FLOWSAFE

F7000/8000 Series

Pilot-Operated
Safety Relief Valves

Catalog# F78K0914 (Oct2020)

"EXPERTS IN SOFT SEAT VALVE TECHNOLOGY"

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The policy of FLOW SAFE and its authorized assemblers is a commitment to value through:

- Environmentally compatible products
- Cost-efficient design with minimal parts
- Quality products, readily available
- Flexibility to meet unique customer needs
- “No-hassle” service

UV

INTRODUCTION AND FEATURES

Today’s industrial needs are being driven by requirements for high-capacity leak-tight pressure relief valves to reduce fugitive emissions and to save customer product.

The **F7000/8000** Series “High Performance” pilot -operated relief valves are engineered to provide superior performance for today’s industries.

F7000/8000 design features include:

- ASME-UV stamp standard from 15 psig (1.03 barg) and above; ‘CE’ Mark available
- National Board-certified for gas and liquid service per ASME Section XIII
- Superior capacities through full-bore nozzle (F7000) and a variety of reduced API orifice selections (F8000)
- Direct-mount pilot valves, minimizing potential leak paths
- Modulating or snap-acting pilots available, with interchangeable mounting on main valve
- Integral exhaust of modulating pilots into main valve outlet
- Superior main valve seating force, proportional to nameplate set pressure
- Repeatable, leak-tight seating and re-seating due to soft seat design
- Backflow preventer and field test connection are standard features
- Full lift at set pressure upon demand
- Adjustable blowdown capability
- Set pressures to 6000 psig (413 barg)
- -423 to 525 °F (-252 to 273 °C) temperature range
- Standard 316/316L SS trim for superior corrosion resistance
- Available in a variety of special materials and connection types
- Dual outlets available in several sizes
- Main piston separated from liner by wear rings; wedge ring available for piston movement damping
- Top-entry main valve for easy access
- Standard flange combinations thru ASME 2500# integral with main body casting
- Lifting lugs standard on 2x3 and larger sizes

OPERATION

The Flow Safe **F7000/8000** Series pilot-operated pressure relief valves are designed to provide customers with a stable, smooth-flowing relief valve with substantial capacity. Operating below set pressure, system pressure is routed from below the valve through the pilot to the main valve dome cavity (space above the piston). This pressure, acting on a piston area [A_d] larger than the seat area [A_s], creates an effective downward force [$F = P(A_d - A_s)$] to hold the main piston in the closed position.

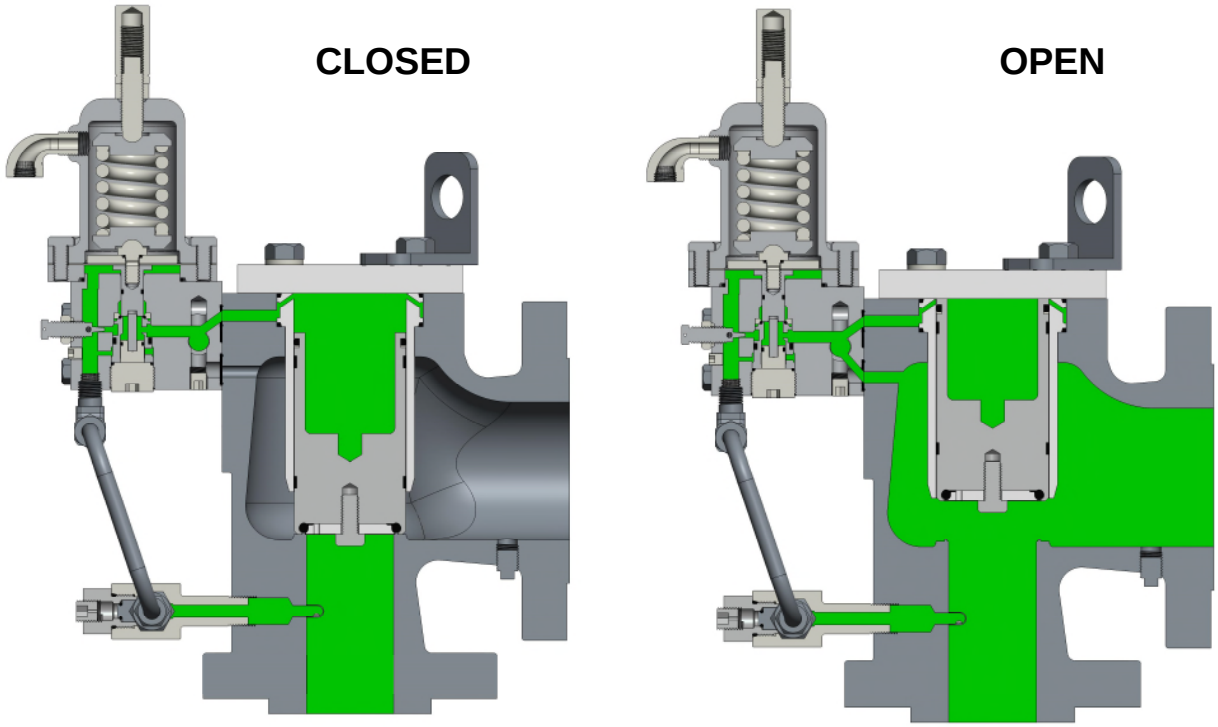
At the designated set pressure, the pilot reduces dome pressure to allow the system pressure force under the piston to open it. Dome pressure reduction is sudden and complete with the snap-acting pilot (F200), or proportional to demand with the modulating pilots (F300, F500). With increasing flow demand, the F300 and F500 will allow the main piston to lift up to 100% with no measurable pressure increase beyond set pressure. As normal system pressure is restored, the pilot closes within its design reseat value, allowing the dome cavity to repressurize and main piston to close. The F200 pilot allows an adjustable blowdown setting of 5 to 20%, and typically are set for a 7 to 10% blowdown on the main valve. F300 and F500 modulating pilots provide near zero nominal blowdown for main valve reseating at set pressure.

To achieve leak-tight seating, Model F7050/8050 uses an elastomeric O-ring seat and piston seal, while Model F7040/8040 uses a plastic seat and spring-energized PTFE piston seal. Graphite-filled PTFE wear rings and an available wedge ring on the main piston eliminate metal-to-metal contact with the liner and help to provide smooth and consistent operation. Pilots employ O-ring seats and seals for precise operation and superior leak-tightness.

Valve orifice size selection is flexible with the F7000/8000 Series POSRV. The F7000 features a fixed full-bore inlet nozzle which may be converted to an F8000 reduced orifice by addition of an annular flow plug to the bottom of the main piston. Flow is thereby channeled through an annular area between the flow plug OD and nozzle ID. The reduced F8000 orifice sizes follow the general API 526 scheme but allow for flow capacities superior to those obtained using API 520 methods for preliminary valve sizing. Field conversions from F7000 to F8000, or vice versa, and associated re-rating of valve capacity can be made by qualified repair organizations.

The F7000/8000 Series is particularly advantageous and cost-effective in installations where:

- There may be size and weight limitations for the valve
- A high cycling rate exists
- A long service life is required
- Minimal product loss is important
- Reduced maintenance and installation time is desirable
- Operation close to set point with zero leakage is required



Connection Dimensions - Single-Outlet Valves

Inlet Connection	Outlet Connection	Dimensions, in (mm)[1]			Approx. weight, lb (kg)
		A	B	C, approx.[2]	
1” FNPT	2” FNPT	5.06 (129)	3.00 (76)	14.0 (356)	35 (16)
1”-150#	2”-150#	4.13 (105)	4.50 (114)	13.1 (333)	38 (17)
1”-300#	2”-150#	4.38 (111)	4.50 (114)	13.3 (338)	40 (18)
1”-600#	2”-150#	4.38 (111)	4.50 (114)	13.3 (338)	40 (18)
1”-900#	2”-300#	4.94 (126)	4.75 (121)	13.8 (351)	50 (23)
1”-1500#	2”-300#	4.94 (126)	4.75 (121)	13.8 (351)	50 (23)
1”-2500#	2”-300#	4.94 (126)	4.75 (121)	13.8 (351)	50 (23)
1-1/2” FNPT	3” FNPT	4.63 (118)	3.75 (95)	14.1 (358)	45 (20)
1-1/2”-150#	3”-150#	5.13 (130)	4.88 (124)	14.6 (371)	50 (23)
1-1/2”-300#	3”-150#	5.13 (130)	4.88 (124)	14.6 (371)	55 (25)
1-1/2”-600#	3”-150#	5.13 (130)	4.88 (124)	14.6 (371)	55 (25)
1-1/2”-900#	3”-300#	6.38 (162)	6.75 (171)	15.1 (384)	80 (36)
1-1/2”-1500#	3”-300#	6.38 (162)	6.75 (171)	15.1 (384)	80 (36)
1-1/2”-2500#	3”-300#	6.38 (162)	6.75 (171)	15.1 (384)	90 (41)
2”-150#	3”-150#	5.38 (137)	4.88 (124)	15.8 (401)	65 (29)
2”-300#	3”-150#	5.38 (137)	4.88 (124)	15.8 (401)	70 (32)
2”-600#	3”-150#	5.38 (137)	4.88 (124)	15.8 (401)	70 (32)
2”-900#	3”-300#	6.56 (167)	6.75 (171)	17.0 (432)	90 (41)
2”-1500#	3”-300#	6.56 (167)	6.75 (171)	17.0 (432)	90 (41)
2”-2500#	3”-300#	7.00 (178)	6.75 (171)	17.4 (442)	115 (52)
3”-150#	4”-150#	6.13 (156)	6.38 (162)	18.3 (465)	90 (41)
3”-300#	4”-150#	6.13 (156)	6.38 (162)	18.3 (465)	100 (45)
3”-600#	4”-150#	6.38 (162)	6.38 (162)	18.5 (470)	100 (45)
3”-900#	4”-300#	7.50 (191)	7.13 (181)	19.6 (498)	130 (59)
3”-1500#	4”-300#	7.50 (191)	7.13 (181)	19.6 (498)	145 (66)
4”-150#	6”-150#	7.75 (197)	8.25 (210)	18.8 (478)	170 (77)
4”-300#	6”-150#	7.75 (197)	8.25 (210)	18.8 (478)	170 (77)
4”-600#	6”-150#	7.75 (197)	8.25 (210)	18.8 (478)	175 (79)
4”-900#	6”-300#	9.81 (249)	9.19 (233)	20.8 (528)	240 (109)
4”-1500#	6”-300#	9.81 (249)	9.19 (233)	20.8 (528)	240 (109)
6”-150#	8”-150#	9.44 (240)	9.50 (241)	22.8 (579)	270 (122)
6”-300#	8”-150#	9.44 (240)	9.50 (241)	22.8 (579)	270 (122)
6”-600#	8”-150#	9.69 (246)	9.50 (241)	23.4 (594)	310 (141)
8”-150#	10”-150#	10.88 (276)	11.00 (279)	26.5 (673)	460 (209)
8”-300#	10”-150#	10.88 (276)	11.00 (279)	26.5 (673)	460 (209)
8”-600#	10”-150#	11.63 (295)	11.00 (279)	27.1 (688)	520 (236)
10”-150#	12”-150#	11.63 (295)	13.00 (330)	28.2 (716)	775 (351)
10”-300#	12”-150#	11.63 (295)	13.00 (330)	28.2 (716)	800 (363)
12”-150#	16”-150#	11.92 (303)	15.56 (395)	32.0 (813)	1100 (500)

[1] Contact Flow Safe for submittal drawing whenever specific dimensions are needed for construction.

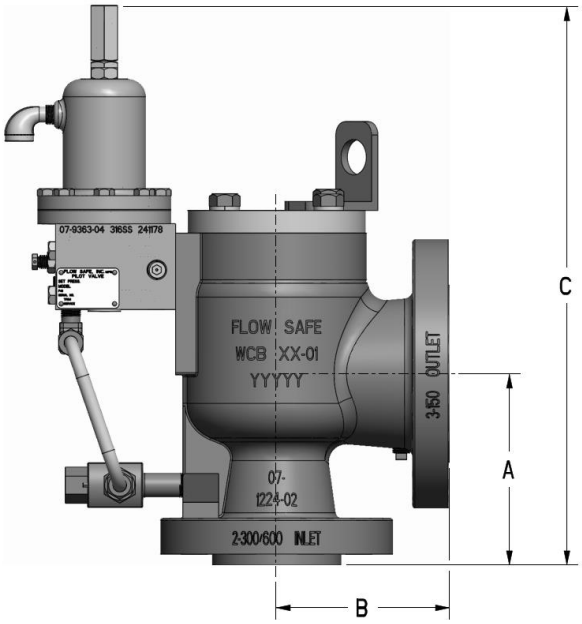
[2] With F300 pilot installed; Deduct 2 in (50 mm) for F200 pilot.
Add 0.5 in (13 mm) for F500 pilot on main valve thru 600# inlet.
Add 4 in (100 mm) for F500 pilot on main valve over 600# inlet.

Connection Dimensions - Dual-Outlet Valves

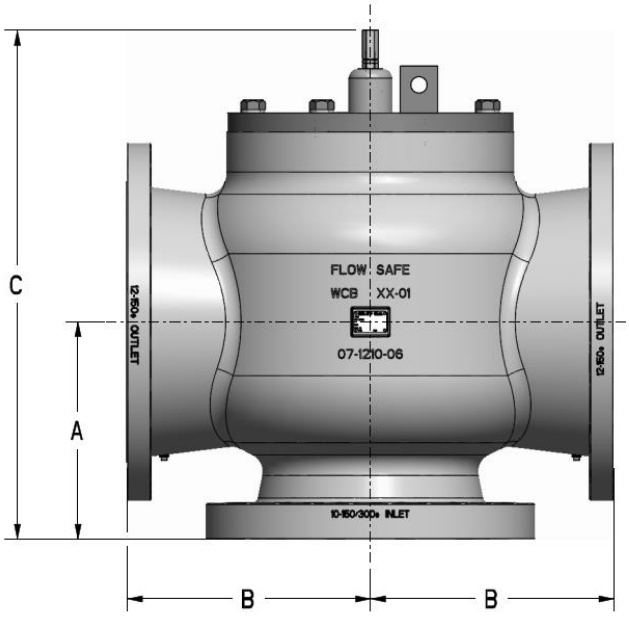
Inlet Connection	Outlet Connections	Dimensions, in (mm)[1]			Approx. weight, lb (kg)
		A	B	C, approx.[2]	
2”-150#	3”-150# x 3”-150#	4.56 (116)	5.31 (135)	15.0 (381)	92 (42)
2”-300#	3”-150# x 3”-150#	4.69 (119)	5.31 (135)	15.1 (384)	100 (45)
2”-600#	3”-150# x 3”-150#	5.06 (129)	5.31 (135)	15.5 (394)	100 (45)
3”-150#	4”-150# x 4”-150#	5.56 (141)	7.00 (178)	17.7 (450)	125 (57)
3”-300#	4”-150# x 4”-150#	5.81 (148)	7.00 (178)	18.0 (457)	135 (61)
3”-600#	4”-150# x 4”-150#	6.12 (155)	7.00 (178)	18.3 (465)	138 (63)
4”-150#	6”-150# x 6”-150#	6.90 (175)	7.38 (187)	18.0 (457)	185 (84)
4”-300#	6”-150# x 6”-150#	7.43 (189)	7.38 (187)	18.5 (470)	188 (85)
4”-600#	6”-150# x 6”-150#	7.93 (201)	7.38 (187)	19.0 (483)	192 (87)
6”-150#	8”-150# x 8”-150#	8.87 (225)	8.25 (210)	22.2 (564)	285 (129)
6”-300#	8”-150# x 8”-150#	9.31 (236)	8.25 (210)	22.7 (577)	290 (132)
6”-600#	8”-150# x 8”-150#	10.00 (254)	8.25 (210)	23.4 (594)	325 (147)
8”-150#	8”-150# x 8”-150#	10.44 (265)	11.44 (291)	26.6 (676)	555 (252)
8”-300#	8”-150# x 8”-150#	10.94 (278)	11.44 (291)	27.1 (688)	565 (256)
8”-600#	8”-150# x 8”-150#	11.12 (282)	11.44 (291)	27.3 (693)	610 (276)
8”-150#	10”-150# x 10”-150#	10.25 (260)	11.06 (281)	25.9 (658)	620 (281)
8”-300#	10”-150# x 10”-150#	10.93 (278)	11.06 (281)	26.5 (673)	630 (286)
8”-600#	10”-150# x 10”-150#	11.75 (298)	11.06 (281)	27.4 (696)	690 (313)

[1] Contact Flow Safe for submittal drawing whenever specific dimensions are needed for construction.

[2] With F300 pilot installed; Deduct 2 in (50 mm) for F200 pilot.
Add 0.5 in (13 mm) for F500 pilot on main valve thru 600# inlet.
Add 4 in (100 mm) for F500 pilot on main valve over 600# inlet.



Single Outlet Valves



Dual Outlet Valves

DIMENSIONS & RATINGS

F7000/8000 Series

Orifice Sizes / Flow Areas

Inlet Connection	Outlet Connection	F7000 Full-Bore Orifice		F8000 Orifices Available	F8000 Orifices Certified [2]	
		Diameter, in (mm)	Flow Area, in^2 (mm^2)	Designation[1] - Flow Area, in^2 (mm^2)	Gas	Liquid
1” FNPT	2” FNPT	0.957 (24.3)	0.719 (464)	D - 0.134 (86) E - 0.235 (152) F - 0.358 (231)	D E F	D E F
1”-150#	2”-150#				D E F	D E F
1”-300#	2”-150#				D E F	D E F
1”-600#	2”-150#				D E F	D E F
1”-900#	2”-300#				D E F	D E F
1”-1500#	2”-300#	0.815 (20.7)	0.521 (336)		D E F	D E
1”-2500#	2”-300#				D E	D E
1-1/2” FNPT	3” FNPT	1.500 (38.1)	1.767 (1140)	F - 0.358 (231) G - 0.588 (379) H - 0.916 (591)	F G H	F G H
1-1/2”-150#	3”-150#				F G H	F G H
1-1/2”-300#	3”-150#				F G H	F G H
1-1/2”-600#	3”-150#				F G H	F G H
1-1/2”-900#	3”-300#	1.337 (34.0)	1.404 (906)		F G H	F G
1-1/2”-1500#	3”-300#				F G H	F G
1-1/2”-2500#	3”-300#	1.100 (27.9)	0.950 (613)		F G H	F
2”-150#	3”-150#	1.939 (49.3)	2.953 (1905)	G - 0.588 (379) H - 0.916 (591) J - 1.503 (970)	G H J	G H J
2”-300#	3”-150#				G H J	G H J
2”-600#	3”-150#				G H J	G H J
2”-900#	3”-300#	1.689 (42.9)	2.241 (1446)		G H J	G H
2”-1500#	3”-300#				G H J	G H
2”-2500#	3”-300#	1.503 (38.2)	1.774 (1145)		G H J	G H
3”-150#	4”-150#	2.900 (73.7)	6.605 (4261)	J - 1.503 (970) K - 2.147 (1385) L - 3.277 (2114)	J K L	J K L
3”-300#	4”-150#				J K L	J K L
3”-600#	4”-150#				J K L	J K L
3”-900#	4”-300#	2.624 (66.6)	5.408 (3489)		J K L	J K L
3”-1500#	4”-300#				J K L	J K L
4”-150#	6”-150#	3.816 (96.9)	11.437 (7379)	L - 3.277 (2114) M - 4.147 (2675) N - 5.014 (3235) P - 7.397 (4772)	L M N P	L M N P
4”-300#	6”-150#				L M N P	L M N P
4”-600#	6”-150#				L M N P	L M N P
4”-900#	6”-300#	3.624 (92.0)	10.315 (6655)		L M N P	L M N P
4”-1500#	6”-300#				L M N P	L M N P
6”-150#	8”-150#	5.760 (146.3)	26.06 (16813)	Q - 12.913 (8331) R - 18.704 (12067)	Q R	Q R
6”-300#	8”-150#				Q R	Q R
6”-600#	8”-150#				Q R	Q R
8”-150#	8” or 10”-150#	7.625 (193.7)	45.66 (29458)	T - 30.409 (19619)	T	T
8”-300#	8” or 10”-150#				T	T
8”-600#	8” or 10”-150#				T	T
10”-150#	12”-150#	9.565 (243)	71.85 (46355)	V - 51.00 (32903)	V	V
10”-300#	12”-150#				V	V
12”-150#	16”-150#	11.935 (303)	111.87 (72174)	W - 78.81 (50845)	W	W

[1] Orifice letter designations and sizes (except “V” and “W”) based on API 526.

[2] Capacity certifications per ASME XIII Div. 1. All F7000 sizes are certified for gas and liquid, except dual-outlets (gas only). F8000 dual-outlet valves are certified for gas only.

INLET / OUTLET FLANGE RATINGS

ASME Class	Material	Maximum Working Pressure, psig (barg)					
		-423 to –21 °F (-252 to –29 °C)	-20 to 100°F (-28 to 38 °C)	200 °F (93 °C)	300 °F (149 °C)	400 °F (204 °C)	500 °F (260 °C)
150#	C. Steel S. Steel	--- [2] 275 (19.0)	285 (19.7) 275 (19.0)	260 (17.9) 235 (16.2)	230 (15.9) 215 (14.8)	200 (13.8) 195 (13.4)	170 (11.7) 170 (11.7)
300#	C. Steel S. Steel	--- [2] 720 (49.6)	740 (51.0) 720 (49.6)	680 (46.9) 620 (42.7)	655 (45.2) 560 (38.6)	635 (43.8) 515 (35.5)	605 (41.7) 480 (33.1)
600# [1]	C. Steel S. Steel	--- [2] 1440 (99)	1480 (102) 1440 (99)	1360 (93.8) 1240 (85.5)	1310 (90.3) 1120 (77.2)	1265 (87.2) 1025 (70.7)	1205 (83.1) 955 (65.8)
900#	C. Steel S. Steel	--- [2] 2160 (149)	2220 (153) 2160 (149)	2035 (140) 1860 (128)	1965 (135) 1680 (115)	1900 (131) 1540 (106)	1810 (124) 1435 (99)
1500#	C. Steel S. Steel	--- [2] 3600 (248)	3705 (255) 3600 (248)	3395 (234) 3095 (213)	3270 (225) 2795 (192)	3170 (218) 2570 (177)	3015 (208) 2390 (164)
2500#	C. Steel S. Steel	--- [2] 6000 (413)	6000 (413) 6000 (413)	5655 (390) 5160 (355)	5450 (375) 4660 (321)	5280 (364) 4280 (295)	5025 (346) 3980 (274)

Carbon steel: ASME SA-216 WCB or SA-352 LCC
Stainless steel: ASME SA-351 CF8M
Reference for pressure / temperature ratings: ASME B16.34 / B16.5
Other materials available, including SA-216 WCC, SA-494 M35-1, SA-494 CX2MW

[1] Includes 1 x 2 and 1-1/2 x 3 NPT
[2] LCC min. service temperature = -60 F (-51 C)

SEAT / SEAL DATA

F7040/8040 Seats (Plastics)	Continuous Process Temperature, °F (°C)		Approx. Pressure Range, psig (barg)	
	Min.	Max.		
Teflon ® (PTFE)	-423 (-252)	400 (204)	25 - 1000 (1.7 - 69)	
Kel-F (PCTFE)	-423 (-252)	400 (204)	1000 - 3000 (69 - 207)	
Polyimide (PI) or Polyamide-imide (PAI) - Vespel ®, Duratron ®, or equal	-423 (-252)	500 (260)	3000 - 6000 (207 - 413)	
Polyetheretherketone (PEEK)	0 (-18)	525 (273)	3000 - 6000 (207 - 413)	
Seals / Pilot Seats / F7050/8050 Seats (O-rings)			*Pressure Range as Seal or Main Valve Seat*	*Pressure Range as Pilot Seat*
Buna-N	-30 (-34) [1]	275 (135)	7 - 6000 (0.5 - 413)	7 - 4000 (0.5 - 275)
Fluorocarbon - Viton ® or equal	-30 (-34)	400 (204)	7 - 6000 (0.5 - 413)	7 - 4500 (0.5 - 310)
Ethylene propylene (EPR / EPDM)	-65 (-54)	325 (163)	7 - 6000 (0.5 - 413)	7 - 4000 (0.5 - 275)
Aflas ® (TFE/P)	10 (-12)	450 (232)	500 - 6000 (34 - 413)	500 - 6000 (34 - 413)
Polyurethane	-65 (-54)	225 (107)	15 - 6000 (1.0 - 413)	15 - 6000 (1.0 - 413)
Perfluoroelastomer - Kalrez ®, Chemraz ®, or equal	0 (-18) [1]	525 (273)	15 - 4000 (1.0 - 275)	15 - 4000 (1.0 - 275)

[1] Some elastomer seat applications are qualified for service down to –261 F (-163 C). Contact factory for details.

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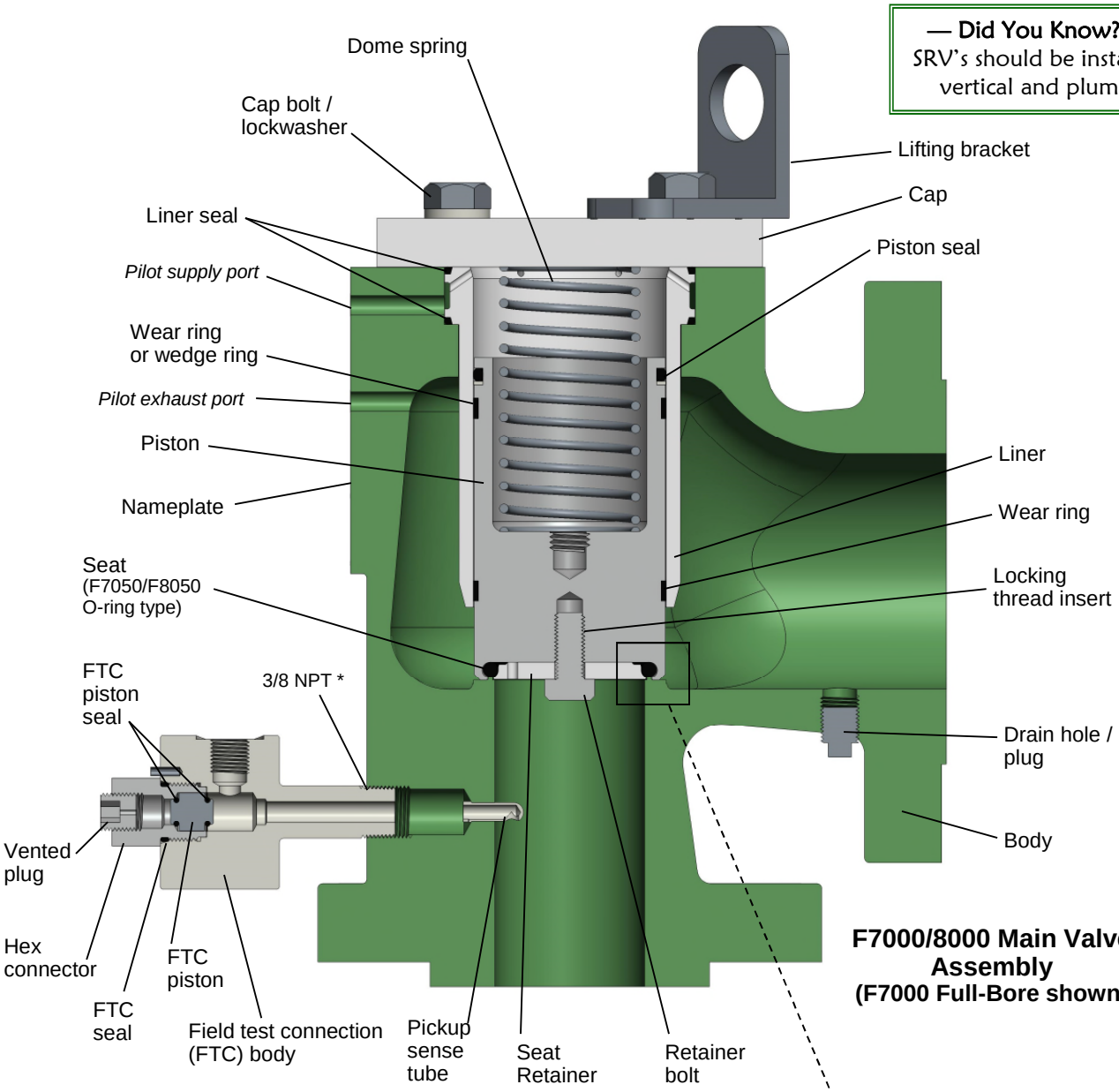
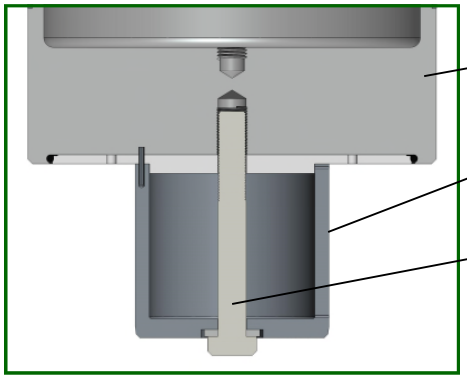
MAIN VALVE CONSTRUCTION

F7000/8000 Series

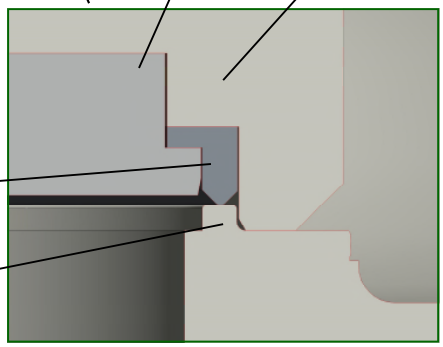
— Did You Know? —
SRV's should be installed vertical and plumb.



F7000/8000 Main Valve Assembly
(F7000 Full-Bore shown)



F8000 Piston / Annular Flow Plug Assembly

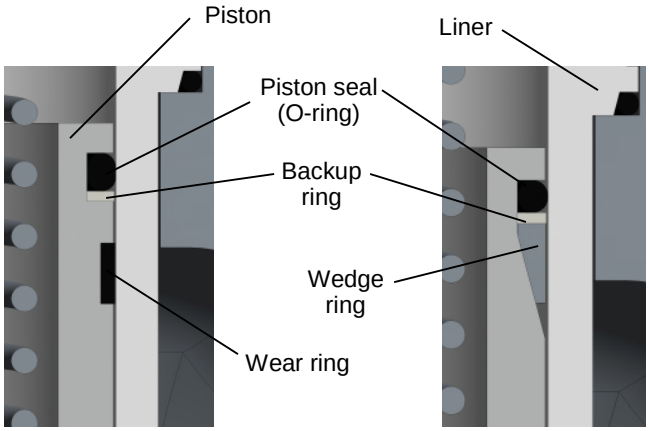


* Older models have 5/8" straight thread, jam nut, and Teflon seal.

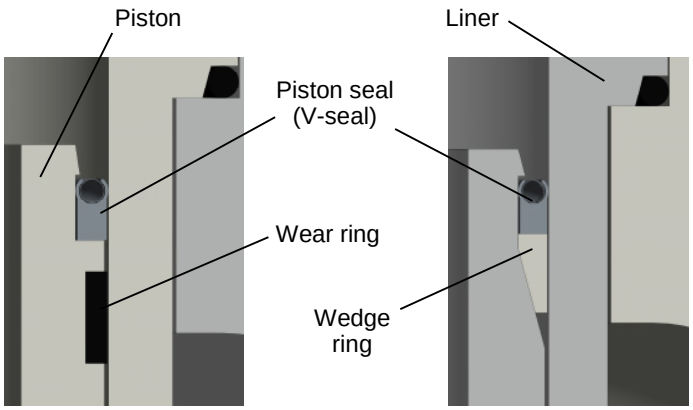
MAIN VALVE CONSTRUCTION

Part Name	Standard Materials of Construction [1]	
	Carbon Steel (NACE [2])	Stainless Steel (NACE [2])
Body	SA-216 WCB	SA-351 CF8M
Cap	SA-516 Gr. 70 Normalized	SA-240/479 316/316L
Liner	A743 CF8M	A743 CF8M
Piston	A479 316/316L or A351 CF8M	A479 316/316L or A351 CF8M
Retainer	A240/479 316/316L	A240/479 316/316L
Retainer bolt	A193 B8M	A193 B8M
Annular flow plug (F8000)	A479 316/316L	A479 316/316L
Piston seal	Elastomer [3] or PTFE [4]	Elastomer [3] or PTFE [4]
Backup ring	PTFE	PTFE
Liner seal	Elastomer [3]	Elastomer [3]
Wear ring / wedge ring	Graphite-filled PTFE	Graphite-filled PTFE
Seat	Elastomer or Plastic [3]	Elastomer or Plastic [3]
FTC body, piston, connector, plug	A479 316/316L	A479 316/316L
FTC seal / FTC piston seals	Elastomer [3]	Elastomer [3]
Pickup tube	A479 316/316L	A479 316/316L
Cap bolt	SA-193 B7 or SA-540 B22	SA-193 B8 or SA-564 630
Lockwasher	316 SS	316 SS
Locking thread insert	304 SS (Inconel X750)	304 SS (Inconel X750)
Dome spring	302/304 SS (Inconel X750)[5]	302/304 SS (Inconel X750)[5]
Pipe plug	316 SS	316 SS
Nameplate	316 SS	316 SS
Lifting bracket	A36	316 SS
Pilot mounting bolts (not shown)	316 SS	316 SS

[1] Materials are subject to change without notice. Contact Flow Safe for availability of materials not shown.
[2] (Alternate material) to meet NACE MR0175 / ISO 15156.
[3] See p. 7 for seat and seal selections.
[4] PTFE "V-seals" for F7040/8040 models have 316 SS (Elgiloy) spring.
[5] Dome spring may be omitted for NACE service.



F7050/8050 Piston Seal Arrangements



F7040/8040 Piston Seal Arrangements

F200 PILOT OPERATION

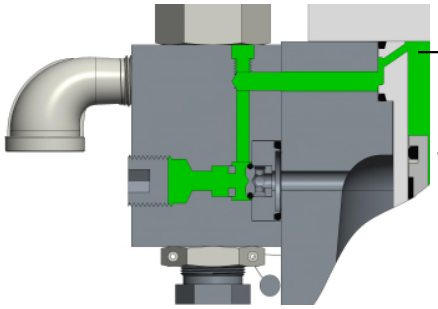
F7000/8000 Series

F200 Specifications

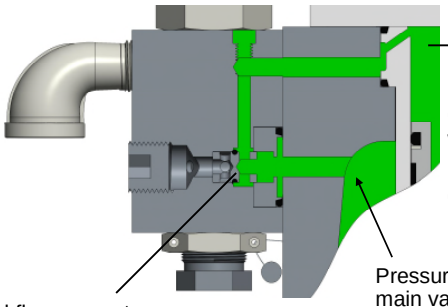
Style: Snap-acting, non-flowing
Service: Gas / vapor
Set Pressure Range:
15 - 6000 psig (1 - 413 barg)
Performance: Pilot exhaust @ 100% of set pressure (main valve opening). Blowdown adjustable from 5 to 20%.

F200 Features

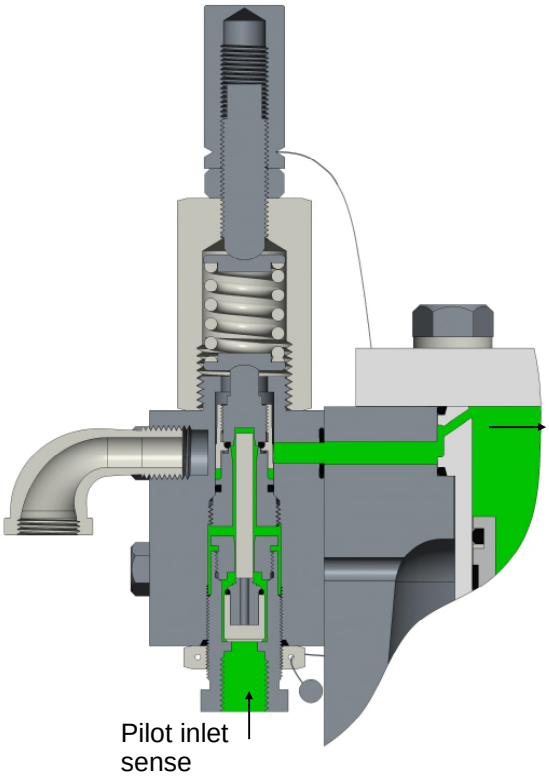
- Direct mount to main valve
- Built-in backflow preventer
- Balanced against backpressure when vented to atmosphere
- Main valve full lift at set point



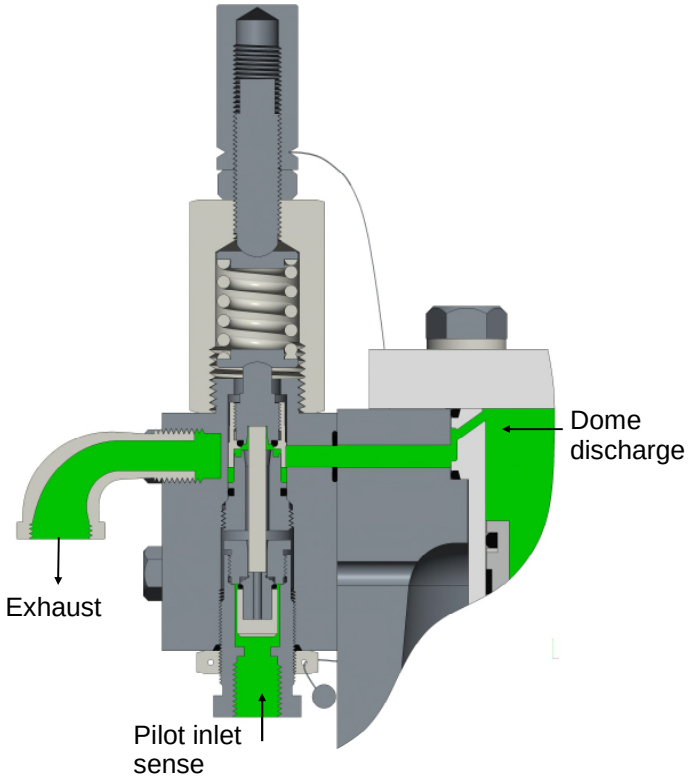
CLOSED
With inlet pressure loading main valve dome through BFP



CLOSED
With backpressure loading main valve dome through BFP



CLOSED POSITION
Inlet pressure below set pressure



OPEN (RELIEVING) POSITION
Inlet pressure at or above set pressure

FLOWSAFE
www.flowsafe.com
www.dresserutility.com

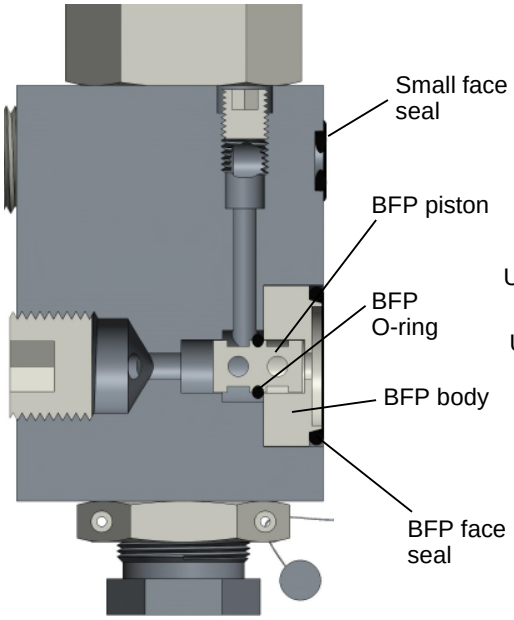
F200 PILOT CONSTRUCTION

F7000/8000 Series

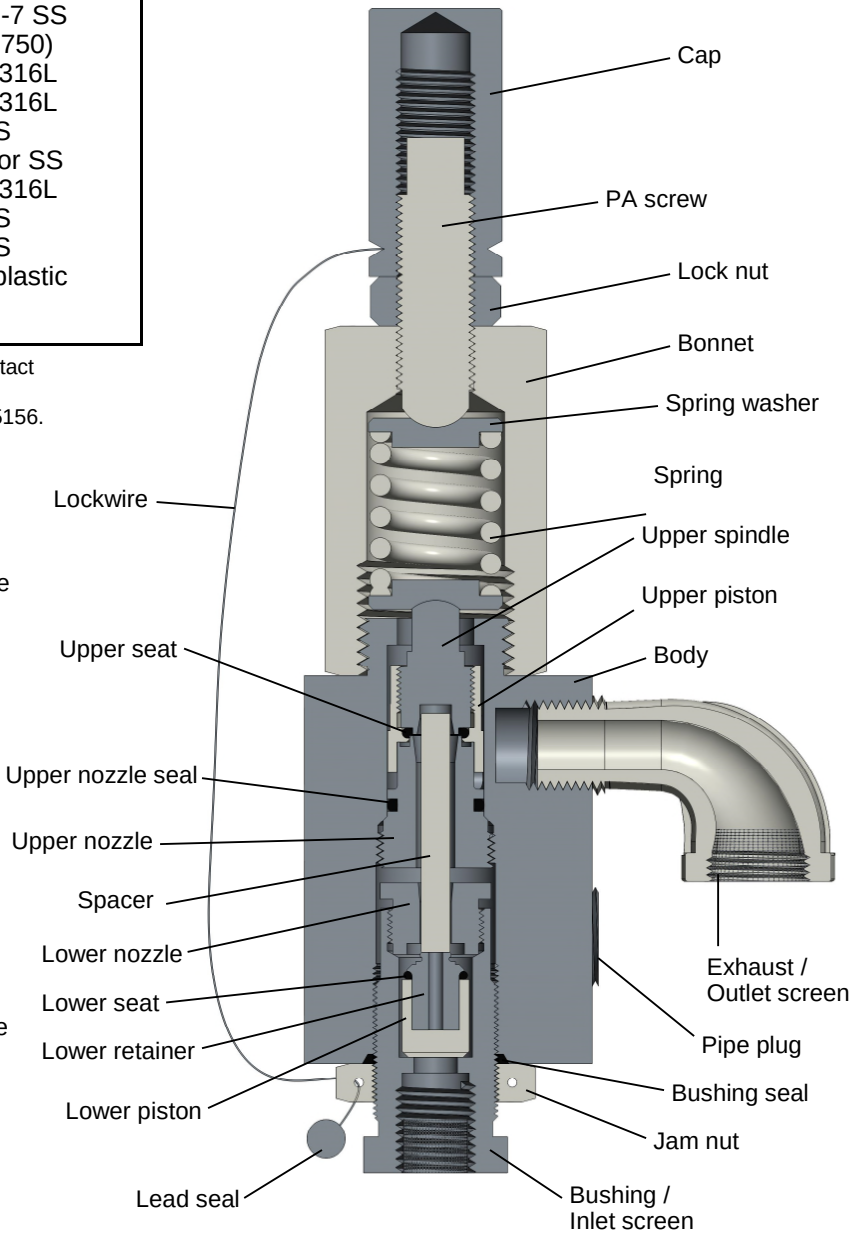
F200 Part Name	Standard Materials of Construction [1] (NACE [2])
Body	A479 316/316L
Bushing	A564 630 (Inconel 625)
Jam nut	316 SS
Bushing seal	Teflon / PTFE
Lower piston	A479 316/316L
Face seals, O-rings	Elastomer [3]
Upper seat, lower seat	Elastomer [3]
Lower retainer	A564 630
Lower nozzle	A479 316/316L
Spacer	A479 316/316L
Upper nozzle	A479 316/316L
Upper piston	A479 316/316L
Upper spindle	A479 316/316L
Bonnet	A479 316/316L
Spring	302/304/17-7 SS (Inconel X750)
Spring washer	A479 316/316L
PA screw	A479 316/316L
Lock nut	316 SS
Cap	Aluminum or SS
BFP body, piston	A479 316/316L
Pipe plugs	316 SS
Inlet screen	316 SS
Exhaust / outlet screen	316 SS or plastic

[1] Materials are subject to change without notice. Contact Flow Safe for availability of materials not shown.
[2] (Alternate material) to meet NACE MR0175 / ISO 15156.
[3] See p. 7 for seat and seal selections.

— Did You Know? —
This pilot contains 6 O-rings. Valve S/N should be provided for repair kit orders.



Backflow Preventer (BFP) Section



F300 PILOT OPERATION

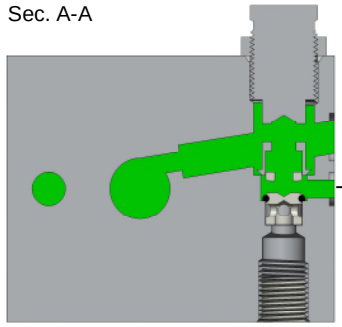
F7000/8000 Series

F300 Specifications

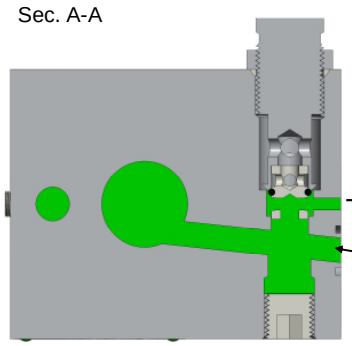
Style: Modulating, flowing
Service: Gas / vapor / liquid
Set Pressure Range:
Diaphragm type: 7 - 500 psig (0.5 - 34.5 barg)
Piston style: 500 - 6000 psig (34.5 - 413 barg)
Performance: First pilot exhaust @ 96-98% of set pressure (main valve opening). Zero main valve blowdown.

F300 Features

- Direct mount to main valve with integral exhaust
- Opens in proportion to upset
- Built-in backflow preventer (BFP)
- Balanced against backpressure
- Main valve full lift at set point upon demand

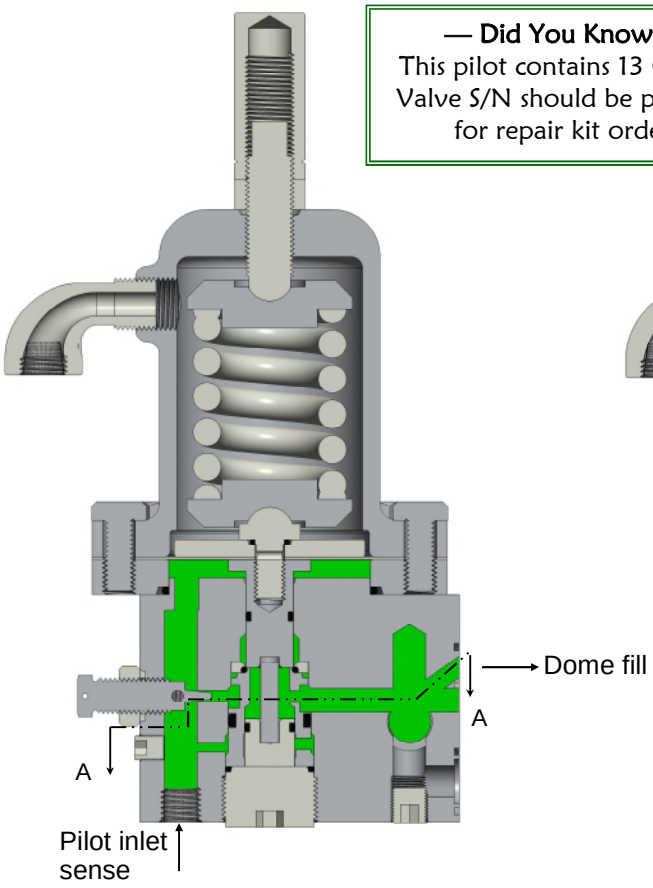


CLOSED
With inlet pressure loading main valve dome through BFP

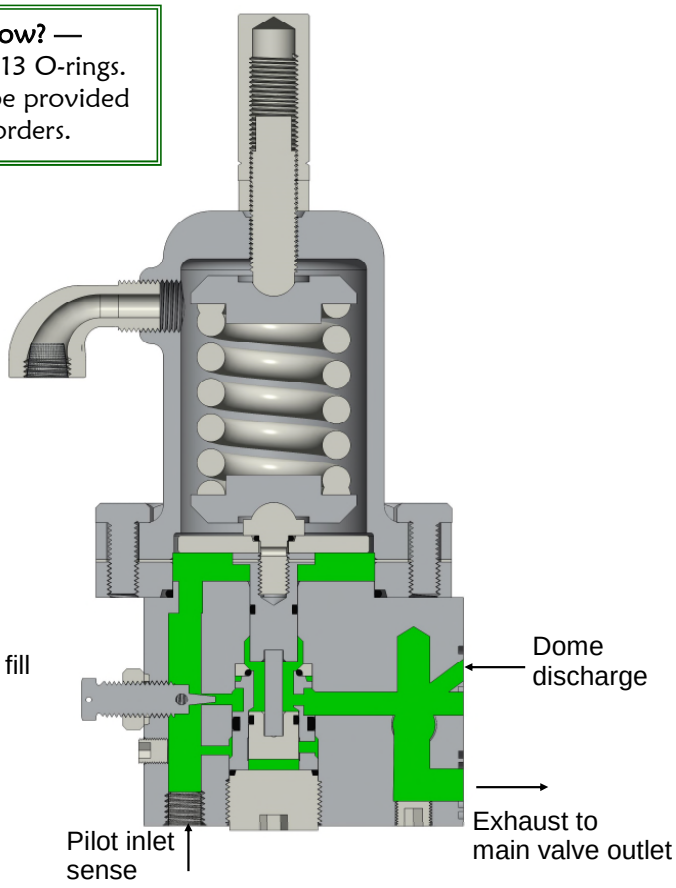


CLOSED
With backpressure loading main valve dome through BFP

— Did You Know? —
This pilot contains 13 O-rings. Valve S/N should be provided for repair kit orders.



CLOSED POSITION
Inlet pressure below set pressure



OPEN (RELIEVING) POSITION
Inlet pressure at or above set pressure

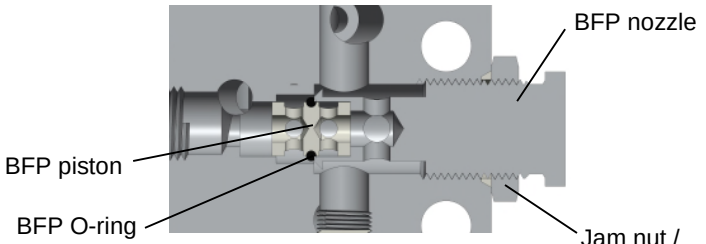
F300 PILOT CONSTRUCTION

F7000/8000 Series

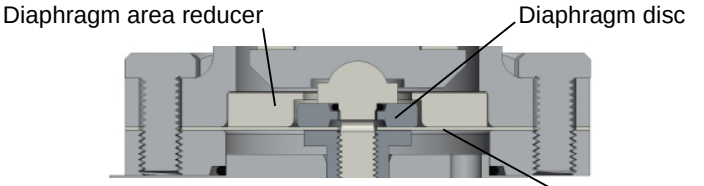
F300 Part Name	Standard Materials of Construction [1]
Body	A479 316/316L
Internal plug	A479 316/316L
Lower piston	A479 316/316L
Sleeve	A479 316/316L
Seat, seals, O-rings	Elastomer [2]
Backup ring	Teflon / PTFE
Spacer	A479 316/316L
Seat retainer nozzle	A479 316/316L
Upper piston	A479 316/316L
Diaphragm fastener	A479 316/316L
Diaphragm discs, ring	A479 316/316L
Diaphragm area reducer	A479 316/316L
Adapter	A479 316/316L
Spring	302/304/17-7 SS
Spring washer	A479 316/316L
Bonnet	A351 CF8M
Bonnet bolt	316 or 13-8 SS
Diaphragm	Elastomer [2]
BFP nozzle, piston	A479 316/316L
Proportional band screw	A479 316/316L
Seal - BFP, prop. band screw	Teflon / PTFE
PA screw	A479 316/316L
Cap	Aluminum or SS
Lock / jam nuts	316 SS
Pipe plugs	316 SS
Inlet screen	316 SS
Vent / screen	316 SS or plastic
Lockwire	18-8 SS

[1] Materials are subject to change without notice. Contact Flow Safe for availability of materials not shown. Standard materials for wetted parts meet NACE MR0175 / ISO 15156.

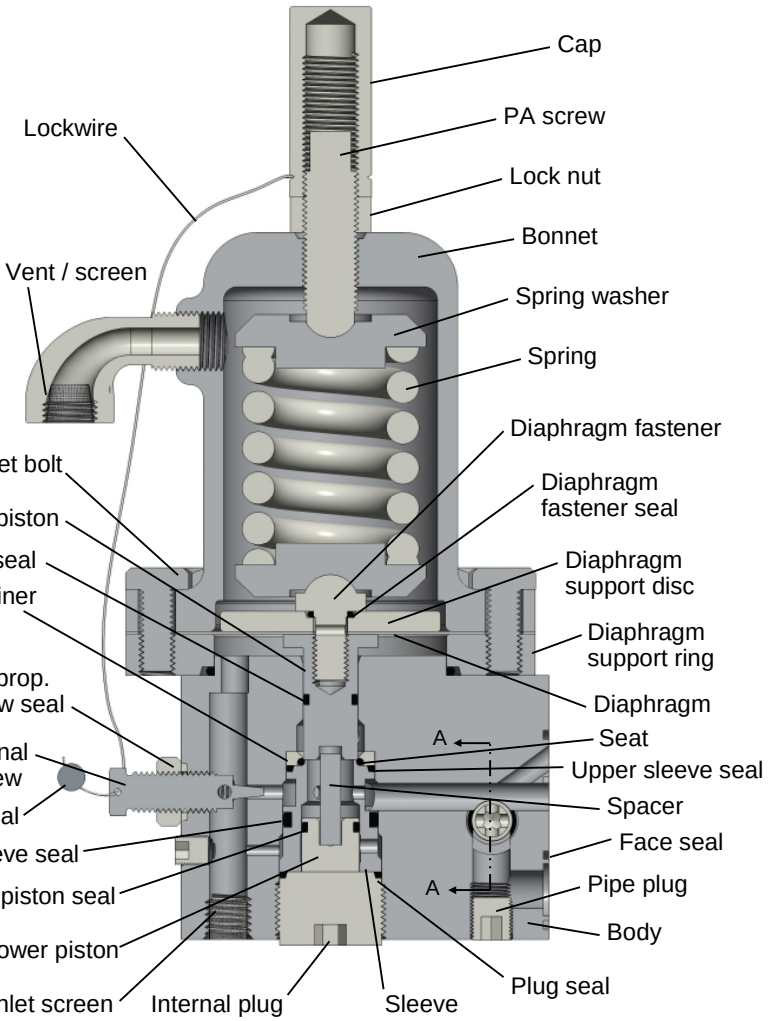
[2] See p. 7 for seat and seal selections. Diaphragm is available in Buna-N,Viton, EPDM, and Teflon/FEP.



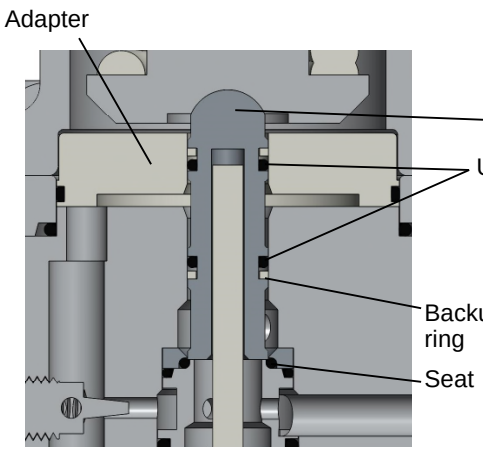
Backflow Preventer (BFP)
Section A-A



HP Diaphragm Style
Over 285 psig (19.6 barg) to 500 psig (34.5 barg)



LP Diaphragm Style
Up to 285 psig (19.6 barg)



HP Piston Style
Over 500 psig (34.5 barg) to 6000 psig (413 barg)

F500 PILOT OPERATION

F7000/8000 Series

F500 Specifications

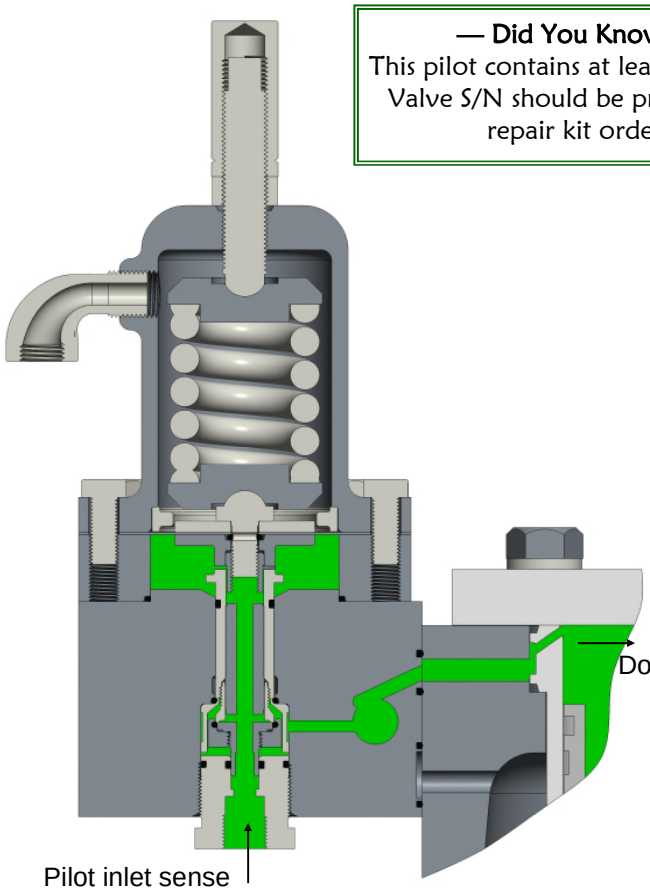
Style: Modulating, non-flowing
Service: Gas / vapor / liquid
Set Pressure Range:
Diaphragm type: 7 - 285 psig (0.5 - 19.6 barg)
Piston styles: 285 - 6000 psig (19.6 - 413 barg)
Performance: Locks out inlet pressure @ 93% of set pressure. First pilot exhaust @ 96-98% of set pressure (main valve opening). Zero main valve blowdown.

F500 Features

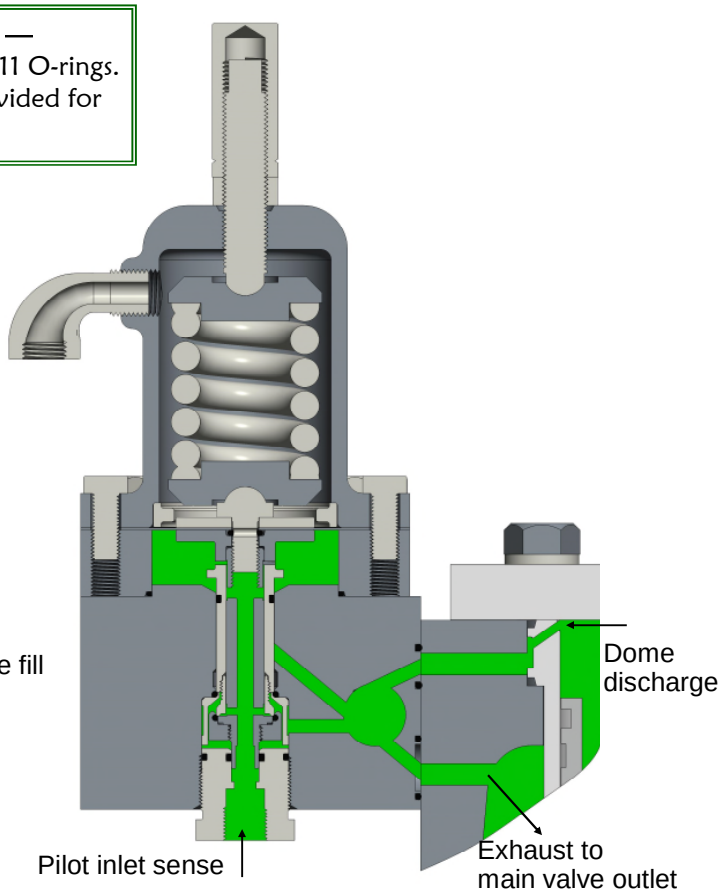
- Direct mount to main valve with integral exhaust
- Opens in proportion to upset
- Built-in backflow preventer (BFP)
- Optional setpoint indicator button available
- Balanced against backpressure
- Main valve full lift at set point upon demand

Backflow preventer operation same as for F300 Pilot (see Page 12).

— Did You Know? —
This pilot contains at least 11 O-rings. Valve S/N should be provided for repair kit orders.



CLOSED POSITION
Inlet pressure below set pressure



OPEN (RELIEVING) POSITION
Inlet pressure at or above set pressure

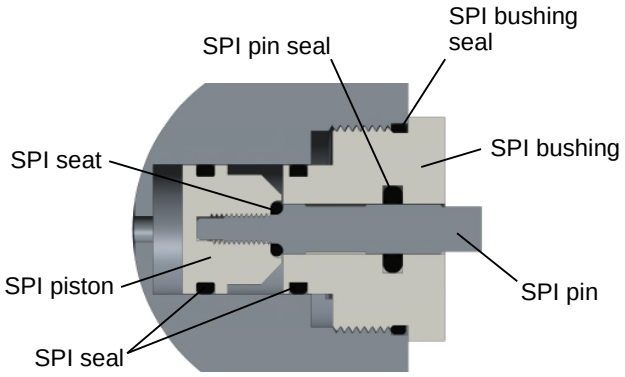
F500 PILOT CONSTRUCTION

F500 Part Name	Standard Materials of Construction [1]
Body	A479 316/316L
Bushing	A479 316/316L
Retainer	A479 316/316L
Lower seat, seat retainer	A564 630
Seats, seals, O-rings	Elastomer [2]
Spindle	A564 630
Feedback piston	A479 316/316L
Diaph. support ring, piston ring	A479 316/316L
Reducer ring	A479 316/316L
Piston	A479 316/316L
Spindle spring	Inconel X750
Diaphragm fastener	A479 316/316L
Diaphragm washer	A479 316/316L
Spring	302/304/17-7/17-4 SS
Spring washer	A479 316/316L
Bonnet	A479 316 or A351 CF8M
Bonnet bolt	316 SS or A574-plated
Diaphragm	Elastomer [2]
BFP nozzle, piston	A479 316/316L
Seal - BFP	Teflon / PTFE
SPI pin, bushing, piston	A479 316/316L
PA screw	A479 316/316L
Cap	Aluminum or SS
Lock / jam nuts	316 SS
Pipe plugs	316 SS
Inlet screen	316 SS
Vent / screen	316 SS or plastic
Lockwire	18-8 SS

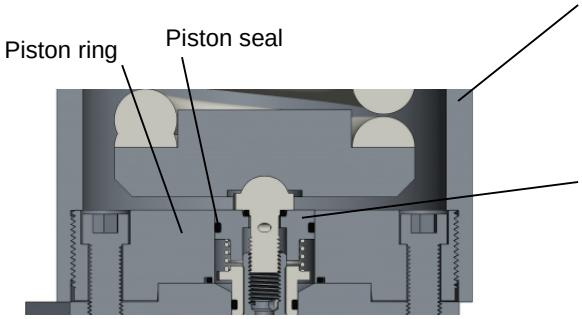
[1] Materials are subject to change without notice. Contact Flow Safe for availability of materials not shown. Standard materials for wetted parts meet NACE MR0175 / ISO 15156.

[2] See p. 7 for seat and seal selections. Diaphragm is available in Buna-N,Viton, EPDM, and Teflon/FEP.

Backflow preventer — same arrangement as for F300 Pilot (see Page 13).

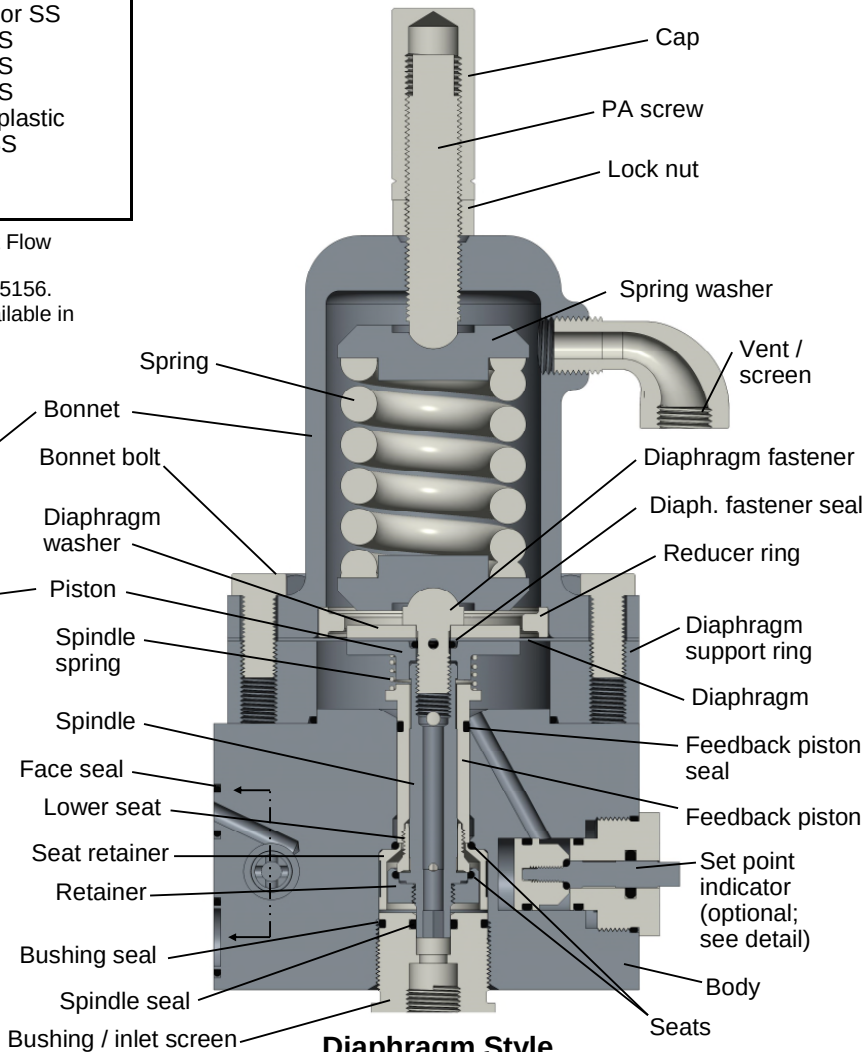


Set Point Indicator (SPI)
(Optional)



High Pressure Piston Style
Over 1480 to 6000 psig (102-413 barg)

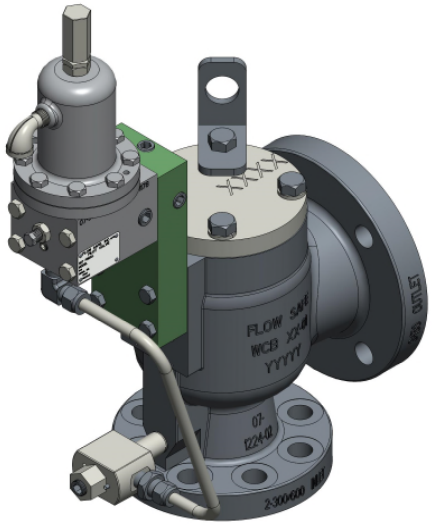
Intermediate Pressure Piston Style
Over 285 to 1480 psig (19.6-102 barg)
— Similar —



Diaphragm Style
Up to 285 psig (19.6 barg)

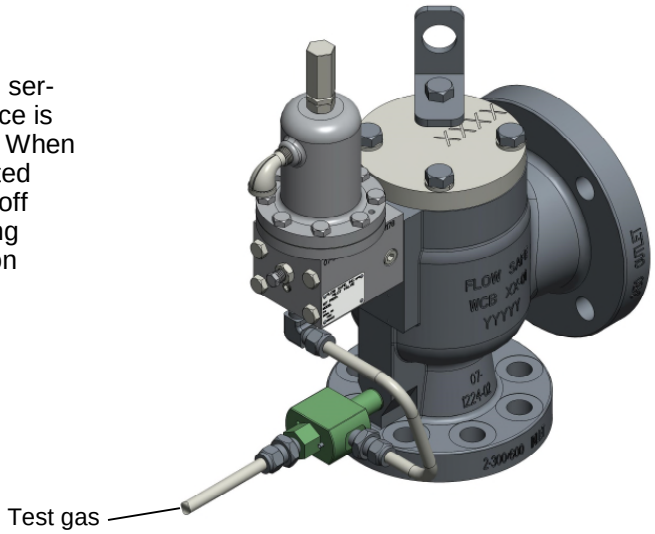
THERMAL (CRYO) BLOCK

Normally used with the F200 pilot, this option helps ensure heat absorption to the pilot in cryogenic applications by elevating the pilot and separating it from the main valve. Seats and seals retain more of their resilience for effective sealing when they are maintained as warm as possible.



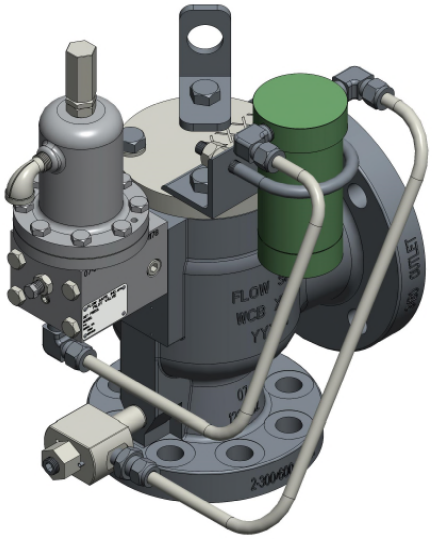
FIELD TEST CONNECTION (FTC)

The FTC allows the user to verify set pressure while in service without valve removal. An external pressure source is attached to the FTC to introduce pressure to the pilot. When test pressure overcomes inlet pressure, the self-actuated shuttle piston within the assembly slides over to block off inlet (See sectional view on Page 8). With a modulating F300 or F500 pilot, it is possible to detect pilot actuation without opening the main valve.



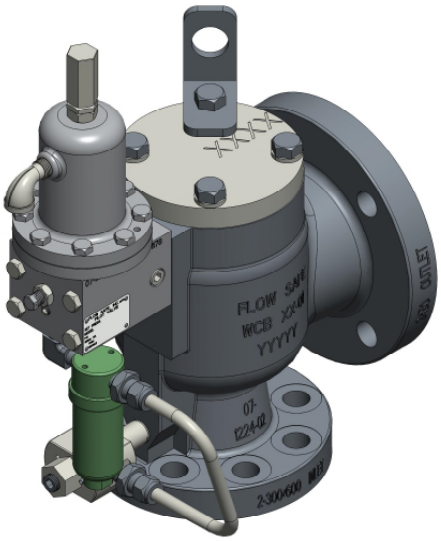
SURGE SUPPRESSOR (SNUBBER)

This feature provides extra volume and scatters the fluid path to help ensure a constant pressure supply to the pilot for service that involves pulsations or pressure spikes. Uncontrolled pulsations from a positive displacement compressor or similar equipment may have the effect of opening the pilot prematurely, below set pressure.



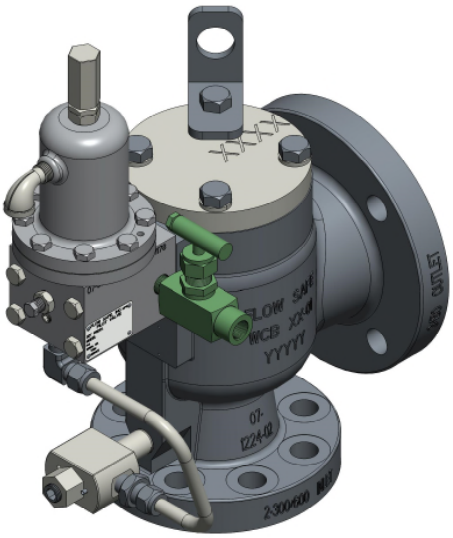
INLET SUPPLY FILTER

A filter should be used for dirty applications to clean the supply fluid to the pilot, which has several small orifices that can become plugged. A drain plug is standard, and may be replaced by a drain valve as an option.



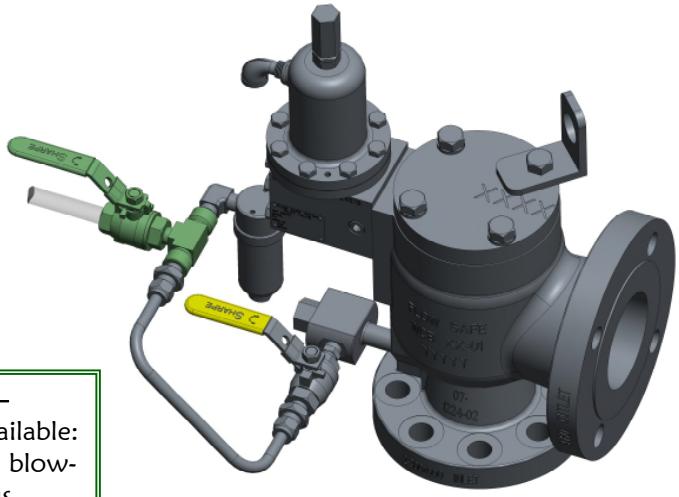
MANUAL / REMOTE BLOWDOWN VALVE

This valve, which may also be located on the main valve cap, allows opening of the main valve without actuating the pilot. Opening the blowdown valve rapidly exhausts main valve dome pressure, allowing the piston to lift. Various arrangements of solenoid or pneumatic pilot valves, or air-actuated ball valves, may be used for emergency shutdown or other operation according to system needs.



REMOTE PRESSURE PICKUP

When inlet piping pressure losses exceed 3% of relief valve set pressure, remote sensing of the pilot is recommended. The connection to the system being protected should be a point where pressure is stable and flow is at a minimum if the relief valve should open.



— Did You Know? —
Many other options are available: remote trip indication, ESD blow-down, clean sense. Ask us . . .

SIZING FOR GAS & VAPOR SERVICE

The ASME Boiler & Pressure Vessel Code, Section XIII, requires that capacity certification be obtained for pressure relief valves designed for gas or vapor service. Certification tests include determination of the rated coefficient of discharge for the PRVs at an overpressure of 10% or 3 psi, whichever is greater.

To size the F7000/8000 relief valve for gas or vapor service, the following information is required:

- Required flow capacity
- Required set pressure
- Backpressure (pressure at valve outlet)
- Acceptable overpressure [10% or 3 psi max.; 21% for fire case per ASME XIII, UG-125(c)(2)]
- Operating pressure, to assure that it is below valve reseat pressure
- Gas properties, including molecular weight, specific heat ratio or gas constant, and compressibility factor

To select the required orifice size for a gas or vapor application, the below equations should be used. Depending on the gas, critical flow generally exists at pressures above 11 to 12 psig with zero backpressure, or at higher pressures where backpressure is less than approximately 50% of inlet pressure. If backpressure is less than or equal to P_{cf} in the following equation, critical flow will occur:

$$P_{cf} = P_1 \left[\frac{2}{k+1} \right]^{\frac{k}{k-1}}$$

Critical Flow

In US customary units:

$$A = \frac{V\sqrt{MTZ}}{6.32CK_dP_1K_bK_c}$$

- OR -

$$A = \frac{W}{CK_dP_1K_bK_c}\sqrt{\frac{TZ}{M}}$$

In SI units:

$$A = \frac{2.676V\sqrt{MTZ}}{CK_dP_1K_bK_c}$$

- OR -

$$A = \frac{W}{CK_dP_1K_bK_c}\sqrt{\frac{TZ}{M}}$$

Subcritical Flow

In US customary units:

$$A = \frac{V}{4645F_2K_dK_c}\sqrt{\frac{MTZ}{P_1(P_1-P_2)}}$$

- OR -

$$A = \frac{W}{735F_2K_dK_c}\sqrt{\frac{TZ}{MP_1(P_1-P_2)}}$$

In SI units:

$$A = \frac{47.95V}{F_2K_dK_c}\sqrt{\frac{MTZ}{P_1(P_1-P_2)}}$$

- OR -

$$A = \frac{17.9W}{F_2K_dK_c}\sqrt{\frac{TZ}{MP_1(P_1-P_2)}}$$

A	=	Required discharge orifice area, in^2 or mm^2
V	=	Required flow rate, scfm or Nm^3/min
W	=	Required flow rate, lb/hr or kg/hr
K_d	=	Rated ASME discharge coefficient (See table headings, pp. 24 - 27)
C	=	Gas constant, dependent on specific heat ratio $k = C_p/C_v$ (See table on p. 19)
P_1	=	Relieving pressure (set pressure plus overpressure plus atmospheric pressure), psia or kPaa
P_2	=	Backpressure, psia or kPaa
K_b	=	Backpressure correction factor, for balanced bellows valves only (otherwise, use 1.0)
K_c	=	Rupture disk correction factor: 1.0 with no disk 0.9 with disk in combination
M	=	Molecular weight at inlet relieving Conditions (See table on p. 20)
T	=	Relieving temperature, °R (°F + 460) or °K (°C + 273)
Z	=	Compressibility factor at inlet relieving conditions, 1.0 if unknown
F_2	=	Coefficient of subcritical flow; See figure on p. 20
k	=	Specific heat ratio, C_p/C_v (See table on p. 20)
P_{cf}	=	Critical flow nozzle pressure

See p. 21 for gas sizing example.

SIZING FOR GAS & VAPOR SERVICE (cont'd)

Values of Coefficient C

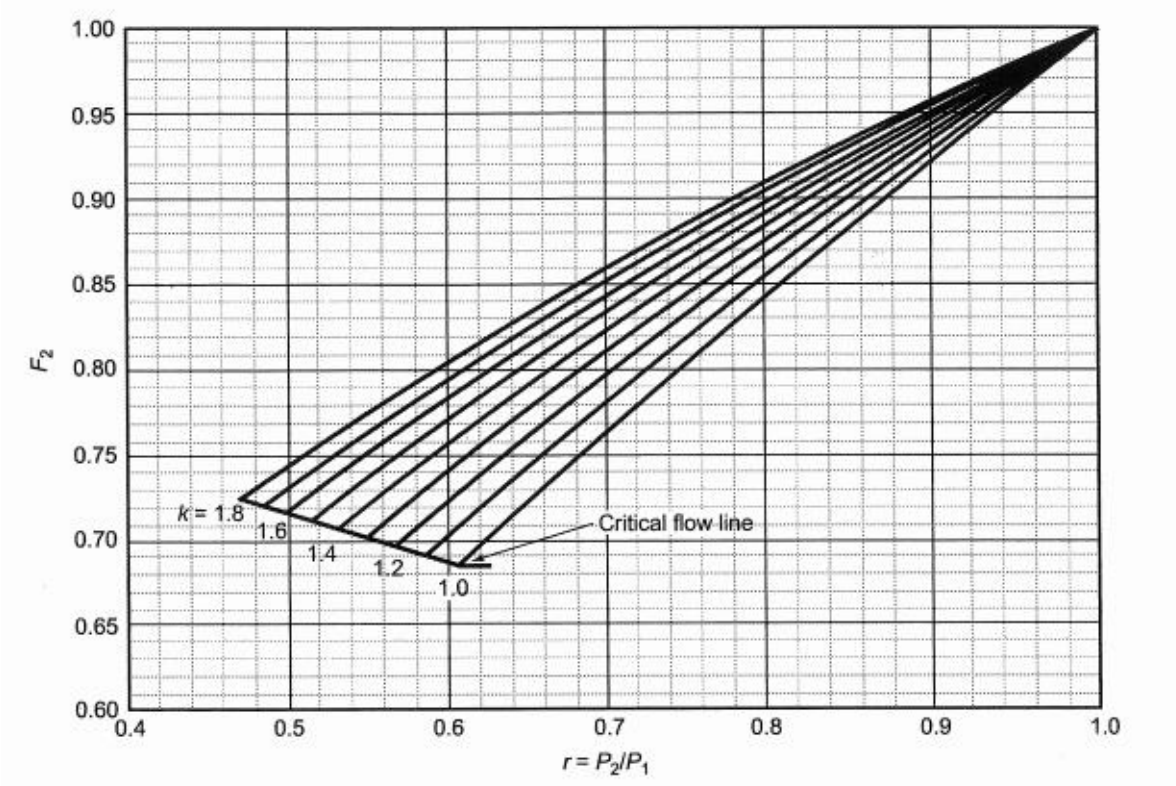
(For equations on p. 18)

k	C		k	C		k	C		k	C	
	USC	SI		USC	SI		USC	SI		USC	SI
1.00	315	0.0239	1.26	343	0.0261	1.51	365	0.0277	1.76	384	0.0292
1.01	317	0.0240	1.27	344	0.0261	1.52	366	0.0278	1.77	385	0.0292
1.02	318	0.0241	1.28	345	0.0262	1.53	367	0.0279	1.78	386	0.0293
1.03	319	0.0242	1.29	346	0.0263	1.54	368	0.0279	1.79	386	0.0293
1.04	320	0.0243	1.30	347	0.0263	1.55	369	0.0280	1.80	387	0.0294
1.05	321	0.0244	1.31	348	0.0264	1.56	369	0.0280	1.81	388	0.0294
1.06	322	0.0245	1.32	349	0.0265	1.57	370	0.0281	1.82	389	0.0295
1.07	323	0.0246	1.33	350	0.0266	1.58	371	0.0282	1.83	389	0.0296
1.08	325	0.0246	1.34	351	0.0266	1.59	372	0.0282	1.84	390	0.0296
1.09	326	0.0247	1.35	352	0.0267	1.60	373	0.0283	1.85	391	0.0297
1.10	327	0.0248	1.36	353	0.0268	1.61	373	0.0283	1.86	391	0.0297
1.11	328	0.0249	1.37	353	0.0268	1.62	374	0.0284	1.87	392	0.0298
1.12	329	0.0250	1.38	354	0.0269	1.63	375	0.0285	1.88	393	0.0298
1.13	330	0.0251	1.39	355	0.0270	1.64	376	0.0285	1.89	393	0.0299
1.14	331	0.0251	1.40	356	0.0270	1.65	376	0.0286	1.90	394	0.0299
1.15	332	0.0252	1.41	357	0.0271	1.66	377	0.0286	1.91	395	0.0300
1.16	333	0.0253	1.42	358	0.0272	1.67	378	0.0287	1.92	395	0.0300
1.17	334	0.0254	1.43	359	0.0272	1.68	379	0.0287	1.93	396	0.0301
1.18	335	0.0254	1.44	360	0.0273	1.69	379	0.0288	1.94	397	0.0301
1.19	336	0.0255	1.45	360	0.0274	1.70	380	0.0289	1.95	397	0.0302
1.20	337	0.0256	1.46	361	0.0274	1.71	381	0.0289	1.96	398	0.0302
1.21	338	0.0257	1.47	362	0.0275	1.72	382	0.0290	1.97	398	0.0302
1.22	339	0.0258	1.48	363	0.0276	1.73	382	0.0290	1.98	399	0.0303
1.23	340	0.0258	1.49	364	0.0276	1.74	383	0.0291	1.99	400	0.0303
1.24	341	0.0259	1.50	365	0.0277	1.75	384	0.0291	2.00	400	0.0304
1.25	342	0.0260	—	—	—	—	—	—	—	—	—

SIZING FOR GAS & VAPOR SERVICE (cont'd)

Common Gas Properties

Gas	Molecular Weight	Specific Heat Ratio, k (C_p/C_v)	Gas	Molecular Weight	Specific Heat Ratio, k (C_p/C_v)
Acetylene	26	1.28	Hydrogen Sulfide	34	1.32
Air	29	1.40	Isobutane	58	1.10
Ammonia	17	1.30	Isopentane	72	1.08
Argon	40	1.66	Methane	16	1.31
Benzene	78	1.12	Methyl Chloride	50	1.20
n-Butane	58	1.09	Natural Gas	19	1.27
Carbon Dioxide	44	1.29	Nitrogen	28	1.40
Chlorine	71	1.36	Oxygen	32	1.40
Ethane	30	1.19	n-Pentane	72	1.08
Ethylene	28	1.24	Propane	44	1.13
Helium	4	1.66	Propylene	42	1.15
n-Hexane	86	1.06	Sulfur Dioxide	64	1.27
Hydrogen	2	1.41	Water vapor / steam	18	1.33



Values of F_2 for Subcritical Flow

(For equations on p. 18)

FLOWSAFE
www.flowsafe.com
www.dresserutility.com

SIZING FOR GAS & VAPOR SERVICE (cont'd)

GAS SIZING EXAMPLE

Service conditions: Set pressure = 500 psig; 10% overpressure; 60 psig backpressure
Natural gas at 120 °F; Compressibility factor = 0.95
Capacity required = 22,000 scfm
Assume F8000 series and associated discharge coefficient

Check critical flow pressure:

$$P_{cf} = P_1 \left[\frac{2}{k+1} \right]^{\frac{k}{k-1}}$$

$$= [(500)(1.10) + 14.7] \bullet [\, 2 / (1.27 + 1)] \wedge [1.27 / (1.27 - 1)]$$

$$= 311 \text{ psia}$$

Backpressure is less than P_{cf} , so critical flow will occur.

Choose critical flow equation from p. 18 that uses "scfm" for flow units:

$$A = \frac{V\sqrt{MTZ}}{6.32CK_dP_1K_bK_c}$$

$$= \frac{22{,}000\sqrt{(19)(460 + 120)(0.95)}}{6.32(344)(0.878)(564.7)(1)(1)} = 2.09 \text{ in}^2$$

Select F8000 with "K" orifice (2.147 in^2) from orifice size listing in table on p. 6.

Based on inlet pressure and temperature, a 3"-300# x 4"-150# body should be used.

SIZING FOR TWO-PHASE FLOW

To size the F7000/8000 relief valve for mixed gas and liquid service, with flashing or non-flashing flow, the Omega Method from API 520 Part I may be used. The following information is required, in addition to required flow capacity, set pressure, etc.:

- Specific volume of the 2-phase fluid system at the relief valve inlet (ft^3/lb or m^3/kg)
- Specific volume evaluated at 90% of the relief valve inlet pressure (ft^3/lb or m^3/kg)

The ASME Code and National Board of Boiler & Pressure Vessel Inspectors rules do not give specific guidance on nameplate stamping (i.e., capacity) in mixed-phase applications. However, good engineering judgment would dictate that the valve be marked for gas or liquid based on the fluid that makes up the greater percentage of the flow stream.

SIZING FOR LIQUID SERVICE

As with ASME Section XIII gas relief valves, certification tests for liquid relief valves are required. These tests include determination of the rated coefficient of discharge for the PRVs at an overpressure of 10% or 3 psi, whichever is greater.

To size the F7000/8000 relief valve for liquid service, the following information is required:

- Required flow capacity
- Required set pressure
- Backpressure (pressure at valve outlet)
- Acceptable overpressure (10% or 3 psi max.)
- Operating pressure, to assure that it is below valve reseat pressure
- Fluid properties, including viscosity and specific gravity

To select the required orifice size for a liquid application, the following equations should be used:

In US customary units:

$$A = \frac{Q}{38 K_d K_w K_c K_v} \sqrt{\frac{G}{P_1 - P_2}}$$

In SI units:

$$A = \frac{11.78\ Q}{K_d K_w K_c K_v} \sqrt{\frac{G}{P_1 - P_2}}$$

For viscous liquid service, determine preliminary orifice area A using 1.0 for K_v in the above equations. Then select the next larger Flow Safe orifice area for determining Reynolds number (Re) below. Using Re, determine K_v from graph on p. 13 for final calculation of A.

In US customary units:

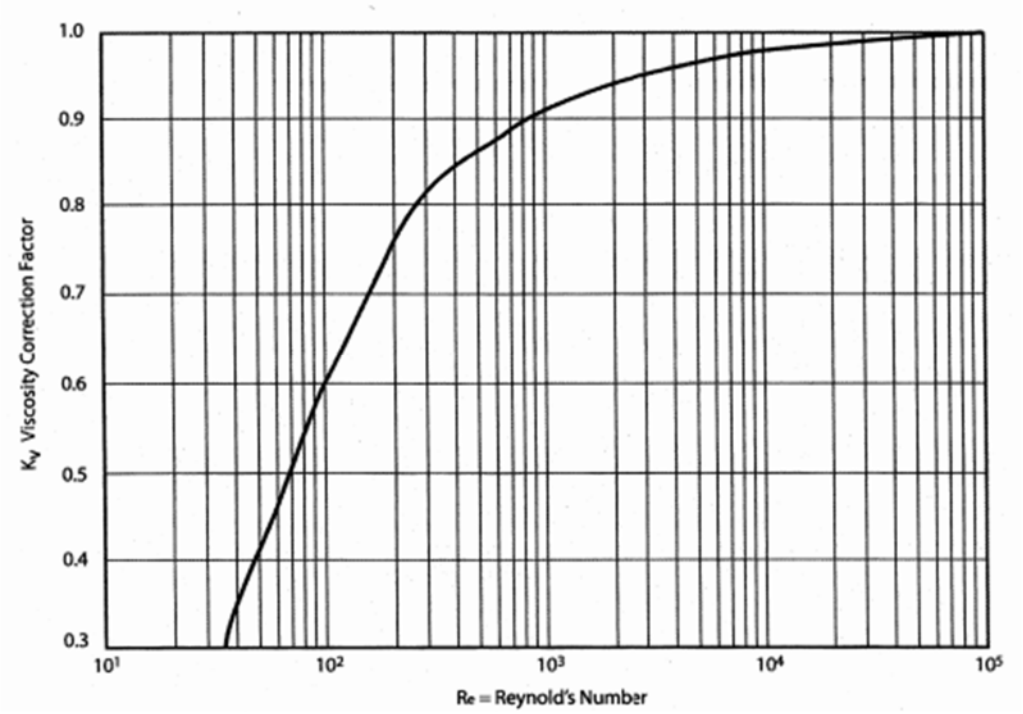
$$Re = \frac{Q(2800G)}{\mu\sqrt{A}} \quad \text{or} \quad Re = \frac{12{,}700Q}{U\sqrt{A}}$$

In SI units:

$$Re = \frac{Q(18{,}800G)}{\mu\sqrt{A}} \quad \text{or} \quad Re = \frac{85{,}220Q}{U\sqrt{A}}$$

A	=	Required discharge orifice area, in^2 or mm^2
Q	=	Flow rate, US gpm or liters/min
K_d	=	Rated ASME discharge coefficient (See table headings, pp. 28 - 29)
K_w	=	Backpressure correction factor, for balanced bellows valves only (otherwise, use 1.0)
K_c	=	Rupture disk correction factor: 1.0 with no disk 0.9 with disk in combination
K_v	=	Viscosity correction factor (from graph on p. 23)
G	=	Specific gravity (water = 1.0 at standard conditions)
P_1	=	Inlet pressure (including overpressure), psig or kPag
P_2	=	Total backpressure, psig or kPag
Re	=	Reynolds number
μ	=	Absolute viscosity at flowing temperature, centipoise (cP)
U	=	Kinematic viscosity at flowing temperature, Saybolt universal seconds (SUS or SSU)

SIZING FOR LIQUID SERVICE (cont'd)



LIQUID SIZING EXAMPLE

Service conditions: Set pressure = 200 psig; 10% overpressure; zero backpressure
Mineral oil, SAE 20W at 0 °F: Viscosity = 5000 cP; SG = 0.91
Capacity required = 125 gpm
Assume Flow Safe F8000 with $K_d = 0.830$; initial $K_v = 1.0$

Preliminary area, A $= \dfrac{Q}{38K_dK_wK_cK_v}\sqrt{\dfrac{G}{P_1 - P_2}}$

$= \dfrac{125}{38(0.830)(1)(1)(1)}\sqrt{\dfrac{0.91}{220 - 0}} = 0.255\ in^2$

Select F8000 'F' with 0.358 in^2 orifice area (from orifice size table on p. 6 or capacity table on p. 29).

Mineral oil is a viscous liquid, so its viscosity factor (K_v) must be determined to see the effect on calculated area. First, determine flow (Q) through the selected orifice using K_v for water (1.0); then use that flow to calculate Reynolds number (Re). Finally, determine K_v based on Reynolds number and recalculate the area.

$Q = 38AK_dK_wK_cK_v\sqrt{\dfrac{P_1 - P_2}{G}} = 38(0.358)(0.830)(1)(1)(1)(220/0.91)^{1/2} = 176$ gpm

$Re = \dfrac{Q(2800G)}{\mu(A)^{1/2}} = \dfrac{176(2800)(0.91)}{5000(0.358)^{1/2}} = 150$

From graph above, $K_v = 0.68$ for Re = 150 (1.50×10^2)

Final area, A $= \dfrac{125}{38(0.830)(1)(1)(0.68)}\sqrt{\dfrac{0.91}{220 - 0}} = 0.375\ in^2 \longrightarrow$ F8000 'F' (0.358 in^2) is undersized. 'G' (0.588 in^2) orifice is required.

SIZING / CAPACITIES

F7000 GAS FLOW CAPACITIES: K_d = 0.824

10% / 3 psi Overpressure, 0 BP, 60 °F, Z=1.0, MW=29

AIR

Valve Size:	1 x 2	1-1/2 x 3	2 x 3	3 x 4	4 x 6	6 x 8	8 x 10	10 x 12	12 x 16
Orifice Area (in^2):	**0.719**	**1.767**	**2.953**	**6.605**	**11.437**	**26.06**	**45.66**	**71.85**	**111.87**
Set Pressure (psig)	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	355	872	1458	3261	5646	12865	22541	35471	55227
20	409	1006	1681	3759	6509	14832	25988	40894	63672
25	464	1139	1904	4258	7373	16799	29435	46318	72117
30	518	1272	2127	4756	8236	18767	32881	51741	80561
40	637	1566	2617	5853	10135	23094	40464	63673	99139
50	757	1859	3107	6950	12035	27422	48047	75605	117717
75	1055	2593	4333	9692	16783	38241	67003	105435	164162
100	1354	3327	5559	12435	21531	49061	85960	135265	210607
150	1951	4794	8011	17919	31028	70699	123873	194925	303498
200	2548	6261	10463	23403	40525	92338	161787	254585	396388
250	3145	7728	12915	28888	50021	113977	199700	314245	489278
285	3563	8755	14632	32727	56669	129124	226239	356007	554301
300	3742	9195	15367	34372	59518	135615	237613	373905	
400	4936	12130	20271	45341	78511	178893	313440	493225	
500	6130	15064	25175	56310	97504	222170	389267	612545	
600	7324	17999	30079	67279	116497	265448	465093	731865	
700	8518	20933	34983	78247	135491	308725	540920	851185	
740	8995	22107	36945	82635	143088	326036	571251	898913	
800	9712	23868	39887	89216	154484	352002	616747		
900	10906	26802	44791	100185	173477	395280	692574		
1000	12100	29736	49695	111154	192470	438557	768400		
1100	13294	32671	54599	122123	211464	481834	844227		
1200	14488	35605	59503	133091	230457	525112	920054		
1300	15682	38540	64407	144060	249450	568389	995880		
1400	16876	41474	69311	155029	268443	611666	1071707		
1480	17831	43822	73234	163804	283638	646288	1132369		
Orifice Area (in^2):	**0.719**	**1.404**	**2.240**	**5.408**	**10.315**				
1500	18070	35286	56296	135915	259238				
2000	24040	46944	74896	180819	344888				
2220	26667	52073	83079	200578	382574				
Orifice Area (in^2):	**0.521**	**1.404**	**2.240**	**5.408**	**10.315**				
2300	20016	53938	86055	207762	396278				
2600	22611	60933	97215	234705	447667				
2900	25207	67928	108375	261648	499057				
3200	27803	74923	119535	288591	550447				
3500	30398	81917	130695	315534	601837				
3705	32172	86697	138320	333945	636953				
Orifice Area (in^2):	**0.521**	**0.950**	**1.774**						
3800	32994	60161	112344						
4000	34724	63317	118236						
4500	39050	71205	132966						
5000	43376	79093	147696						
5500	47702	86981	162426						
6000	52029	94870	177157						

SIZING / CAPACITIES

F7000/8000 Series

F7000 GAS FLOW CAPACITIES: K_d = 0.824

10% / 3 psi Overpressure, 0 BP, 60 °F, Z=1.0, MW=19

NAT. GAS

Valve Size:	1 x 2	1-1/2 x 3	2 x 3	3 x 4	4 x 6	6 x 8	8 x 10	10 x 12	12 x 16
Orifice Area (in^2):	0.719	1.767	2.953	6.605	11.437	26.06	45.66	71.85	111.87
Set Pressure (psig)	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	425	1044	1745	3904	6760	15403	26988	42468	66122
20	490	1204	2012	4501	7794	17758	31114	48961	76232
25	555	1364	2279	5098	8827	20113	35241	55455	86343
30	620	1523	2546	5695	9861	22469	39368	61948	96453
40	763	1875	3133	7008	12135	27650	48446	76234	118696
50	906	2226	3720	8321	14409	32832	57525	90520	140939
75	1263	3104	5188	11604	20094	45785	80221	126234	196546
100	1621	3983	6656	14888	25779	58739	102917	161949	252154
150	2335	5739	9592	21454	37149	84646	148309	233378	363368
200	3050	7496	12527	28020	48519	110553	193702	304807	474582
250	3765	9253	15463	34586	59889	136461	239094	376236	585797
285	4265	10482	17518	39183	67848	154596	270869	426236	663647
300	4480	11009	18399	41153	71259	162368	284487	447665	
400	5909	14523	24270	54285	93999	214183	375272	590523	
500	7339	18036	30142	67418	116739	265997	466057	733381	
600	8768	21549	36013	80551	139479	317812	556841	876239	
700	10198	25063	41884	93683	162219	369626	647626	1019097	
740	10770	26468	44233	98936	171315	390352	683940	1076240	
800	11628	28576	47756	106816	184959	421441	738411		
900	13057	32089	53627	119948	207699	473256	829196		
1000	14487	35602	59499	133081	230438	525070	919981		
1100	15916	39116	65370	146213	253178	576885	1010766		
1200	17346	42629	71241	159346	275918	628699	1101551		
1300	18775	46142	77113	172479	298658	680514	1192336		
1400	20205	49656	82984	185611	321398	732328	1283120		
1480	21349	52466	87681	196117	339590	773780	1355748		
Orifice Area (in^2):	**0.719**	**1.404**	**2.240**	**5.408**	**10.315**				
1500	21635	42246	67401	162726	310377				
2000	28783	56204	89670	216489	412923				
2220	31928	62345	99468	240145	458043				
Orifice Area (in^2):	**0.521**	**1.404**	**2.240**	**5.408**	**10.315**				
2300	23964	64579	103031	248747	474450				
2600	27072	72953	116393	281005	535978				
2900	30179	81328	129754	313263	597505				
3200	33287	89703	143115	345521	659032				
3500	36395	98077	156476	377779	720560				
3705	38518	103800	165607	399821	762603				
Orifice Area (in^2):	**0.521**	**0.950**	**1.774**						
3800	39502	72029	134505						
4000	41574	75807	141560						
4500	46754	85251	159196						
5000	51933	94696	176832						
5500	57113	104140	194468						
6000	62292	113584	212104						

SIZING / CAPACITIES

F7000/8000 Series

F8000 GAS FLOW CAPACITIES: $K_d = 0.878$

10% / 3 psi Overpressure, 0 BP, 60 °F, Z=1.0, MW=29

AIR

Orifice Size:	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	V	W
Orifice Area (in^2):	0.134	0.235	0.358	0.588	0.916	1.503	2.147	3.277	4.147	5.014	7.397	12.913	18.704	30.409	51.00	78.81
Set Pressure (psig)	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	70	124	188	309	482	791	1129	1724	2181	2638	3891	6793	9839	15996	26827	41456
20	81	143	217	357	556	912	1302	1987	2515	3041	4486	7831	11343	18442	30929	47795
25	92	161	246	404	629	1032	1475	2251	2849	3444	5081	8870	12848	20888	35032	54134
30	103	180	275	451	703	1153	1647	2515	3182	3847	5676	9908	14352	23334	39134	60473
40	127	222	338	555	865	1419	2027	3094	3916	4735	6985	12193	17662	28714	48158	74418
50	150	263	401	659	1027	1685	2407	3674	4650	5622	8294	14478	20971	34095	57183	88364
75	210	367	560	919	1432	2350	3357	5124	6484	7840	11566	20191	29246	47548	79744	123228
100	269	471	718	1180	1837	3015	4307	6574	8319	10058	14838	25903	37520	61000	102305	158092
150	387	679	1035	1700	2648	4345	6206	9473	11988	14494	21383	37328	54068	87905	147428	227819
200	506	887	1352	2220	3458	5675	8106	12372	15657	18930	27927	48753	70617	114809	192550	297547
250	624	1095	1668	2740	4269	7004	10006	15272	19326	23367	34472	60178	87165	141714	237673	367274
285	707	1241	1890	3104	4836	7935	11335	17301	21894	26472	39053	68175	98749	160547	269259	416084
300	743	1303	1985	3260	5079	8334	11905	18171	22995	27803	41016	71603	103714	168618	282795	
400	980	1719	2619	4301	6700	10994	15704	23970	30333	36675	54106	94452	136811	222427	373041	
500	1217	2135	3252	5341	8321	13653	19503	29768	37671	45547	67195	117302	169908	276236	463286	
600	1454	2551	3886	6382	9942	16313	23303	35567	45010	54420	80284	140152	203005	330045	553531	
700	1691	2966	4519	7422	11563	18972	27102	41366	52348	63292	93373	163002	236102	383855	643776	
740	1786	3133	4772	7839	12211	20036	28621	43685	55283	66841	98608	172141	249340	405378	679874	
800	1929	3382	5153	8463	13184	21632	30901	47164	59686	72164	106462	185851	269199	437664		
900	2166	3798	5786	9503	14804	24292	34700	52963	67024	81037	119551	208701	302296	491473		
1000	2403	4214	6420	10544	16425	26951	38499	58762	74362	89909	132640	231551	335393	545282		
1100	2640	4630	7053	11584	18046	29611	42298	64561	81700	98781	145729	254400	368490	599091		
1200	2877	5046	7686	12625	19667	32270	46097	70359	89039	107654	158818	277250	401586	652900		
1300	3114	5461	8320	13665	21288	34930	49897	76158	96377	116526	171907	300100	434683	706709		
1400	3351	5877	8953	14706	22909	37589	53696	81957	103715	125398	184996	322950	467780	760518		
1480	3541	6210	9460	15538	24206	39717	56735	86596	109586	132496	195468	341229	494258	803566		
1500	3588	6293	9587	15746	24530	40249	57495	87755	111053	134271	198085					
2000	4774	8372	12754	20949	32634	53547	76491	116749	147744	178632	263531					
2220	5296	9287	14148	23238	36200	59398	84849	129506	163888	198152	292327					
2300	5485	9620	14655	24070	37497	61526	87888	134145	169759	205249	302798					
2600	6197	10867	16555	27191	42359	69504	99285	151541	191773	231866	342065					
2900	6908	12115	18456	30313	47222	77483	110683	168937	213788	258483	381333					
3200	7619	13362	20356	33434	52085	85462	122080	186333	235802	285100	420600					
3500	8331	14610	22257	36556	56947	93441	133478	203729	257817	311717	459867					
3705	8817	15462	23555	38689	60270	98893	141266	215616	272860	329906	486700					
3800	9042	15857	24157	39677	61810	101419										
4000	9516	16689	25424	41758	65052	106739										
4500	10702	18768	28592	46960	73156	120036										
5000	11887	20847	31759	52163	81260	133334										
5500	13073	22927	34926	57365	89365	146632										
6000	14259	25006	38094	62567	97469	159930										

SIZING / CAPACITIES

F7000/8000 Series

F8000 GAS FLOW CAPACITIES: $K_d = 0.878$

10% / 3 psi Overpressure, 0 BP, 60 °F, Z=1.0, MW=19

NAT. GAS

Orifice Size:	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	V	W
Orifice Area (in^2):	0.134	0.235	0.358	0.588	0.916	1.503	2.147	3.277	4.147	5.014	7.397	12.913	18.704	30.409	51.00	78.81
Set Pressure (psig)	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	84	148	225	370	577	947	1352	2064	2612	3158	4659	8133	11780	19151	32120	49634
20	97	171	260	427	665	1091	1559	2379	3011	3641	5371	9376	13581	22080	37031	57224
25	110	193	294	484	753	1236	1766	2695	3410	4123	6083	10620	15382	25008	41942	64813
30	123	216	329	540	842	1381	1972	3011	3810	4606	6796	11863	17183	27937	46853	72402
40	151	266	405	665	1036	1699	2427	3705	4688	5669	8363	14599	21146	34379	57658	89099
50	180	315	481	789	1230	2018	2882	4399	5567	6731	9930	17335	25108	40821	68463	105795
75	251	440	670	1101	1715	2814	4019	6135	7763	9386	13848	24174	35015	56927	95475	147537
100	322	564	860	1412	2200	3610	5156	7870	9960	12042	17765	31013	44921	73033	122487	189278
150	464	813	1239	2035	3170	5202	7431	11342	14353	17353	25601	44692	64734	105245	176510	272761
200	606	1062	1618	2658	4141	6794	9705	14813	18746	22665	33437	58370	84547	137457	230534	356243
250	748	1311	1997	3281	5111	8386	11979	18284	23138	27976	41272	72049	104360	169669	284558	439726
285	847	1485	2263	3717	5790	9501	13571	20714	26213	31694	46757	81624	118229	192218	322375	498164
300	890	1560	2377	3904	6081	9978	14254	21756	27531	33287	49108	85728	124173	201881	338582	
400	1173	2058	3135	5149	8022	13162	18802	28698	36317	43910	64779	113085	163799	266305	446629	
500	1457	2556	3894	6395	9962	16347	23351	35641	45103	54532	80450	140442	203425	330729	554677	
600	1741	3054	4652	7641	11903	19531	27899	42583	53889	65155	96121	167799	243051	395153	662725	
700	2025	3552	5411	8887	13844	22715	32448	49526	62674	75777	111792	195156	282677	459577	770772	
740	2139	3751	5714	9385	14620	23989	34267	52303	66189	80027	118061	206099	298527	485346	813991	
800	2309	4049	6169	10132	15784	25899	36997	56468	71460	86400	127463	222514	322303	524001		
900	2593	4547	6927	11378	17725	29084	41545	63411	80246	97023	143134	249871	361929	588425		
1000	2877	5045	7686	12624	19666	32268	46094	70354	89032	107645	158806	277228	401555	652848		
1100	3161	5543	8444	13869	21606	35452	50642	77296	97817	118268	174477	304585	441181	717272		
1200	3445	6041	9203	15115	23547	38636	55191	84239	106603	128890	190148	331943	480807	781696		
1300	3729	6539	9961	16361	25487	41820	59740	91181	115389	139513	205819	359300	520432	846120		
1400	4012	7037	10720	17607	27428	45005	64288	98124	124175	150135	221490	386657	560058	910544		
1480	4240	7435	11326	18603	28981	47552	67927	103678	131203	158633	234027	408543	591759	962083		
1500	4296	7535	11478	18852	29369	48189	68837	105067	132960	160758	237161					
2000	5716	10024	15270	25081	39072	64110	91580	139780	176889	213871	315517					
2220	6340	11119	16939	27822	43341	71115	101587	155053	196218	237240	349993					
2300	6567	11517	17546	28818	44894	73663	105225	160607	203246	245738	362530					
2600	7419	13011	19821	32555	50715	83215	118871	181435	229604	277606	409544					
2900	8271	14505	22096	36293	56537	92768	132517	202263	255961	309474	456557					
3200	9122	15998	24372	40030	62359	102321	146163	223091	282318	341342	503571					
3500	9974	17492	26647	43767	68181	111873	159809	243918	308675	373209	550584					
3705	10556	18512	28202	46321	72159	118401	169133	258151	326686	394985	582710					
3800	10826	18985	28923	47504	74003	121426										
4000	11394	19981	30439	49995	77884	127795										
4500	12813	22471	34232	56224	87587	143716										
5000	14232	24960	38024	62453	97290	159637										
5500	15652	27449	41816	68681	106993	175558										
6000	17071	29939	45608	74910	116697	191479										

SIZING / CAPACITIES

F7000/8000 Series

F7000 LIQUID FLOW CAPACITIES: $K_d = 0.634$

10% / 3 psi Overpressure, 0 BP, 70 °F, SG=1.0

WATER

Valve Size:	1 x 2	1-1/2 x 3	2 x 3	3 x 4	4 x 6	6 x 8	8 x 10	10 x 12	12 x 16
Orifice Area (in^2):	**0.719**	**1.767**	**2.953**	**6.605**	**11.437**	**26.06**	**45.66**	**71.85**	**111.87**
Set Pressure (psig)	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
15	73	181	302	675	1169	2664	4667	7344	11435
20	83	204	341	763	1321	3011	5276	8302	12926
25	92	225	376	842	1458	3322	5821	9160	14262
30	100	245	409	914	1583	3607	6319	9944	15483
40	115	282	472	1056	1828	4165	7297	11482	17878
50	128	316	528	1180	2043	4656	8158	12838	19988
75	157	387	646	1445	2503	5703	9992	15723	24480
100	182	446	746	1669	2890	6585	11537	18155	28267
150	223	547	914	2044	3539	8065	14130	22235	34620
200	257	631	1055	2360	4087	9312	16316	25675	39976
250	287	706	1180	2639	4569	10412	18242	28706	44694
285	307	754	1260	2818	4879	11116	19477	30649	47721
300	315	773	1292	2891	5005	11405	19983	31445	
400	363	893	1492	3338	5780	13170	23075	36310	
500	406	998	1668	3732	6462	14724	25798	40596	
600	445	1094	1828	4088	7079	16129	28261	44470	
700	481	1181	1974	4416	7646	17422	30525	48034	
740	494	1215	2030	4540	7861	17913	31385	49387	
800	514	1263	2110	4720	8174	18625	32632		
900	545	1339	2238	5007	8670	19754	34612		
1000	575	1412	2360	5278	9139	20823	36484		
1100	603	1481	2475	5535	9585	21839	38265		
1200	629	1547	2585	5781	10011	22810	39966		
1300	655	1610	2690	6017	10420	23742	41598		
1400	680	1671	2792	6245	10813	24638	43169		
1480	699	1718	2871	6421	11118	25332	44385		
Orifice Area (in^2):	**0.719**	**1.404**	**2.240**	**5.408**	**10.315**				
1500	704	1374	2192	5292	10094				
2000	812	1587	2531	6111	11656				
2220	856	1672	2667	6438	12280				
Orifice Area (in^2):	**0.521**	**1.404**	**2.240**	**5.408**	**10.315**				
2300	631	1701	2714	6553	12500				
2600	671	1809	2886	6968	13290				
2900	709	1910	3048	7359	14036				
3200	745	2007	3202	7730	14744				
3500	779	2099	3349	8084	15420				
3705	801	2159	3445	8318	15865				
Orifice Area (in^2):	**0.521**	**0.950**	**1.774**						
3800	812	1480	2763						
4000	833	1518	2835						
4500	883	1610	3007						
5000	931	1697	3170						
5500	976	1780	3324						
6000	1020	1859	3472						

SIZING / CAPACITIES

F7000/8000 Series

F8000 LIQUID FLOW CAPACITIES:

10% / 3 psi Overpressure, 0 BP, 70 °F, SG=1.0

WATER

Orifice Size:	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	V	W
Orifice Area (in^2):	**0.134**	**0.235**	**0.358**	**0.588**	**0.916**	**1.503**	**2.147**	**3.277**	**4.147**	**5.014**	**7.397**	**12.913**	**18.704**	**30.409**	**51.00**	**78.81**
K_d:	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830 [1]	0.830	0.830	0.730	0.830	0.730	0.730	0.730	0.730
Set Press. (psig)	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
15	18	31	48	79	123	201	287	439	555	671	871	1728	2201	3579	6002	9275
20	20	36	54	89	139	227	325	496	627	758	984	1953	2488	4046	6785	10485
25	22	39	60	98	153	251	358	547	692	837	1086	2155	2745	4464	7486	11568
30	24	43	65	107	166	272	389	594	751	908	1179	2340	2981	4846	8127	12559
40	28	49	75	123	192	314	449	686	868	1049	1361	2702	3442	5595	9384	14502
50	31	55	84	138	214	352	502	767	970	1173	1522	3020	3848	6256	10492	16213
75	38	67	103	168	262	431	615	939	1188	1436	1864	3699	4713	7662	12850	19857
100	44	78	118	195	303	497	710	1084	1372	1659	2152	4272	5442	8847	14838	22929
150	54	95	145	238	371	609	870	1328	1680	2031	2636	5232	6665	10836	18173	28082
200	63	110	167	275	429	703	1004	1533	1940	2346	3044	6041	7696	12512	20984	32426
250	70	123	187	308	479	786	1123	1714	2169	2622	3403	6754	8604	13989	23461	36254
285	75	131	200	328	512	839	1199	1830	2316	2800	3633	7211	9187	14936	25049	38709
300	77	135	205	337	525	861	1230	1878	2376	2873	3728	7399	9425	15324	25700	
400	89	155	237	389	606	994	1420	2168	2744	3317	4304	8543	10883	17694	29676	
500	99	174	265	435	678	1112	1588	2424	3067	3709	4812	9551	12168	19783	33179	
600	109	190	290	476	742	1218	1740	2655	3360	4063	5271	10463	13329	21671	36345	
700	117	206	313	515	802	1315	1879	2868	3629	4388	5694	11301	14397	23407	39257	
740	121	211	322	529	824	1352	1932	2949	3732	4512	5854	11620	14803	24067	40364	
800	125	220	335	550	857	1406	2009	3066	3880	4691	6087	12082	15392	25024		
900	133	233	355	584	909	1492	2131	3252	4115	4976	6456	12815	16325	26542		
1000	140	246	374	615	958	1572	2246	3428	4338	5245	6805	13508	17208	27977		
1100	147	258	393	645	1005	1649	2356	3595	4550	5501	7138	14167	18048	29343		
1200	154	269	410	674	1050	1722	2460	3755	4752	5746	7455	14797	18851	30648		
1300	160	280	427	701	1093	1793	2561	3908	4946	5980	7759	15401	19620	31899		
1400	166	291	443	728	1134	1860	2657	4056	5133	6206	8052	15983	20361	33103		
1480	171	299	456	748	1166	1913	2732	4170	5277	6381	8279	16433	20935	34036		
1500	172	301	459	753	1174	1926	2751	3693 [1]	5313	6424	8335					
2000	198	348	530	870	1355	2223	3176	4264	6135	7417	9624					
2220	209	366	558	916	1428	2343	3346	4492	6464	7815	10140					
2300	213	373	568	933	1453	2384	3406	4572	6579	7954	10321					
2600	226	396	604	992	1545	2535	3621	4861	6995	8457	10973					
2900	239	419	638	1047	1632	2677	3825	5134	7387	8932	11589					
3200	251	440	670	1100	1714	2812	4018	5393	7760	9382	12174					
3500	262	460	701	1151	1793	2941	4202	5640	8116	9812	12732					
3705	270	473	721	1184	1844	3026	4323	5803	8350	10096	13099					
3800	273	479	730	1199	1868											
4000	280	492	749	1230	1916											
4500	297	521	794	1305	2033											
5000	313	550	837	1375	2143											
5500	329	577	878	1443	2247											
6000	343	602	917	1507	2347											

[1] For "L" orifice, K_d = 0.730 for 3"-900/1500# x 4"-300# only.
Capacities from 1500 to 3705 psig adjusted accordingly.

PART NUMBERING

F7000/8000 Series

P 8 5 5 M - 0 4 R J 5 - 0 6 R F 2 - C L - S S - V V N P T F

Options:

N = NACE trim	R = Remote sense conn.
P = Backflow preventer	C = Cryo block
T = Field test conn.	Y = Swagelok tube fittings
F = Pilot inlet filter	G = Lift indicator (rod)
K = F500 setpoint indicator	H = Lift indicator (DP switch)
M = Manual blowdown valve	S = Sense Line Split Tee

Seals (includes pilot seat / seals):

B = Buna-N	Y = HNBR
V = Viton ('A')	H = AED Viton
E = EPR / EPDM	A = Aflas
U = Polyurethane	T = Teflon
X = Perfluoroelastomer[1]	

MV Seat: O-ring material from 'Seals' above for F7050/8050, or for F7040/8040:

T = Teflon / PTFE	K = Kel-F / PCTFE
P = PEEK	W = Polyimide / Vespel[2]

Trim material: See "Body material" below, or
SM = SS + Monel
DD = Duplex MV trim with Duplex pilot[3]
DN = Duplex MV trim with Inconel pilot[3]
DS = Duplex MV trim with SS pilot[3]

Body material:

CS = Standard carbon steel	N5 = Inconel 625
CL = Low-temperature CS	N0 = Inconel 600
SS = 316 SS / CF8M	6M = 6 Mo (254 SMO)
SL = 316L SS / CF3M	MO = Monel
D4 = 22% Cr duplex SS	C3 = LC3 CS
D6 = 25% Cr duplex SS	H2 = Hastelloy C / C22
	H6 = Hastelloy C276

Outlet size / connection type / rating: See "Inlet" data below, plus 16 = 16"

Inlet rating:

0 = Threaded / Grayloc / etc.		
1 = 150#	3 = 600#	5 = 1500#
2 = 300#	4 = 900#	6 = 2500#

Inlet connection type:

FN = Female NPT	EF = RF flange (metric)
RF = RF flange (ASME)	EJ = RTJ flange (metric)
RJ = RTJ flange (ASME)	DF = Dual RF flange
GR = Grayloc hub	DJ = Dual RTJ flange
ST = Small tongue (T&G)	TK = Techlok hub

Inlet size:

01 = 1"	02 = 2"	04 = 4"	08 = 8"	12 = 12"
15 = 1-1/2"	03 = 3"	06 = 6"	10 = 10"	

F8000 Orifice letter or 0 for F7000

Model + Pilot + MV Seat type: (725, 825, 734, 754, etc.)

7 = F7000	+	2 = F200 pilot	+	4 = Plastic seat
8 = F8000		3 = F300 pilot		5 = O-ring seat
		5 = F500 pilot		

P = Pilot-operated valve

[1] If not specified, will include appropriate Kalrez, Chemraz, Perlast, or similar grade.
[2] An equivalent PI or PAI may be substituted for Vespel.
[3] If not specified, duplex trim / pilot will match grade of main valve body.

FLOWSAFE
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SAMPLE SPECIFICATION SHEET

Please include data as shown in the following table when contacting Flow Safe or their representatives regarding a relief valve application:

SERVICE CONDITIONS	Quantity	each
	Valve identification / tag number(s)	
	Delivery time	weeks
	Service media / fluid state	
	Molecular weight (gases)	
	Compressibility factor (gases)	
	Specific heat ratio (gases)	
	Specific gravity (liquids)	
	Viscosity (liquids)	
	Required capacity	scfm (Nm^3/hr) lb/hr (kg/hr) gpm (lpm)
	Set pressure	psig barg kPag
	Allowable overpressure	% or psi/bar/kPa
	Backpressure	psig barg kPag
	Required blowdown	% or psi/bar/kPa
	Relieving temperature (at relief valve location)	°F or °C
	Normal operating temperature (at relief valve location)	°F or °C
	System design temperature	°F or °C
	Required cleanliness level	
VALVE SELECTION	Body / bonnet material	
	Trim (wetted internals) material	
	Seat and seal material	
	Size and ASME Class for inlet / outlet	
	Flange facing, inlet/outlet	
	Special inlet / outlet	
	Orifice area calculated / selected	
	Valve part number (optional - see p. 30)	
	Accessories (see pp. 16 - 17)	

Experts in Soft-Seated Technology

F84/85/88 Series
Safety Relief Valve (Gas) - ASME XIII

F84L/88 Series
Liquid Relief Valve - ASME XIII

F70U Series
Unloader Valve

F9000 Series
Liquid Surge Relief

F70PR Series
Pilot-Operated Relief Valve - DOT

Leaders in “true” High Performance with commitment to value through:

- 24/7 service, repair, and support
- Soft seats offering unsurpassed tightness
- Large coefficients and orifice areas = Best capacities
- Backpressure-balanced without bellows
- ASME Sec. XIII, API, DOT, ISO 9001, CE, Marine class societies (e.g., DNV, BV)
- Trained representatives with solid factory support
- Quick-ship program through Flow Safe Supply

Texas Office
Flow Safe, Inc.
16240 Port Northwest Drive
Houston, TX 77041
P: (832) 678-2070
F: (716) 662-2580

New York Office
Flow Safe, Inc.
3865 Taylor Road
Orchard Park, NY, USA 14127
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F: (716) 662-2580

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