ASTM A182 Gr F-5a 316 St. St. ASTM A182 Gr F-316 (HRC 22 max)
8	Bonnet	
1L	Liner	Inconel 718, Inconel X750, Monel K500 (HRC 35 Max.) or Solid Stellite No. 6
1S	Spacer Tube	
2	Seat Ring	316 St. St. ASTM A479 TP316 (HRC 22 Max.) with Hard Facing 316 St. St. with PTFE Seat (400°F limit) or Solid Stellite No. 6
2G	Seat Ring Gasket	304 St. St. with Asbestos or Grafoil or TFE Filler (Spiral Wound)
4	Plug	Nitronic 60 ASTM 479 Type S21800 (HRC 22 Max.) with H.F. in Seat Area Nitronic 50 ASTM 479-Type XM19 (HRC 35) with H.F. In seat and Guide Area Nitronic 50 ASTM 479-Type XM19 (HRC 35 Max.) or ASTM 479 Type 316 (HRC 22 Max.) with Full Overlay of Wetted Area Solid Stellite No. 6
4S	Balancing Seal Set	Carbon-Graphite Filled PTFE (spring energized)
5	Valve Plug Stem	Inconel X750 ASTM A461 (HRC 35 Max.)
6	Plug Pin	Inconel 718
8BF	Bonnet Flange (2" thru 4" only)	Carbon Steel ASTM A515 Gr 70
8ST	Bonnet Spacer (2" thru 4" only)	Carbon Steel ASTM A106 Gr B
10	Packing Follower	304 St. St. ASTM A479 Type 304
11	Package Flange	Carbon Steel ASTM A668 CL B Cadmium Plated
12	Packing Flange Stud	Alloy Steel ASTM A193 Gr B7
13	Packing Flange Nut	304 St. St. ASTM A194 Gr 8
14	Packing	PTFE Aramid Fibre-Crane 285K
16	Packing Spacer	304 St. St. ASTM A479 Type 304
47	Body Stud	Alloy Steel ASTM A193 Gr B7
48	Body Stud Nut	Carbon Steel ASTM A194 Gr 2H
49	Bonnet Gasket	304 St. St. with Asbestos or Grafoil or TFE Filler (Spiral Wound)

Note:
Optional materials are intended for chlorides bearing water and sour service only.
Certification to NACE MR01-75 1980 Revision is available,

Note: Partial or solid overlay of 316 St. St. or other material components or areas can be supplied upon specification.

Optional Designs

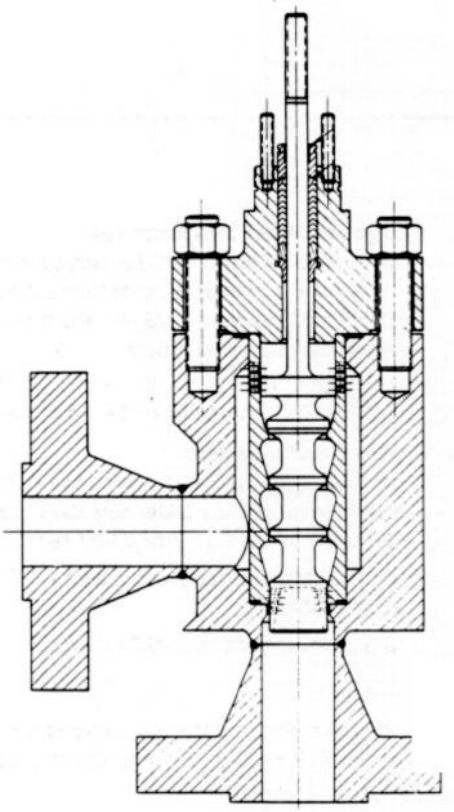


Figure 1

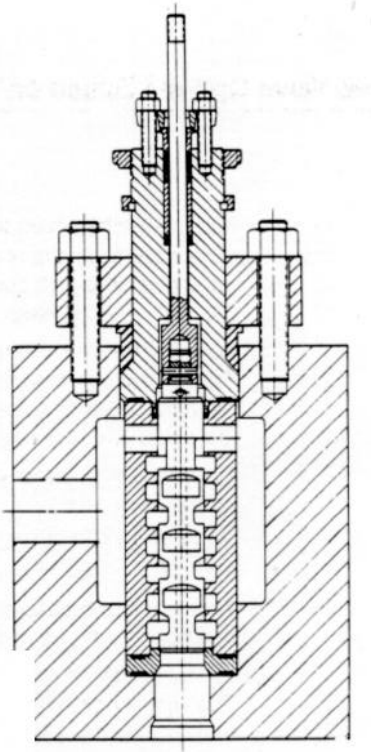


Figure 2

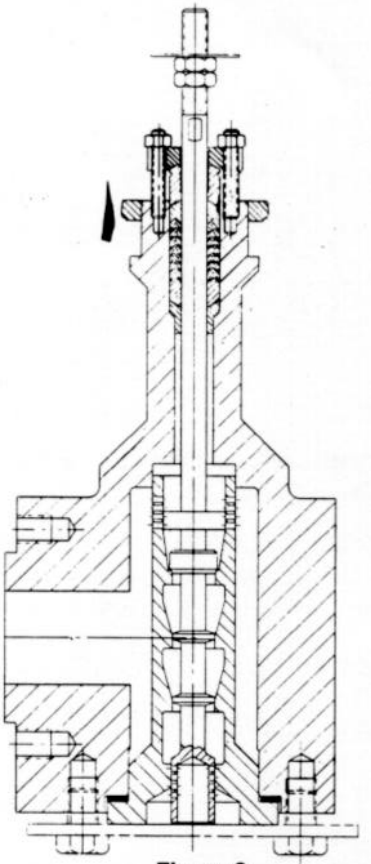


Figure 3

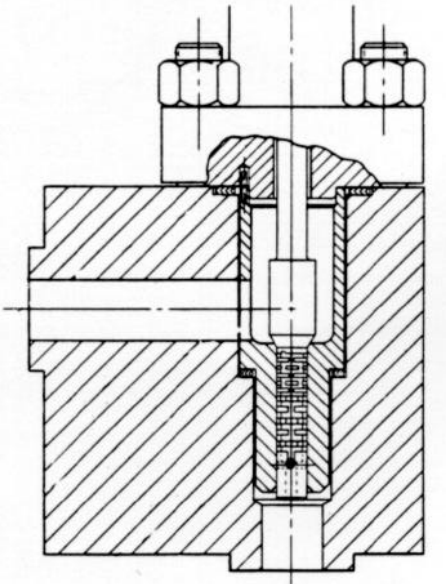


Figure 4

Optional Designs

Engineered Valve Options Based on 78000 Series

Masoneilan has manufactured a variety of special valves based on the original 78000 series design for applications with specific requirements not generally met by this product line.

Low Downstream Pressures:
The trim design shown in Fig. 1 lends itself particularly well to water injection applications with low outlet pressure conditions.

The product is available in angle, "Y" and "T" block pattern.

Sizes range from 1 thru 12 inch, C_v values from 3 thru 400.

The construction allows for many different alloys and body configurations.

Extreme High Pressure Drop:
The valve shown in Fig. 2 has been designed for pressure drops of 5000-6000 psi under continuous duty in a corrosive process stream, and has been successfully applied in highly erosive hydrocarbon with catalyst fines.

High and Low Temperatures:
The valve shown in Fig. 3 is particularly suitable for extreme low or high temperature applications. Thermal expansion is taken care of by the free expanding seat ring design.

Significant thermal shock can be handled without potential overstressing of the seat ring cage.

Very Low C_v Values:
The labyrinth design shown in Fig. 4 has been developed for extremely low C_v values, high turndown ratios and high pressure drop.

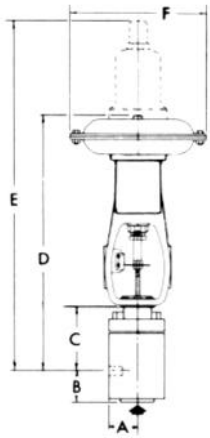
The valve is available with 1 and 1-1/2 inch connections.

C_v values ranging from 0.01 thru 2.

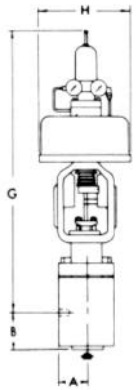
We encourage our customers to consider these products for applications outside the range of the standard product.

Consult Masoneilan for your applications.

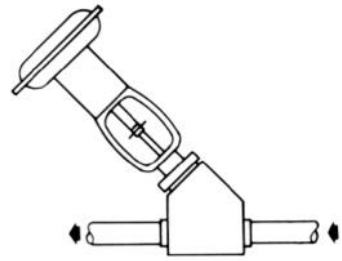
Dimensions (Inches) and Weights (Lbs.)



Spring Diaphragm



Domotor ®



In-line valve "Y" pattern or "T" block dimensions on request.

Valve Size (in)	ANSI Class	A		B		C	Spring Diaphragm Actuator						Domotor®			
								Air-To-Close		Air-To-Open						
		Flg. End	Weld ③ End	Flg. End	Weld ③ End		Size	D	Shipping Wt. (lbs)①	E	Shipping Wt. (lbs)①	F	Series	G	H	Shipping Wt. (lbs)①
1	600-2500	2.63	2.63	4.00	4.00	7.00	13	27.25	185	36.75	200	15.00	A	24.50	7.63	130
1 1/2	600-2500	2.88	2.88	4.63	4.63	8.50	15	34.25	280	44.00	300	17.50	C	34.00	13.25	210
2	600-2500	3.88	3.88	6.00	6.00	11	15	36.75	400	46.50	320	17.50	B	30.75	9.25	310
													C	36.50	13.25	330
													D	50.50	18.00	510
3	600-2500	5.75	5.75	8.50	8.50	13	18	40.00	860	49.75	930	20.75	C	38.50	13.25	730
													D	52.50	18.00	910
													DD	66.00	18.00	960
4	600-2500 ②	5.75	5.75	5.75	8.50	13	18	40.00	860	49.75	930	20.75	C	38.50	13.25	730
													D	52.50	18.00	910
													DD	66.00	18.00	960

① Weights are for complete valve and actuator assembles.
② Flange mating ends are only available up to ANSI Class 900 rating.
③ Covers socket ends for 1" thru 2" valve sizes and butt weld for all sizes. For available pipe schedules, contact your Masoneilan Representative.

Line Bolting Data

Dimensions of Studbolts

Valve Size (In.)		ANSI CLASS			
		600 RF/RTJ	900 RF/RTJ	1500 RF/RTJ	2500 RF/RTJ
1	Dia. (in.)	5/8	7/8	7/8	7/8
	# Threads	11	9	9	9
	Min. Lgth. (in.)	3.19	4.13	4.13	4.38
1 1/2	Dia. (in.)	3/4	1	1	1.12
	# Threads	10	8	8	8
	Min. Lgth. (in.)	3.63	4.5	4.5	5.25
2	Dia. (in.)	5/8	7/8	7/8	1
	# Threads	11	9	9	8
	Min. Lgth. (in.)	3.63	4.69	4.69	5.44
3	Dia. (in.)	3/4	7/8	1 1/8	1 1/4
	# Threads	10	9	8	8
	Min. Lgth. (in.)	4.13	4.56	5.44	6.63
4	Dia. (in.)	7/8	1 1/8	1 1/4	1 1/2
	# Threads	9	8	8	8
	Min. Lgth. (in.)	4.69	5.53	6.19	7.56
6	Dia. (in.)	1	1 1/8	1 3/8	2
	# Threads	8	8	8	8
	Min. Lgth. (in.)	5.38	6.03	7.50	10.25

Options and Accessories

Shaded areas indicate product combinations within standard delivery cycle. For other combinations, contact your Masoneilan Representative.

Side Mounted Handwheels

Type		
	6A1 ■	6A2 ■
	6A3 ■	8A □
	C ■	D □

Oversize Actuators–Spring Diaphragm

Standard	to	Oversize	
13		15	
15		18	
18		24	

Oversize Actuators–Domotor®

A	B	
B	C	
C	D	
D	DD	

7400 Series Positioner Instrument Signals—3-15, 6-30 psi 3-9 and 9-15 psi Split and Special Ranges	

8012 Electropneumatic Positioner Instrument Signals—10-50mA; 104 ohms 4-20mA;173 ohms	

I/PEX 9000 Electropneumatic Transducer Input Range—4-20 mA or 10-50 mA Split range up to 3 times Output (Direct or Reverse) 3-15 psi, adjustable to 0-20 psi	

Refer to specific actuator and accessory specification literature for complete information.

496 Rotary Switches 496-1 (1 switch) 496-2 (2 switches)	

77-4 or 77-40 Airset	
77-6 Lockup Valve	
2" Gauge 0-30 psi	

2700/3700 Controllers	

Solenoid Valves (ASCO)

ASCO Ref.	Voltage	
HBX8320A25	120V-60Hz or 110V-50Hz	
HBX8320A26	120V-60Hz or 110V-50Hz	
HPX8320A26	125DC	
HBX8320A40	120V-60Hz or 110V-50Hz	

Additional Options Available

Other Body Materials	
Other Flange Facings	
N.A.C.E. Compliance	
Custom Trim Materials	
Non-Destructive Examination	
Electric and Electro-Hydraulic Actuators	

How to Specify your 78000 Series Control Valve

Specification Data
The checklist provided below contains the necessary data to specify the basic 78000 Series Control Valve. The page references will refer you to the appropriate sections when a selection is to be made.
For Options and Accessories, see page 14.

Quantity:	Size		Model (page 3):
Body	Type		Angle ☐ In-line ☐
	Material (pages 7 & 9)		Carbon Steel ☐ Chr. Mo Gr F5a ☐ 316 St. St. ☐
	Rating (page 3)		600 ☐ 1500 ☐ 900 ☐ 2500 ☐
	Connections (page 4)		Threaded ☐ S/W Sched ☐ RF Flanged ☐ B/W Sched ☐ RTJ Flanged ☐
Bonnet	Type		Standard
	Packing (pages 7 & 9)		PTFE Asbestos ☐ Grafoil ☐ Lubr & Iso Valve ☐
Trim	Size & Type (page 4)		A (liquid) ☐ B+ (liquid) ☐ B (liquid) ☐Gas or Steam ☐
	Spacer Tube & Liner	Material (Pg. 7 & 9)	17-4 PH St. St.
	Plug	Type	Unbalanced ☐ Balanced ☐
		Guiding	Cage
		Material (pg. 7 & 9)	440-C St. St.
	Seat Ring	Material (pg. 7 & 9)	316 St. St. Hard Faced Seat ☐ 316 St. St. w/PTFE Seat ☐
Leakage	ANSI Class (page 4)		V ☐ VI ☐
Actuator (Page 8)	Type		Spring Diaphragm ☐ Throttling Piston ☐ (Domotor®)
	Sizes		13 ☐ 15 ☐ 18 ☐ A ☐ B ☐ C ☐ D ☐ DD ☐
	Action	Flow to Air to Fail	Open ☐ Close ☐ Open ☐ Close ☐ Open ☐
	Range① (page 12)		See Pressure Drop Tables

① Other spring ranges not listed in pressure drop tables are available. Consult your Masoneilan Representative.

ARGENTINA ■△ AUSTRALIA ■●△ BAHRAIN ■△ BELGIUM ■△ BOLIVIA ■ BRAZIL ■●△
CAMEROON (REPUBLIC OF) ■ CANADA ■●△ CHILE ■ COLOMBIA ■ DENMARK ■△ EGYPT ■△
FINLAND ■△ FRANCE ■●△ GERMANY ■●△ GREAT BRITAIN ■●△ GREECE ■ INDIA ■ IRAN ■△ IRAQ ■
ITALY ■●△ IVORY COAST ■△ JAPAN ■●△ JORDAN ■
KENYA ■ KOREA ■ KUWAIT ■△ MAURITIUS ■
MEXICO ■●△ MOROCCO ■△ NETHERLANDS ■△
NEW ZEALAND ■△ NIGERIA ■ NORWAY ■△
OMAN ■ PAKISTAN ■ PORTUGAL ■△ QATAR ■△
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List of Masoneilan Sales Offices, Stocking Centers and Manufacturing facilities on request.

Legend : ■ Sales Offices.
● Manufacturing facilities.
△ Stocking Centers.

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