

“THE NEXT GENERATION”



FLOW SAFE, INC

“Environmental Performance for Industry”

High Performance

F7000/8000 SERIES PILOT-OPERATED SAFETY RELIEF VALVES



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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

INTRODUCTION AND FEATURES

Introduction

Today's industrial needs are being driven by requirements for high capacity, leak-tight safety relief valves to reduce fugitive emissions and to save customer product. The FLOW SAFE F7000/8000 Series Pilot Operated Safety Relief Valves, with accurate operational characteristics, are engineered to provide superior performance for today's industries.

- Direct mount pilot valves, minimizing potential leak paths.
- Modulating or snap-acting, with interchangeable pilot valves.
- Superior main valve seating force, proportional to nameplate set pressure.
- Repeatable, bubble-tight seating and re-seating, due to soft seat design.
- Compact profiles, for easier handling and installation.
- Adjustable blowdown capability.
- Large capacities through the overbored nozzle (F7000) and a variety of reduced orifice selections (F8000).
- Superior flow capacities, independently verified.
- Full lift at set pressure upon demand.
- Easy convertability of orifice sizes, field adjustable.
- Integral exhaust with F300 pilot valve.
- Set pressures from 15 to 6000 psig.
- -423°F to +525°F temperature range.
- A variety of materials and end connections, 316SS trim standard on carbon steel main valves.
- Material traceability availability.
- Top entry main valve for easy maintenance.
- Lifting lugs standard on sizes 2x3 and larger.
- One piece main valve casting with integral flanges.
- Backflow preventor and field test connection - standard features.
- Adjustments are heavy duty stainless steel safety-wired and sealed.
- All valves bear ASME "UV" stamp, at 15 psig and above.
- Compliance with industry standards, including ASME, NACE, ANSI, and DOT.

System pressure is routed from below the valve through the pilot valve to the dome cavity of the main valve. This pressure acting on a piston (dome) area A_d larger than the seat area (A_s), creates an effective downward force ($F=P \times (A_d - A_s)$) holding the main valve piston down in the closed position.

At the designated set pressure, the pilot valve reduces the dome pressure, proportional to demand if modulating (F300), or fully if snap-acting (F200), and allows the piston to go into lift. Once the system pressure is relieved, the pilot valve closes at the preset blowdown, allowing the dome to repressurize and the main valve piston to close. When closed, dome pressure acting on a differential area between the top and bottom of the piston assembly, creates a downward force on the seat providing bubble-tight shutoff.

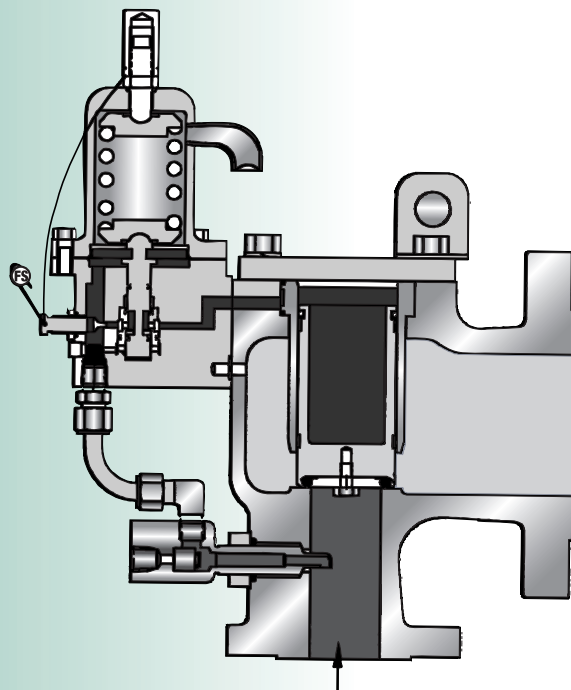
The F7000/8000 utilizes an elastomeric or plastic seat on the piston to achieve bubble-tight seating. A dynamic piston seal prevents any leakage from the dome to the discharge. Guide rings on the piston eliminate metal-to-metal contact with the liner and help to provide smooth and consistent operation. Elastomeric/plastic seals seal the main valve and pilot valves.

The F200 Snap-Acting pilot valve blowdown is set at 5-7% of the set pressure and can be adjusted from 3% to 20% if so specified. The F300 Modulating pilot valve provides zero blowdown, i.e. the main valve opens in proportion to demand and closes at the set pressure.

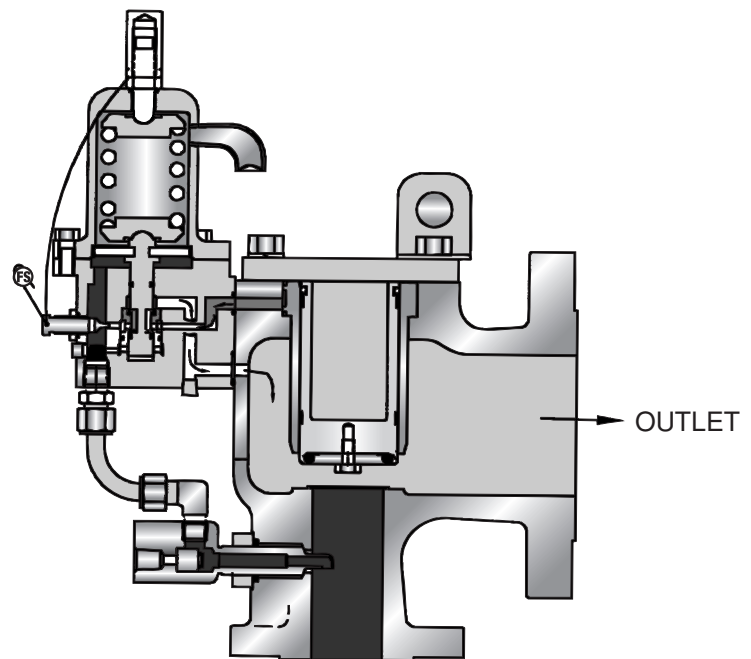
The orifice size may be easily selected by choosing an overbored fixed inlet nozzle on the F7000, or by converting to a reduced size orifice (F8000), by attaching FLOW SAFE's unique patent-pending annular-flow plug to the bottom of the piston assembly. This plug reduces the effective flow area of the valve by directing the fluid between the plug O.D. and the nozzle I.D. This feature in orifice selection allows the valve owner greater versatility in valve standardization, utilization, and minimized inventory.

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.



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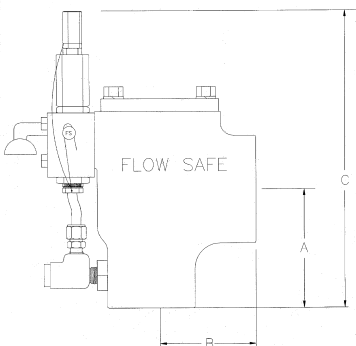
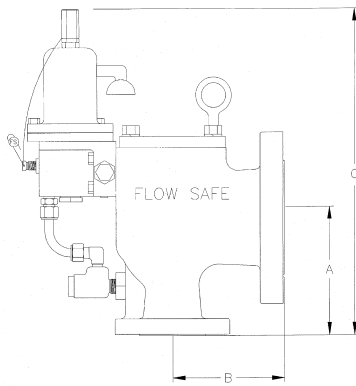
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DIMENSIONS AND WEIGHTS

F7000/8000 Series Flanged

* With F300 Pilot Valve., Deduct 2" for F200 Pilot Valve.

** See Page7 for reduced orifice flow areas.



F7000/8000 Series Threaded

Available Full Bore Orifice (F7000)	Available Reduced Orifice (F8000)**	Inlet Flange	Outlet Flange	Dimensions			Approx Weight (lbs)
				A	B	C* Approx	
.957" (.72 in ²)	D, E, F	1" - 150#	2" - 150#	4.38	4.50	13.25	40
	D, E, F	1" - 300#	2" - 150#	4.38	4.50	13.25	40
	D, E, F	1" - 600#	2" - 150#	4.38	4.50	13.25	45
	D, E, F	1" - 900#	2" - 300#	4.94	4.75	13.80	50
.815" (.52 in ²)	D, E, F	1" - 1500#	2" - 300#	4.94	4.75	13.80	50
	D, E, F	1" - 2500#	2" - 300#	4.94	4.75	13.80	55
1.500" (1.77 in ²)	F, G, H	1-1/2" - 150#	3" - 150#	5.12	4.87	14.60	50
	F, G, H	1-1/2" - 300#	3" - 150#	5.12	4.87	14.60	50
	F, G, H	1-1/2" - 600#	3" - 150#	5.12	4.87	14.60	55
1.337" (1.40 in ²)	F, G, H	1-1/2" - 900#	3" - 300#	6.38	6.75	15.10	80
	F, G, H	1-1/2" - 1500#	3" - 300#	6.38	6.75	15.10	80
1.100" (.95 in ²)	F, G, H	1-1/2" - 2500#	3" - 300#	6.38	6.75	15.10	90
1.939" (2.95 in ²)	G, H, J	2" - 150#	3" - 150#	5.37	4.87	15.70	60
	G, H, J	2" - 300#	3" - 150#	5.37	4.87	15.70	60
	G, H, J	2" - 600#	3" - 150#	5.37	4.87	15.70	65
1.689" (2.24 in ²)	G, H, J	2" - 900#	3" - 300#	6.56	6.75	16.40	80
	G, H, J	2" - 1500#	3" - 300#	6.56	6.75	16.40	80
1.503" (1.77 in ²)	G, H, J	2" - 2500#	3" - 300#	7.00	6.75	16.40	95
2.900" (6.60 in ²)	J, K, L	3" - 150#	4" - 150#	6.13	6.38	18.25	100
	J, K, L	3" - 300#	4" - 150#	6.38	6.38	18.40	100
	J, K, L	3" - 600#	4" - 150#	6.38	6.38	18.40	100
2.624" (5.40 in ²)	J, K, L	3" - 900#	4" - 300#	7.50	7.12	17.80	130
	J, K, L	3" - 1500#	4" - 300#	7.50	7.12	17.80	145
3.816" (11.43 in ²)	L, M, N, P	4" - 150#	6" - 150#	7.75	8.25	18.75	185
	L, M, N, P	4" - 300#	6" - 150#	7.75	8.25	18.75	185
	L, M, N, P	4" - 600#	6" - 150#	7.75	8.25	18.75	195
	L, M, N, P	4" - 900#	6" - 300#	9.74	9.19	20.80	240
3.624" (10.30 in ²)	L, M, N, P	4" - 1500#	6" - 300#	9.74	9.19	20.80	265
5.760" (26.06 in ²)	Q, R	6" - 150#	8" - 150#	9.44	9.50	22.75	270
	Q, R	6" - 300#	8" - 150#	9.44	9.50	22.75	270
	Q, R	6" - 600#	8" - 150#	9.70	9.50	23.35	310
7.625" (45.66 in ²)	T	8" - 150#	10" - 150#	10.88	11.00	26.50	460
	T	8" - 300#	10" - 150#	10.88	11.00	26.50	460
	T	8" - 600#	10" - 150#	11.62	11.00	27.00	520
11.938" (111.87 in ²)	W	12" - 150#	16" - 150#	11.92	15.56	32.00	1100
.957" (.72 in ²)	D, E, F	1" FNPT	2" FNPT	5.06	3.00	14.00	35
	F, G, H	1-1/2" FNPT	3" FNPT	4.63	3.75	14.13	45

INLET/OUTLET FLANGE RATINGS

Flange Class	Material	Maximum Pressure Rating, psig Temperature, °F					
		-423 to -21	-20 to 100	200	300	400	525
150#	C. Steel	—	285	260	230	200	170
	S. Steel	275	275	240	215	195	170
300#	C. Steel	—	740	675	655	635	600
	S. Steel	720	720	620	560	515	480
600#	C. Steel	—	1480	1350	1315	1270	1200
	S. Steel	1440	1440	1240	1120	1030	955
900#	C. Steel	—	2220	2025	1970	1900	1795
	S. Steel	2160	2160	1860	1680	1540	1435
1500#	C. Steel	—	3705	3375	3280	3170	2995
	S. Steel	3600	3600	3095	2795	2570	2390
2500#	C. Steel	—	6170	5625	5470	5280	4990
	S. Steel	6000	6000	5160	4660	4280	3980

Carbon Steel: ASTM SA216, Grade WCB

Stainless Steel: ASTM SA351, Grade CF8M

Ratings at temperatures equal to or above -20°F per ANSI B16.34

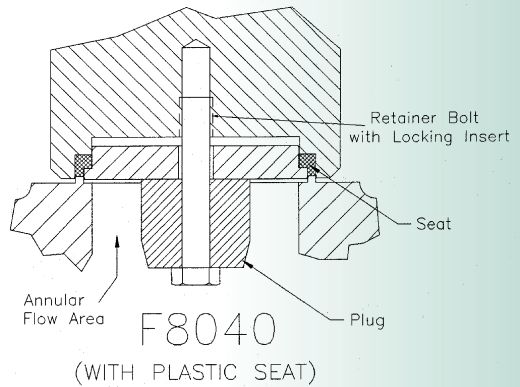
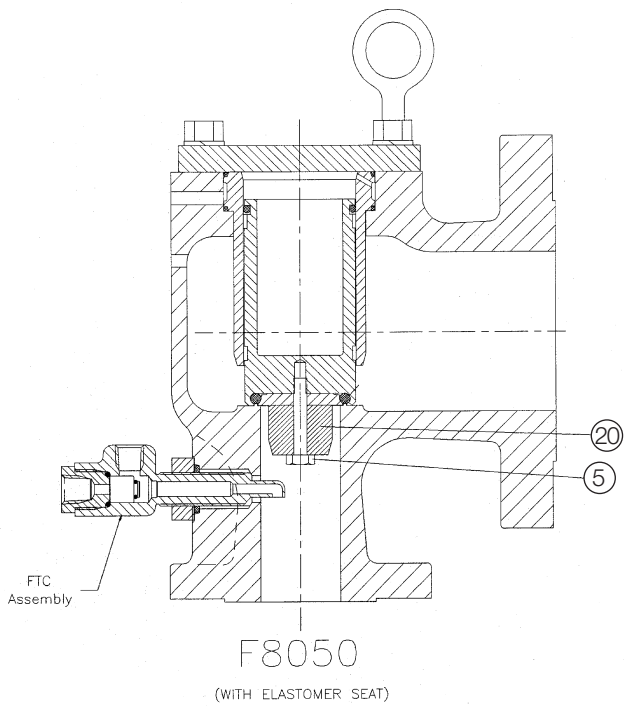
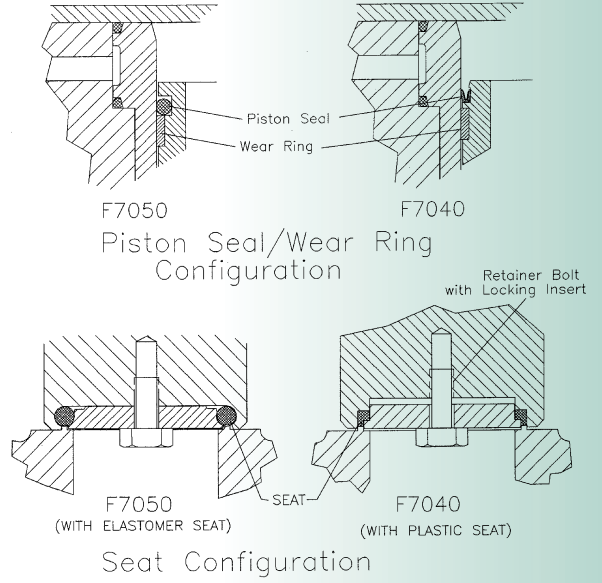
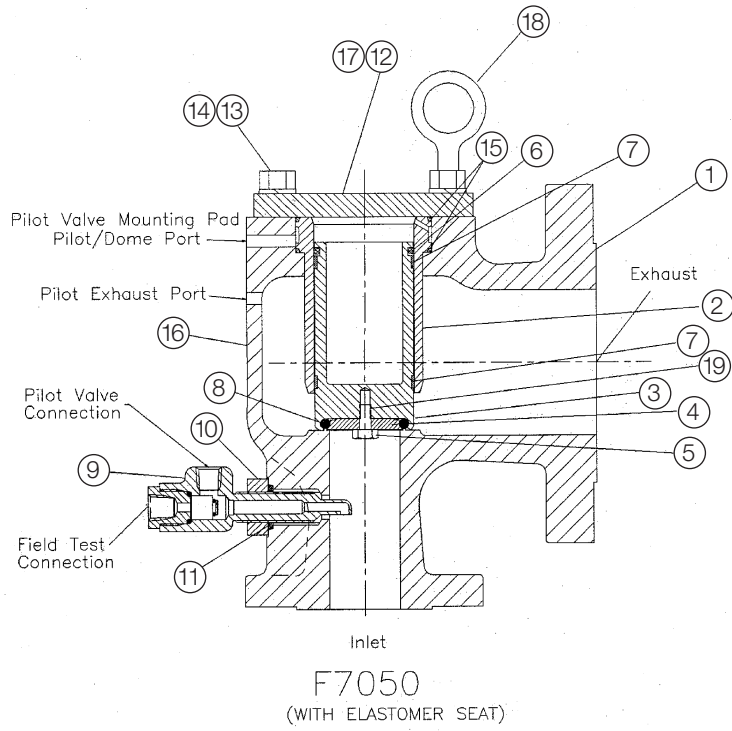
See page 16 for conversions to °C.

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SEAT AND SEAL DATA

Material	Continuous Process Temperature, °F		Minimum Pressure (psig)	Maximum Pressure (psig)
	Min	Max		
Buna-N	-65	+275	15	6000
Viton	-20	+400	15	6000
Ethylene Propylene	-65	+325	15	6000
Urethane	-65	+325	15	6000
Teflon	-423	+400	15	1000
Kel-F	-423	+400	1000	4000
VespeI	-423	+550	4000	6000
Peek	-100	+525	4000	6000

MAIN VALVE ASSEMBLY



MAIN VALVE CONSTRUCTION

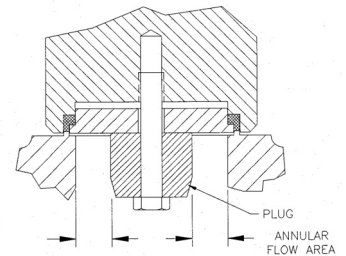
Item No.	Description	Standard -S1	Stainless -SS	Standard* NACE -N1	Stainless* NACE -NS
1	Body	SA-352 Gr LCB SA-216 Gr WCB	316 SS SA-351 Gr CF8M	SA-352 Gr LCB SA-216 Gr WCB	316 SS SA-351 Gr CF8M
2	Liner	304 SS	304 SS	304 SS	304 SS
3	Piston	316 SS	316 SS	316 SS	316 SS
4	Seat Retainer	316 SS	316 SS	316 SS	316 SS
5	Retainer Bolt	304 SS	304 SS	304 SS	17-4ph SS
6	Piston seal	Buna-N or Plastic	Buna-N or Plastic	Buna-N or Plastic	Buna-N or Plastic
7	Wear Ring	Teflon/Brass	Teflon/Brass	Teflon/Brass	Teflon/Brass
8	Seat	Buna-N	Buna-N	Buna-N	Buna-N
9	Pickup Tube Assembly	316 SS	316 SS	316 SS	316 SS
10	Nut	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
11	Seal	Teflon	Teflon	Teflon	Teflon
12	Cap	Carbon Steel SA-516, Gr70	Stainless Steel SA-240, 316	Carbon Steel SA-516, Gr70	Stainless Steel SA-240, 316
13	Cap Bolts	A193, GrB7	A193, GrB8	A193, GrB7	A193, GrB8
14	Lock Washers	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
15	Liner seal	Buna-N	Buna-N	Buna-N	Buna-N
16	Nameplate	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
17	Nameplate, Warning	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
18	Lift Lug	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
19	Locking Insert	Stainless Steel	Stainless Steel	Inconel	Inconel
20	Annular Plug (F8000 Only)	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel

* In conformance with NACE MR 0175. Material for F200 pilot valve spring to be Inconel. Not required for F300 Pilot Valve.

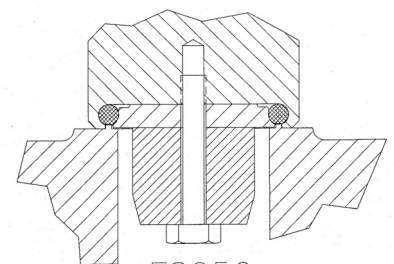
Valve Size	Orifice Size	Flow Area (in ²)*	Part Number	Plug Stamp	Material
1 x 2	D	.134	07-1201-01	1D2	A479-316
	E	.235	07-1201-02	1E2	A479-316
	F	.358	07-1201-03	1F2	A479-316
1-1/2 x 3	F	.358	07-1202-01	1.5F3	A479-316
	G	.588	07-1202-02	1.5G3	A479-316
	H	.916	07-1202-03	1.5H3	A479-316
2 x 3	G	.588	07-1203-01	2G3	A479-316
	H	.916	07-1203-02	2H3	A479-316
	J	1.503	07-1203-03	2J3	A479-316
3 x 4	J	1.503	07-1204-01	3J4	A479-316
	K	2.147	07-1204-02	3K4	A479-316
	L	3.277	07-1204-03	3L4	A479-316
4 x 6	L	3.277	07-1205-01	4L6	A479-316
	M	4.417	07-1205-02	4M6	A479-316
	N	5.014	07-1205-03	4N6	A479-316
	P	7.397	07-1205-04	4P6	A479-316
6 x 8	Q	12.913	07-1206-01	6Q8	A479-316
	R	18.704	07-1206-02	6R8	A479-316
8 x 10	T	30.409	07-1207-01	8T10	A479-316
12 x 16	W	78.81	07-1208-01	12W16	A479-316

*20% greater than standard API orifice flow areas.

F8000 ANNULAR-FLOW PLUG PART NUMBERS

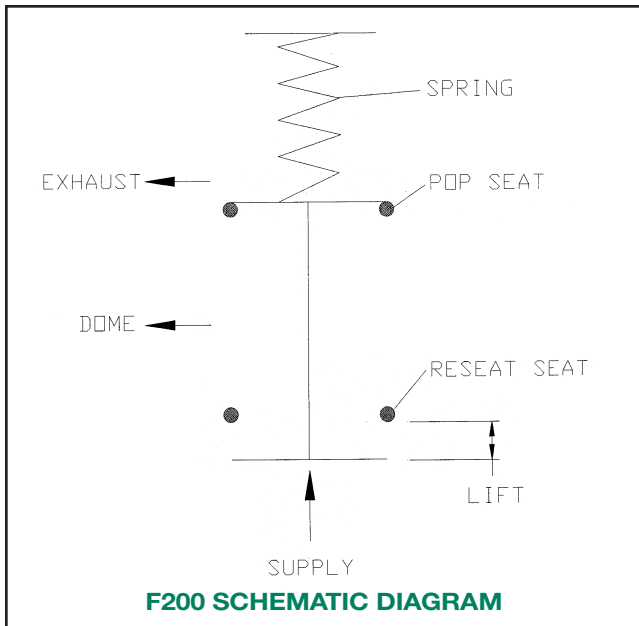


F8040
(WITH PLASTIC SEAT)

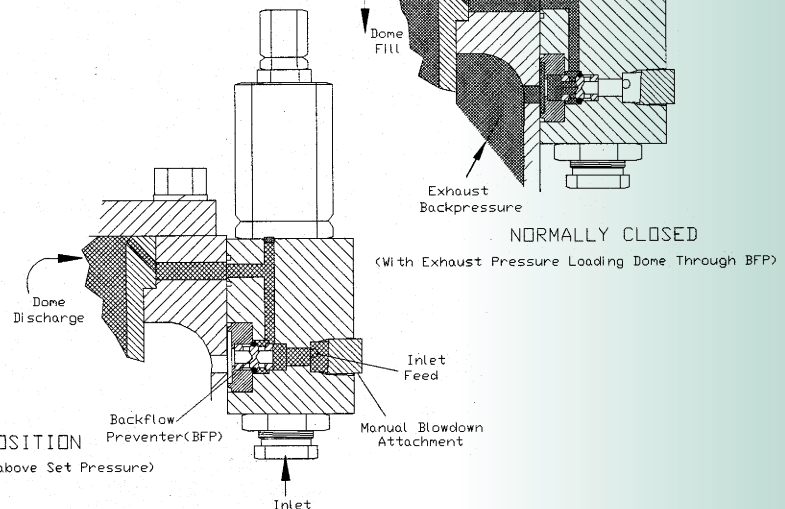
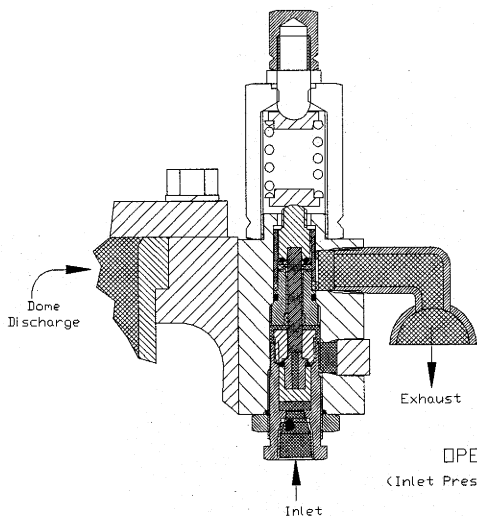
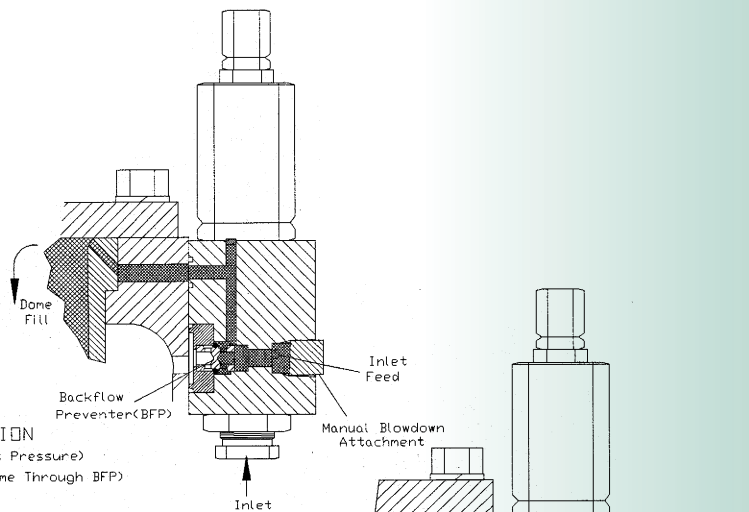
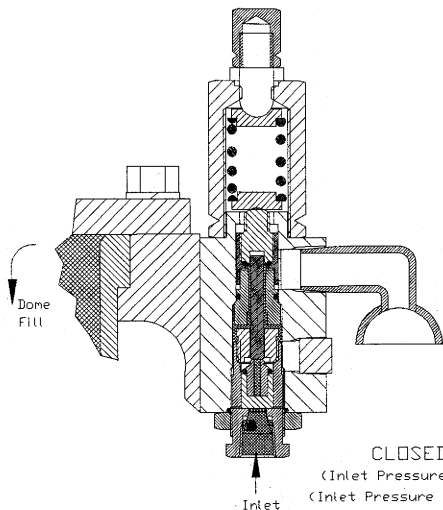


F8050
(WITH ELASTOMER SEAT)

F200 SERIES PILOT VALVE OPERATION

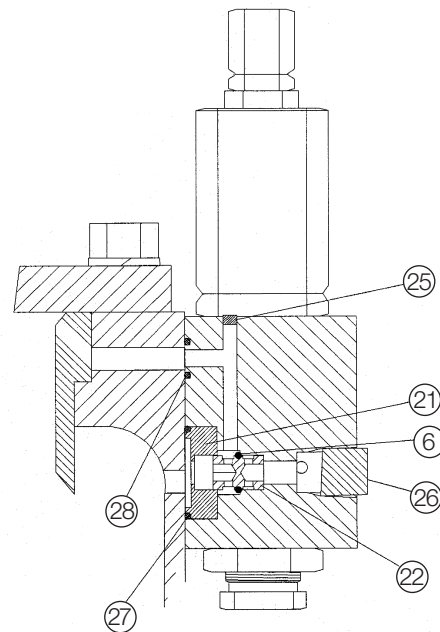
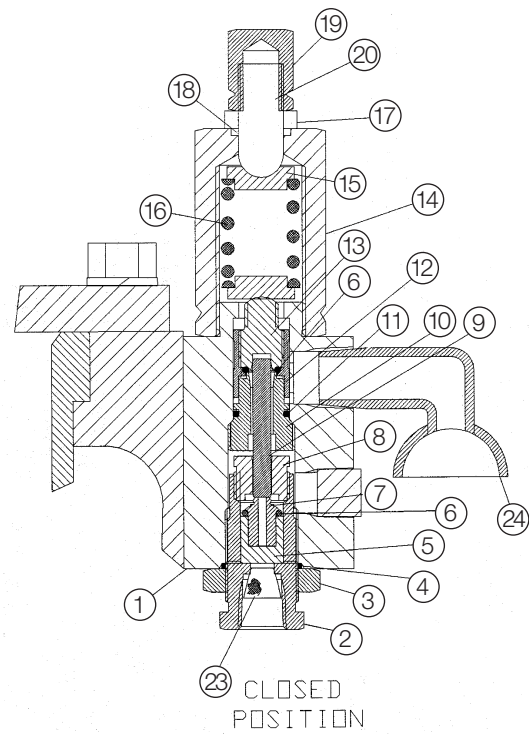


SPECIFICATIONS
Style: Non-Flowing, Snap-Acting
Service: Gas/Vapor
Set Pressure Range: 15 – 6000 psig
FEATURES
● Direct Mount to Main Valve
● Built-in Backflow Preventer
● Adjustable Blowdown
● Variety of Materials Available
● Minimal Components
● Simple to Maintain
● Main Valve Full Lift at Set Point

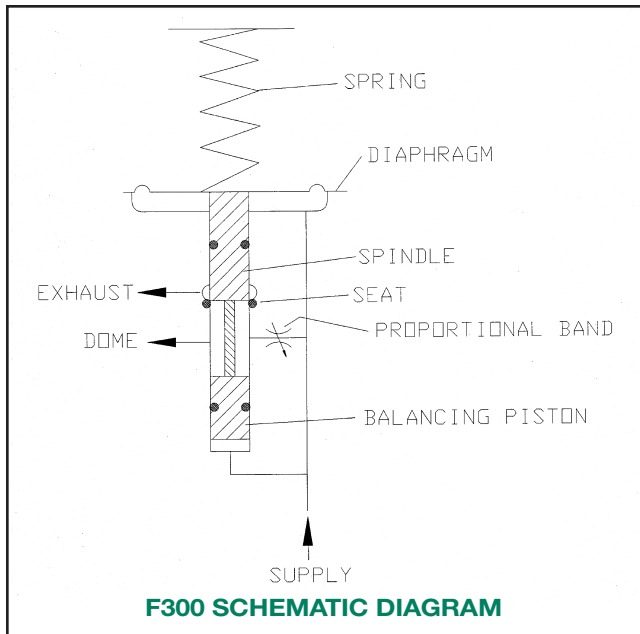


F200 SERIES PILOT VALVE CONSTRUCTION

Item No.	Description	Standard
1	Body	316 SS
2	Bushing	316 SS
3	Jam Nut	304 SS
4	Seal	Buna-N
5	Lower Piston	316 SS
6	Piston Seal	Buna-N
7	Lower Retainer	316 SS
8	Lower Nozzle	316 SS
9	Spacer	316 SS
10	Upper Nozzle	316 SS
11	Seal	Buna-N
12	Upper Piston	316 SS
13	Upper Spindle	316 SS
14	Bonnet	316 SS
15	Spring Washer	304 SS
16	Spring	Stainless Steel
17	Nut	304 SS
18	Seal	Buna-N
19	Cap	316 SS
20	Pressure Adjustment Screw	304 SS
21	Backflow Check Body	316 SS
22	Backflow Check Spindle	316 SS
23	Inline Screen	Stainless Steel
24	Bug Screen	304 SS
25	Plug	Stainless Steel
26	Plug	Stainless Steel
27	Seal	Buna-N
28	Seal	Buna-N

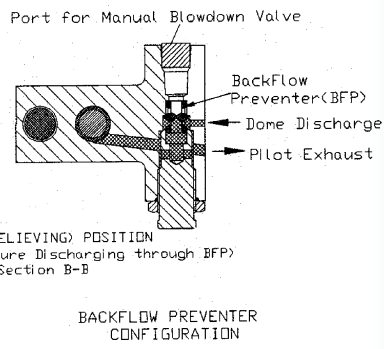
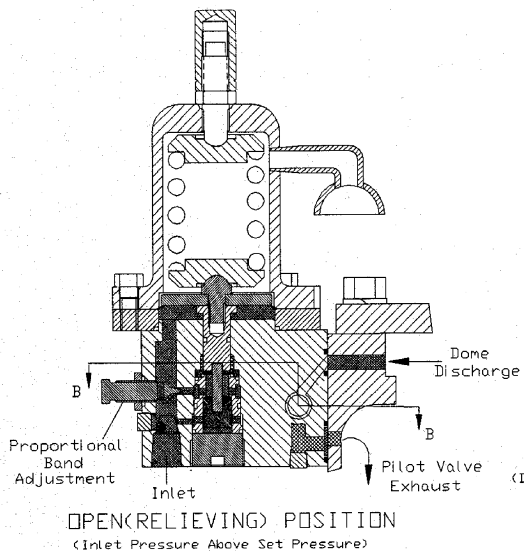
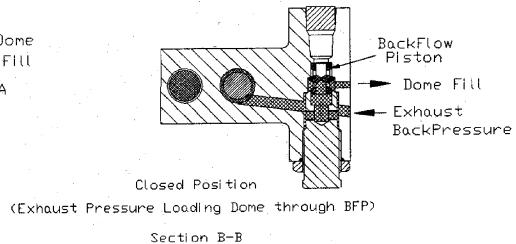
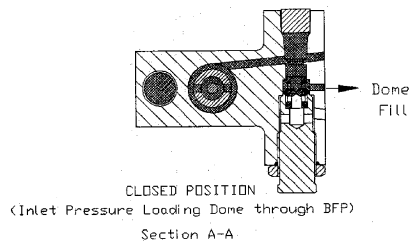
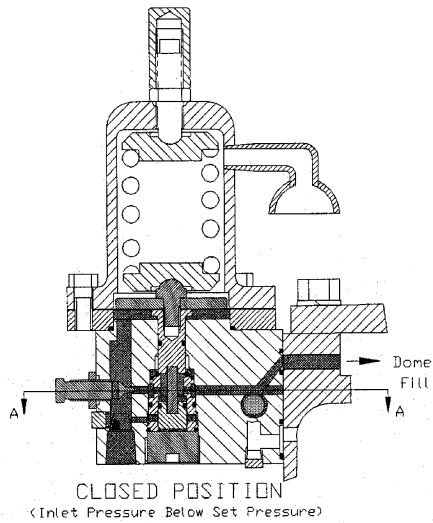


F300 SERIES PILOT VALVE OPERATION



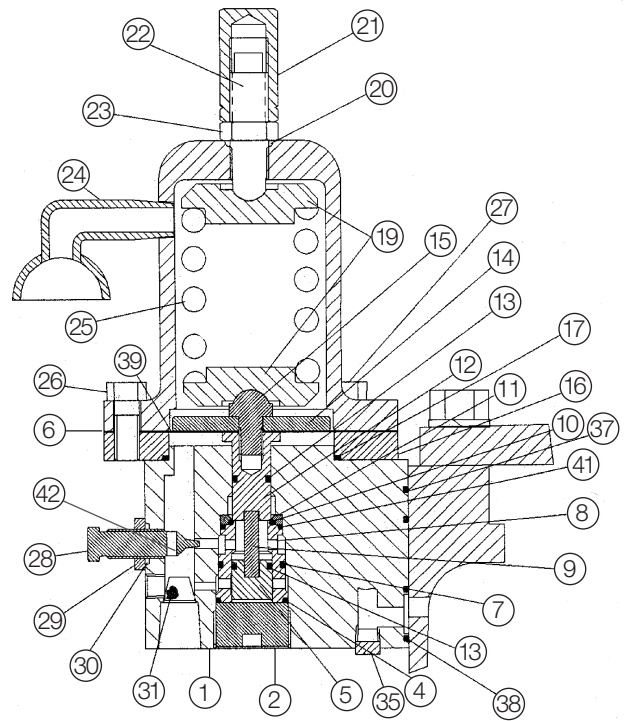
SPECIFICATIONS
Style: Modulating, Balanced Service: Gas/Vapor/Liquid Set Pressure Range: Diaphragm Style: 15 – 1480 psig Piston Style: 1480 – 6000 psig
FEATURES
<ul style="list-style-type: none"> ● Direct Mount to Main Valve ● Dome/Exhaust Lines Integral to Main Valve Body ● Balanced against Backpressure, with Built-in Backflow Preventer ● Safe, Chatter-free Performance ● Variety of Materials Available ● Minimal Components ● Simple to Maintain

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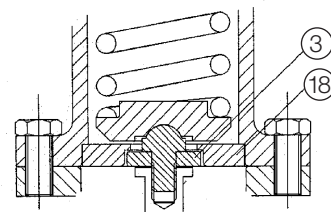


F300 SERIES PILOT VALVE CONSTRUCTION

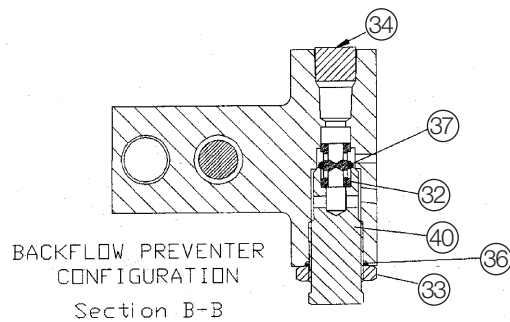
Item No.	Description	Standard
1	Body	316 SS
2	Plug	316 SS
3	Diaphragm Disc	304 SS
4	Seal	Buna-N
5	Lower Piston	316 SS
6	Bonnet	316 SS
7	Seal	Buna-N
8	Sleeve	316 SS
9	Spacer Pin	316 SS
10	Seat	Buna-N
11	Seat Retainer Nozzle	316-SS
12	Upper Piston	316 SS
13	Piston Seal	Buna-N
14	Diaphragm Support Disc	316 SS
15	Diaphragm Fastener	316 SS
16	Diaphragm Support Ring	316 SS
17	Seal	Buna-N
18	Diaphragm Effective Area Reducer	304 SS
19	Spring Washer	304 SS
20	PA Screw Seal	Teflon
21	Cap	304 SS
22	Pressure Adjustment Screw	316 SS
23	Jam Nut	304 SS
24	Bug Screen	304 SS
25	Spring	304/17-7 SS
26	Bolt, Bonnet/Support Ring	A193, B8
27	Bolt, Bonnet/Body	A193, B8
28	Proportional Band Screw	304 SS
29	Jam Nut	304 SS
30	Seal	Buna-N
31	Screen	Stainless Steel
32	Backflow Piston	304 SS
33	Jam Nut	Buna-N
34	Plug	304 SS
35	Plug	304 SS
36	Seal	Buna-N
37	Seal	Buna-N
38	Seal	Buna-N
39	Diaphragm	Buna-N/Fiber
40	BFP Nozzle	316 SS
41	O-Ring	Buna-N
42	Roll Pin	Stainless Steel



LOW PRESSURE CONFIGURATION
(15 - 286 psig)



HIGH PRESSURE CONFIGURATION
(286 - 1480 psig)

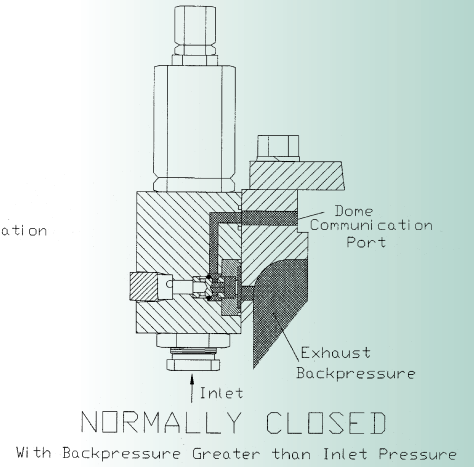
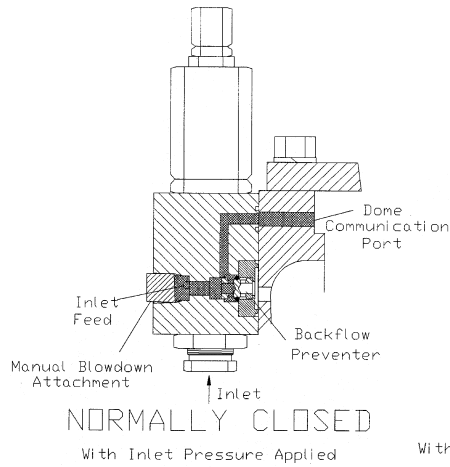
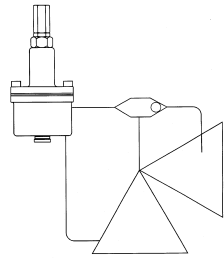


BACKFLOW PREVENTER CONFIGURATION
Section B-B

ACCESSORIES AND OPTIONS

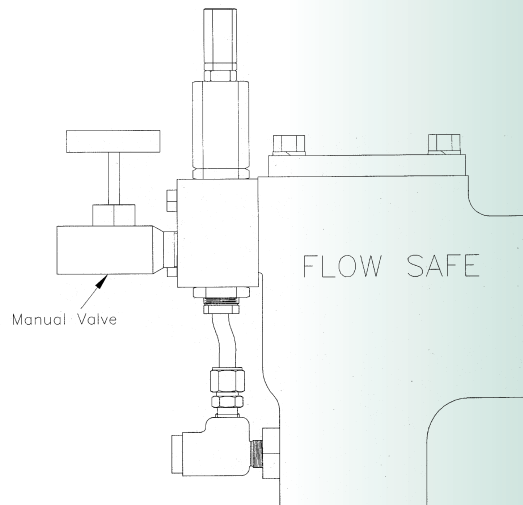
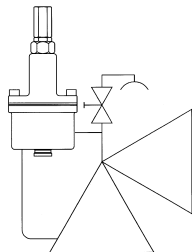
Backflow Preventer (Standard Feature)

If outlet pressure exceeds the inlet pressure, the main valve can open and backflow may occur. To prevent backflow, a standard backflow preventer is installed between the valve outlet and the pilot valve. An increase in the outlet pressure above the inlet is transmitted to the top of the main valve piston, thus keeping the main valve closed and protecting the vessel from exposure to backpressure and backflow contamination.



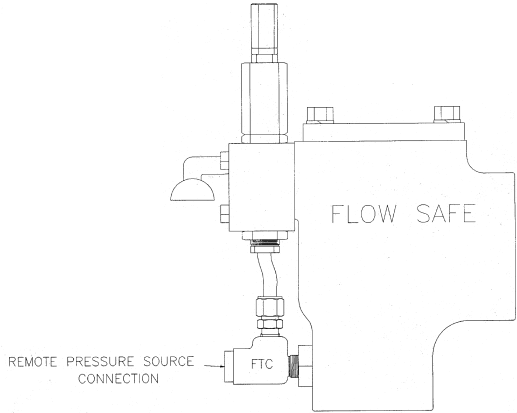
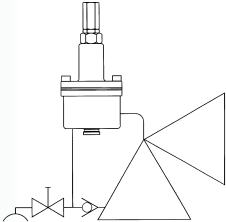
Manual/Remote Blowdown

This allows the main valve to lift by bypassing the pilot valve, and discharging the piston dome pressure directly to the atmosphere. This is accomplished by use of a manual or automatic blowdown valve, e.g. hand valve or solenoid valve.



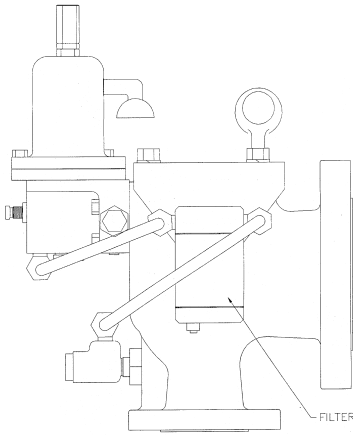
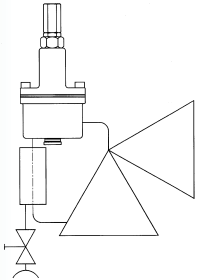
Field Test Connection (FTC)

This allows the user to verify the set pressure while in service without valve removal. An external pressure source may be attached to the FTC to direct pressure to the pilot valve, while blocking off the inlet pressure, thus checking the set pressure and the general operation of the valve.



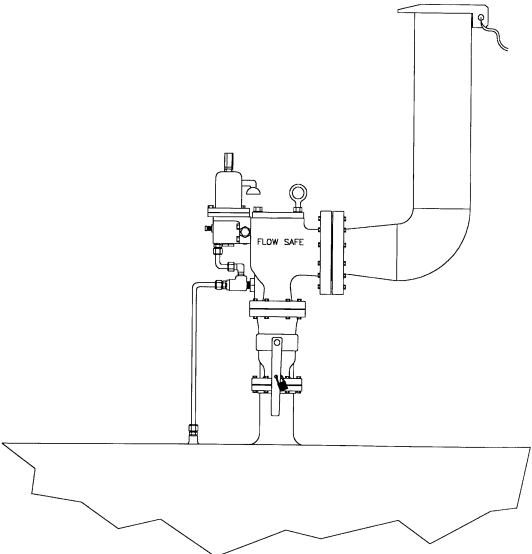
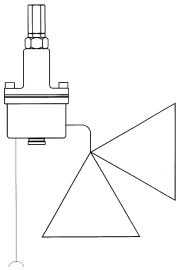
Inlet Supply Filter

This should be used for dirty applications to clean the supply gas to the pilot valve. This is supplied with a purge vent.



Remote Pressure Pickup

Remote pressure pickup is recommended when inlet piping pressure losses exceed 3% to the relief valve. This allows a remote, more direct pressure sensing to the pilot valve, plus an excellent source of clean air.



SIZING: GASES AND LIQUIDS

Gases

To size for gases, use the formula below.

To select the proper orifice for the particular service conditions, the following information is required:

1. Required flow capacity in SCFM or Lbs/Hr
2. Required set pressure (psig)
3. Operating Pressure – to assure that it is below the reseal pressure
4. Overpressure (10% Maximum) (psi)
5. Molecular Weight/Gas Constant of Media
6. Process Temperature

Vapors or Gases (SCFM)

$$A_0 = \frac{V \sqrt{MTZ}}{6.32 CKK_b P_1}$$

Vapors or Gases (lbs/hr)

$$A_0 = \frac{W}{CKK_b P_1} \sqrt{\frac{TZ}{M}}$$

- A_0 = Required Valve Orifice Area (in²)
- V = Required Flow Capacity (SCFM)
- W = Required Flow Capacity (lbs/hr)
- K = Derated Valve Coefficient of Discharge (see chart below)
= .90 x K_d (K_d =Certified Flow Coefficient)
- P_1 = Pressure at Valve Inlet During Flow (psia)
= Set Pressure + Overpressure + P_{atm}
- P_{atm} = Atmospheric Pressure
= 14.7 if unknown
- C = Gas Constant
- M = Molecular Weight of Flowing Media
- T = Inlet Temperature, Absolute (°R) = (°F + 460)
- Z = Compressibility Factor, if Unknown, $Z = 1.0$
- K_b = Backpressure Correction Factor (Subcritical Flow) See page 18

Liquids

To size for liquids, use the formula below.

To select the proper orifice for the particular service conditions, the following information is required:

1. Required flow capacity in U.S. Gallons per minute (GPM)
2. Required set pressure (start of full discharge)
3. Operating Pressure – to assure that it is below the reseal pressure
4. Acceptable Overpressure (10% Maximum)
5. Specific Gravity of the Liquid
6. Backpressure

$$A_0 = \frac{Q \sqrt{G}}{38 KK_c K_v \sqrt{P_1 - P_2}}$$

- A_0 = Required Valve Orifice Area (in²)
 - Q = Required Flow Rate (GPM)
 - G = Specific Gravity of Liquid at Temperature (°F)
 - K = Derated Valve Coefficient of Discharge (see chart below)
= .90 x K_d (K_d =Certified Flow Coefficient)
 - K_c = Combination Correction Factor for *
 - K_v = Viscosity Correction Factor (see page 17)
 - P_1 = Pressure at Valve Inlet During Flow (psig)
= Set Pressure + Overpressure
 - P_2 = Backpressure (psig)
- * installations with a rupture disk upstream of the relief valve. (=1.0, no rupture disk installed; =.90, with rupture disk installed)

FLOW COEFFICIENTS (K)

	F7000	F8000
Gas	.824	.878
*Liquid	.634	.875

*F300 modulating pilot only

On the following pages are published capacity charts for two common gases, air and natural gas, and for water. These charts can be used for direct selection of the Safety Relief valve orifice required without calculations. Capacities in these charts are based upon a process media temperature of 60°F, and a compressibility factor (Z) = 1.0. To determine Capacities at other temperatures, further calculations should be made using the formulas on page 14.

Molecular Weights and “C” Factors

Listed below are the molecular weights, specific heat ratios, and “C” factors for common gases. This “C” factor is used in both formulas for sizing valves for gas or vapor service.

Gas	Mol. Wt	Specific Heat Ratio (Cp/Cv)	C
Acetylene - C ₂ H ₂	26	1.28	345
Air	29	1.40	356
Ammonia - NH ₃	17	1.33	351
Argon - Ar	40	1.66	377
Benzene - C ₆ H ₆	78	1.10	327
Carbon Disulphide - CS ₂	76	1.21	338
Carbon Dioxide - CO ₂	44	1.28	345
Carbon Monoxide - CO	28	1.40	356
Chlorine - Cl ₂	71	1.36	352
Cyclohexane	84	1.08	324
Ethane - C ₂ H ₆	30	1.22	339
Ethylene - C ₂ H ₄	28	1.20	337
Freon 22	86.5	1.18	335
Helium - He	4	1.66	377
Hexane - C ₆ H ₁₄	86	1.08	324
Hydrochloric Acid - HCl	36.5	1.40	356
Hydrogen - H ₂	2	1.40	356
Hydrogen Sulphide - H ₂ S	34	1.32	348
Iso Butane	58	1.11	328
Methane - CH ₄	16	1.30	346
Methyl Alcohol - CH ₃ OH	32	1.20	337
Methyl Chloride - CH ₃ Cl	50.5	1.20	337
Methyl Mercaptan - CH ₄ S	48.1	1.20	337
N-Butane - C ₄ H ₁₀	58	1.11	328
Natural Gas	19	1.27	345
Nitrogen - N ₂	28	1.40	356
Oxygen - O ₂	32	1.40	356
Pentane - C ₅ H ₁₂	72	1.09	325
Propane - C ₃ H ₈	44	1.14	331
Propylene - C ₃ H ₆	42	1.15	332
Sulphur Dioxide - SO ₂	64	1.26	342
Water Vapor/Steam	18	1.30	347

Specific Heat Ratio (Cp/Cv)	C	Specific Heat Ratio (Cp/Cv)	C
1.00	315	1.52	366
1.02	318	1.54	368
1.04	320	1.56	369
1.06	322	1.58	371
1.08	324	1.60	372
1.10	327	1.62	374
1.12	329	1.64	376
1.14	331	1.66	377
1.16	333	1.68	379
1.18	335	1.70	380
1.20	337	1.72	382
1.22	339	1.74	383
1.24	341	1.76	384
1.26	343	1.78	386
1.28	345	1.80	387
1.30	347	1.82	388
1.32	349	1.84	390
1.34	351	1.86	391
1.36	352	1.88	392
1.38	354	1.90	394
1.40	356	1.92	395
1.42	358	1.94	397
1.44	359	1.96	398
1.46	361	1.98	399
1.48	363	2.00	400
1.50	364	2.20	412

TEMPERATURE CONVERSION

Deg C	Deg F	Deg C	Deg F	Deg C	Deg F	Deg C	Deg F	Deg C	Deg F
-40	-40.0	26	78.8	92	197.6	158	316.4	224	435.2
-39	-38.2	27	80.6	93	199.4	159	318.2	225	437.0
-38	-36.4	28	82.4	94	201.2	160	320.0	226	438.8
-37	-34.6	29	84.2	95	203.0	161	321.8	227	440.6
-36	-32.8	30	86.0	96	204.8	162	323.6	228	442.4
-35	-31.0	31	87.8	97	206.6	163	325.4	229	444.2
-34	-29.2	32	89.6	98	208.4	164	327.2	230	446.0
-33	-27.4	33	91.4	99	210.2	165	329.0	231	447.8
-32	-25.6	34	93.2	100	212.0	166	330.8	232	449.6
-31	-23.8	35	95.0	101	213.8	167	332.6	233	451.4
-30	-22	36	96.8	102	215.6	168	334.4	234	453.2
-29	-20.2	37	98.6	103	217.4	169	336.2	235	455.0
-28	-18.4	38	100.4	104	219.2	170	338.0	236	456.8
-27	-16.6	39	102.2	105	221.0	171	339.8	237	458.6
-26	-14.8	40	104.0	106	222.8	172	341.6	238	460.4
-25	-13	41	105.8	107	224.6	173	343.4	239	462.2
-24	-11.2	42	107.6	108	226.4	174	345.2	240	464.0
-23	-9.4	43	109.4	109	228.2	175	347.0	241	465.8
-22	-7.6	44	111.2	110	230.0	176	348.8	242	467.6
-21	-5.8	45	113.0	111	231.8	177	350.6	243	469.4
-20	-4	46	114.8	112	233.6	178	352.4	244	471.2
-19	-2.2	47	116.6	113	235.4	179	354.2	245	473.0
-18	-0.4	48	118.4	114	237.2	180	356.0	246	474.8
-17	1.4	49	120.2	115	239.0	181	357.8	247	476.6
-16	3.2	50	122.0	116	240.8	182	359.6	248	478.4
-15	5.0	51	123.8	117	242.6	183	361.4	249	480.2
-14	6.8	52	125.6	118	244.4	184	363.2	250	482.0
-13	8.6	53	127.4	119	246.2	185	365.0	251	483.8
-12	10.4	54	129.2	120	248.0	186	366.8	252	485.6
-11	12.2	55	131.0	121	249.8	187	368.6	253	487.4
-10	14.0	56	132.8	122	250.6	188	370.4	254	489.2
-9	15.8	57	134.6	123	253.4	189	372.2	255	491.0
-8	17.6	58	136.4	124	255.2	190	374.0	256	492.8
-7	19.4	59	138.2	125	257.0	191	375.8	257	494.6
-6	21.2	60	140.0	126	258.8	192	377.6	258	496.4
-5	23.0	61	141.8	127	260.6	193	379.4	259	498.2
-4	24.8	62	143.6	128	262.4	194	381.2	260	500.0
-3	26.6	63	145.4	129	264.2	195	383.0	261	501.8
-2	28.4	64	147.2	130	266.0	196	384.8	262	503.6
-1	30.2	65	149.0	131	267.8	197	386.6	263	505.4
0	32.0	66	150.8	132	269.6	198	388.4	264	507.2
1	33.8	67	152.6	133	271.4	199	390.2	265	509.0
2	35.6	68	154.4	134	273.2	200	392.0	266	510.8
3	37.4	69	156.2	135	275.0	201	393.8	267	512.6
4	39.2	70	158.0	136	276.8	202	395.6	268	514.4
5	41.0	71	159.8	137	278.6	203	397.4	269	516.2
6	42.8	72	161.6	138	280.4	204	399.2	270	518.0
7	44.6	73	163.4	139	282.2	205	401.0	271	519.8
8	46.4	74	165.2	140	284.0	206	402.8	272	521.6
9	48.2	75	167.0	141	285.8	207	404.6	273	523.4
10	50.0	76	168.8	142	287.6	208	406.4	274	525.2
11	51.8	77	170.6	143	289.4	209	408.2	275	527.0
12	53.6	78	172.4	144	291.2	210	410.0	276	528.8
13	55.4	79	174.2	145	293.0	211	411.8	277	530.6
14	57.2	80	176.0	146	294.8	212	413.6	278	532.4
15	59	81	177.8	147	296.6	213	415.4	279	534.2
16	60.8	82	179.6	148	298.4	214	417.2	280	536.0
17	62.6	83	181.4	149	300.2	215	419.0	281	537.8
18	64.4	84	183.2	150	302.0	216	420.8	282	539.6
19	66.2	85	185.0	151	303.8	217	422.6	283	541.4
20	68	86	186.8	152	305.6	218	424.4	284	543.2
21	69.8	87	188.6	153	307.4	219	426.2	285	545.0
22	71.6	88	190.4	154	309.2	220	428.0	286	546.8
23	73.4	89	192.2	155	311.0	221	429.8	287	548.6
24	75.2	90	194.0	156	312.8	222	431.6	288	550.4
25	77.0	91	195.8	157	314.6	223	433.4		

Conversion Formulas:

Defrees Celsius (C)

$C + 273.15 =$
 $(C \times 1.8) + 32 =$

Degrees Fahrenheit (F)

$F + 459.67 = R$ (Rankine)
 $(-32) \times 0.556 = C$ (Celsius)

Viscosity Correction Method, per API RP520

When using the method below, first size the valve for non-viscous conditions, to determine a preliminary required orifice area (A_0). Select the next larger orifice and then use that area in determining the Reynold's number (R). Either of the formula below can be used to determine R.

$$R = \frac{Q \times (2800) \times G}{C_p \times \sqrt{A_0}}$$

- OR -

$$R = \frac{12700 \times Q}{SSU \times \sqrt{A_0}}$$

Q = Required flowrate at the flowing temperature, in U.S. gallons per minute.

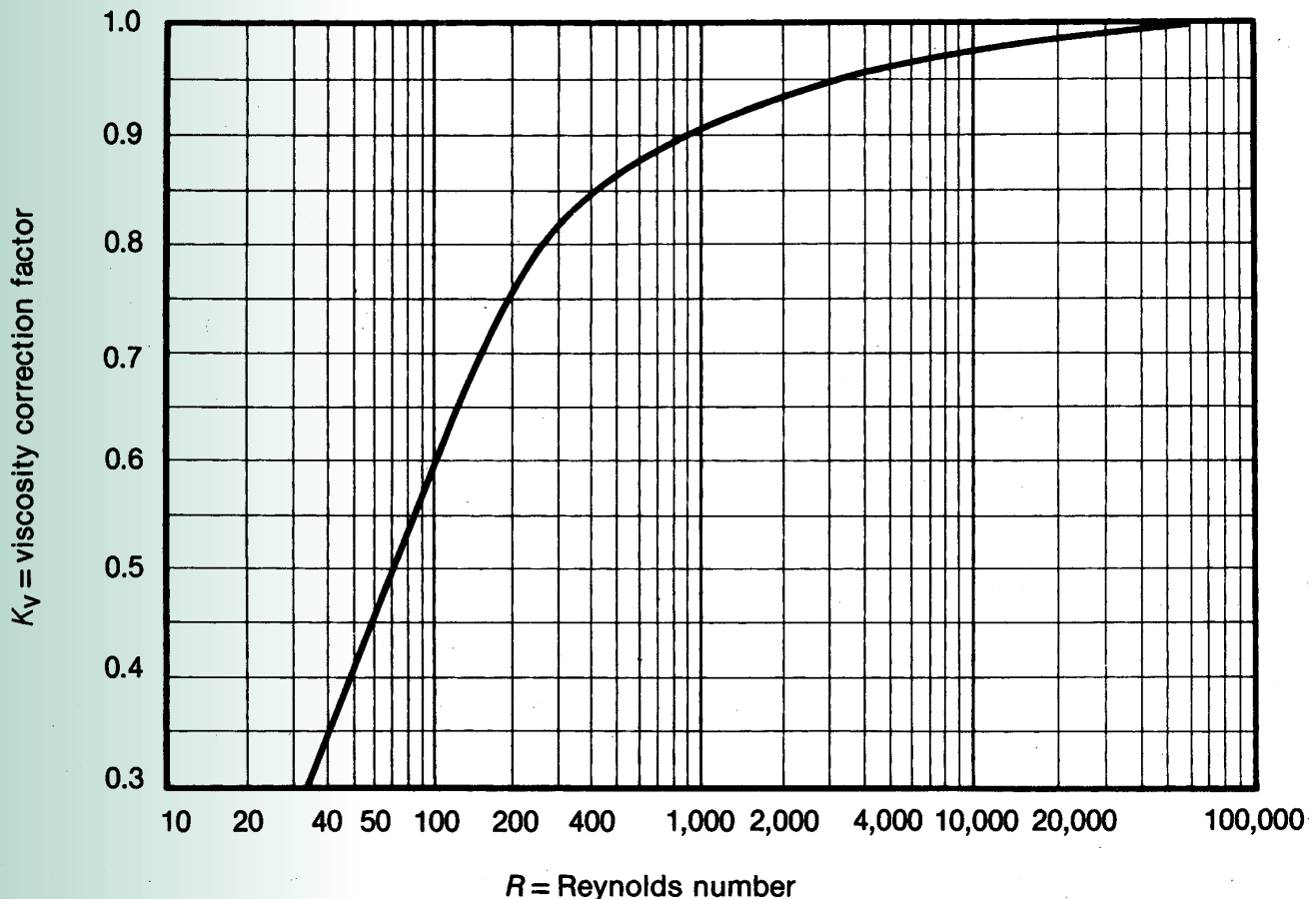
G = Specific gravity of the liquid at the flowing temperature. Water: G = 1.0

C_p = Absolute viscosity at the flowing temperature, in centipoises.

SSU = Viscosity at the flowing temperature, in Saybolt Seconds Universal.

After the value of R is determined, K_v is obtained from the chart below. K_v is then applied to correct the "preliminary required flow area". If the corrected area exceeds the chosen standard orifice area, repeat the above procedure using the next larger orifice size.

Minimum and maximum conditions should be considered when determining the required orifice size, for proper pilot valve operation.



SIZING AND SET PRESSURE CONSIDERATIONS FOR BACKPRESSURE

Constant Backpressure Sizing Factor (K_b) (Gases & Vapors Only)

In general, back pressure has no effect on the flow capacity of the FLOW SAFE F7000/8000 Series of Pilot operated valves as long as a critical flow condition exists. The critical flow pressure ratio for a particular gas may be estimated per API RP 520 by the equation below:

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

- k = Specific Heat Ratio for Ideal Gas (see page 15)
- P_1 = Upstream Relieving Pressure (psia)
- P_{cf} = Critical Flow Throat Pressure (psia)
- C_1 = Capacity with Backpressure
- C_2 = Rated Capacity with Zero Backpressure
- P_b = Backpressure, psia
- P_a = Set Pressure, psia
- P_o = Overpressure, psia

When sufficient back pressure exists to create a subcritical flow condition, the critical sizing equation shown on page 14 should be used along with the Back pressure Sizing Factor (K_b) shown in the chart below. This is in accordance with API RP520 and is considered to be a conservative approach.

Set pressures are not affected by back pressure when using the F300 pilot valve as it is balanced against such pressure, or the F200 as it is normally vented to atmosphere. Caution should be used if the F200 vent is routed to the main valve discharge or other pressurized vessel, as the set pressure and blowdown may be affected.

Back pressure greater than the system inlet pressure normally would cause the main valve piston to open. Because the F200 and F300 pilot valves are equipped with backflow preventers as standard features this cannot occur on the F7000/8000 valves. The backpressure is routed to the main valve piston dome, keeping the valve closed and bubbletight.

Example: See figure below.

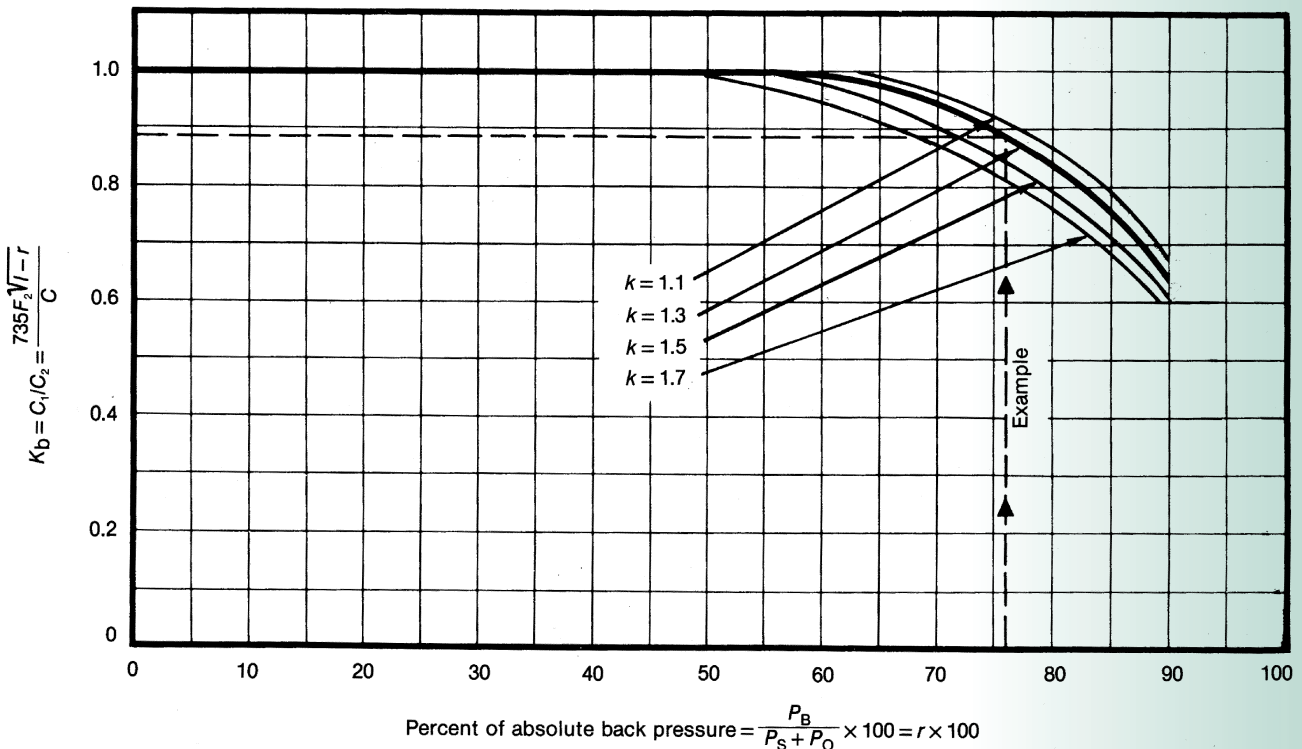
Set Pressure = 150 psig

Over Pressure = 15 psi

Superimposed Back Pressure = 107 psig

Built-up Back Pressure = 15 psi

Percent Absolute Back Pressure = $\frac{107+15+14.7}{150+15+14.7} \times 100 = 76\%$



(Ref: API RP520)

This table may be used two ways:

- Multiply** the unit under column A by the figure under column B, the result is the unit under Column C.
- Divide** the unit under column C by the figure under column B, the result is then the unit under column A.

Multiply A	By B	To Obtain C
Atmospheres	14.697	Pounds / sq. in.
Atmospheres	1.033	Kilograms / sq. cm.
Atmospheres	29.92	Inches of mercury
Atmospheres	760.	Millimeters of mercury
Atmospheres	407.	Inches of water
Atmospheres	33.90	Feet of water
Atmospheres	1.014	Bars
Atmospheres	101.36	KiloPascals
Barrels	42.	Gallons (U.S.)
Bars	14.5	Pounds / sq. in.
Bars	1.02	Kilograms / sq. cm.
Bars	100.0	KiloPascals
Centimeters	0.3937	Inches
Centimeters	0.03281	Feet
Centimeters	0.01	Meters
Centimeters	0.01094	Yards
Cubic centimeters	0.06102	Cubic inches
Cubic feet	7.48055	Gallons
Cubic feet	0.17812	Barrels
Cubic ft. / minute	.02831	Cubic meters / minute
Cubic ft. / second	448.833	Gallons / minute
Cubic inches	16.39	Cubic centimeters
Cubic inches	0.004329	Gallons
Cubic meters	264.17	Gallons
Cubic meters / hour	4.4	Gallons / minute
Cubic meters / minute	35.32	Cubic ft. / minute
Feet	0.3048	Meters
Feet	0.3333	Yards
Feet	30.48	Centimeters
Feet of water	0.882	Inches of mercury
Feet of water	0.433	Pounds / sq. in.
Gallons (U.S.)	3785.	Cubic centimeters
Gallons (U.S.)	0.13368	Cubic feet
Gallons (U.S.)	231.	Cubic inches
Gallons (Imperial)	277.4	Cubic inches
Gallons (U.S.)	0.833	Gallons (Imperial)
Gallons (U.S.)	3.785	Liters
Gallons of water	8.328	Pounds (at 21°C)
Gallons of liquid / minute	550 x Sp. Gr.	Pounds / hour liquid (at 21°C)
Gallons / minute	0.002228	Cubic ft / second
Grams	.035	Ounces
Inches	2.54	Centimeters
Inches	0.0833	Feet
Inches	0.0254	Meters

Multiply A	By B	To Obtain C
Inches	0.02778	Yards
Inches of mercury	1.133	Feet of water
Inches of mercury	0.4912	Pounds / sq. in.
Inches of mercury	0.0334	Atmospheres
Inches of mercury	0.0345	Kilograms / sq. cm.
Inches of water	0.03613	Pounds / sq. in.
Inches of water	0.07355	Inches of mercury
Kilograms	2.205	Pounds
Kilograms	0.001102	Short tons (2000 lbs)
Kilograms	35.27	Ounces
Kilograms	.2646	H2O @ 70°F Gallons (U.S.)
Kilograms / minute	132.3	Pounds / hour
Kilograms / sq. cm.	14.22	Pounds / sq. in.
Kilograms / sq. cm.	0.9678	Atmospheres
Kilograms / sq. cm.	28.96	Inches of mercury
KiloPascals	.145	Pounds / sq. in.
KiloPascals	.01	Bars
KiloPascals	.0102	Kilograms / sq. cm.
Liters	.035	Cubic feet
Liters	1000.	Cubic centimeters
Liters	0.2642	Gallons
Liters / hour	0.0044	gallons / minute
Meters	3.281	Feet
Meters	1.0936	Yards
Meters	100.	Centimeters
Meters	39.37	Inches
Pounds	.1198	H2O @ 70°F Gallons (U.S.)
Pounds	453.6	Grams
Pounds	0.0005	Short tons (2000 lbs)
Pounds	0.4536	Kilograms
Pounds	0.000454	Metric tons
Pounds	16.	Ounces
Pounds / hour	6.32/M.W.	Cubic ft. / minute
Pounds / hour liquid	0.002/Sp.Gr.	Gallons / minute liquid (at 21°C)
Pounds / sq. in.	27.684	Inches of water
Pounds / sq. in.	2.307	Feet of water
Pounds / sq. in.	2.036	Inches of mercury
Pounds / sq. in.	0.0703	Kilograms / sq. in.
Pounds / sq. in.	0.0680	Atmospheres
Pounds / sq. in.	51.71	Millimeters of mercury
Pounds / sq. in.	0.7037	Meters of water
Specific gravity (of gas or vapors)	28.97	Molecular Wt. (of gas or vapors)
Square centimeters	0.1550	Square inches
Square Inches	6.452	Square centimeters
Water (cubic feet)	62.3	Pounds (at 21°C)
Temperature		
	Centigrade = 5/9 (Fahrenheit - 32)	
	Fahrenheit = 9/5 (Centigrade) + 32	

F7000 FLOW CAPACITIES (SCFM)

10% OVERPRESSURE, 60 DEGREE F, Z=1.0, AIR (MW=29)

VALVE SIZE	1 x 2	1-1/2x3	2x3	3x4	4x6	6x8	8x10	12x16
ORIFICE AREA(in ²)	0.72	1.77	2.95	6.60	11.43	26.06	45.66	111.87
K(=.90xKd)	0.824	0.824	0.824	0.824	0.824	0.824	0.824	0.824

Set Pressure (psig)	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	355	874	1456	3258	5643	12865	22541	55227
20	409	1007	1679	3756	6506	14832	25988	63672
25	464	1141	1902	4255	7368	16799	29435	72117
30	518	1275	2124	4753	8231	18767	32881	80561
35	577	1422	2369	5301	9180	20931	36673	89850
40	637	1569	2614	5849	10129	23094	40464	99139
50	757	1863	3104	6945	12027	27422	48047	117717
60	876	2156	3594	8041	13926	31750	55629	136295
66	936	2303	3839	8589	14875	33914	59421	145584
70	995	2450	4084	9137	15824	36078	63212	154873
80	1055	2597	4329	9685	16773	38241	70795	164162
90	1234	3038	5064	11329	19620	44733	78377	192029
100	1354	3332	5554	12425	21518	49061	85960	210607
120	1592	3920	6533	14617	25315	57716	101125	247764
140	1831	4508	7513	16809	29111	66372	116291	284920
160	1951	4802	8003	17905	31009	70699	123873	303498
180	2309	5684	9473	21194	36703	83683	146621	359232
200	2548	6272	10453	23386	40500	92338	161787	396388
220	2786	6860	11433	25578	44296	100994	176952	433544
240	3025	7447	12412	27770	48092	109649	192117	470700
260	3264	8035	13392	29962	51889	118305	207283	507856
285	3563	8770	14617	32702	56634	129124	226239	554301
300	3742	9211	15352	34346	59481	135615	237613	
320	3980	9799	16332	36538	63278	144271	252779	
340	4219	10387	17311	38730	67074	152926	267944	
360	4458	10975	18291	40923	70870	161582	283109	
380	4697	11563	19271	43115	74667	170237	298275	
400	4936	12150	20251	45307	78463	178893	313440	
420	5174	12738	21231	47499	82259	187548	328605	
440	5413	13326	22210	49691	86056	196204	343771	
460	5652	13914	23190	51883	89852	204859	358936	
480	5891	14502	24170	54075	93648	213515	374101	
500	6130	15090	25150	56267	97445	222170	389267	
600	7324	18029	30049	67228	116426	265448	465093	
700	8518	20969	34948	78188	135408	308725	540920	
740	8995	22144	36907	82572	143000	326036	571251	
800	9712	23908	39847	89149	154389	352002	616747	
850	10309	25378	42296	94629	163880	373641	654660	
900	10906	26847	44746	100109	173371	395280	692574	
1000	12100	29787	49645	111070	192353	438557	768400	
1200	14488	35666	59443	132991	230316	525112	920054	
1300	15682	38605	64342	143951	249297	568389	995880	
1480	17831	43896	73160	163680	283464	646288	1132369	
ORIFICE AREA	0.72	1.403	2.239	5.405	10.3			
2000	24074	46910	74862	180719	344386			
2200	26465	51570	82299	198671	378596			
ORIFICE AREA	0.521	1.403	2.239	5.405	10.3			
2500	21746	58560	93454	225599	429911			
2700	23476	63220	100890	243551	464121			
2750	23909	64385	102749	248039	472674			
3000	26072	70209	112045	270479	515436			
3324	28875	77758	124092	299561	570857			
3500	30398	81859	130636	315359	600961			
3705	32172	86635	138259	333760	636027			
ORIFICE AREA	0.521	0.95	1.773					
3983	34577	63049	117668					
4292	37251	67923	126767					
4500	39050	71205	132891					
5000	43376	79093	147613					
5500	47702	86981	162335					
5774	50073	91304	170402					
6000	52029	94870	177057					

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F8000 FLOW CAPACITIES (SCFM)

10% OVERPRESSURE, 60 DEGREE F, Z=1.0, AIR (MW=29)

VALVE SIZE ORIFICE AREA (in ²) K(=.90xKd)	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	W
	0.134 0.878	0.235 0.878	0.358 0.878	0.588 0.878	0.916 0.878	1.503 0.878	2.147 0.878	3.277 0.878	4.147 0.878	5.014 0.878	7.397 0.878	12.913 0.878	18.704 0.878	30.409 0.878	78.81 0.878
Set Pressure (psig)	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	58847
20	81	143	217	357	556	912	1302	1987	2515	3041	4486	7831	11343	18442	67845
25	92	161	246	404	629	1032	1475	2251	2849	3444	5081	8870	12848	20888	76843
30	103	180	275	451	703	1153	1647	2515	3182	3847	5676	9908	14352	23334	85841
35	115	201	306	503	784	1286	1837	2804	3549	4291	6330	11051	16007	26024	95738
40	127	222	338	555	865	1419	2027	3094	3916	4735	6985	12193	17662	28714	105636
50	150	263	401	659	1027	1685	2407	3674	4650	5622	8294	14478	20971	34095	125432
60	174	305	465	763	1189	1951	2787	4254	5384	6509	9603	16763	24281	39476	145227
66	188	330	503	826	1286	2111	3015	4602	5824	7041	10388	18134	26267	42705	157105
70	198	347	528	867	1351	2217	3167	4834	6117	7396	10912	19048	27591	44857	165023
80	210	367	560	919	1432	2350	3357	5124	6484	7840	11566	20191	29246	47548	174921
90	245	430	655	1075	1675	2749	3927	5994	7585	9171	13529	23618	34210	55619	204614
100	269	471	718	1180	1837	3015	4307	6574	8319	10058	14838	25903	37520	61000	224409
120	316	555	845	1388	2162	3547	5067	7733	9786	11832	17456	30473	44139	71762	264000
140	364	638	972	1596	2486	4079	5827	8893	11254	13607	20074	35043	50759	82524	303592
160	387	679	1035	1700	2648	4345	6206	9473	11988	14494	21383	37328	54068	87905	323387
180	458	804	1225	2012	3134	5143	7346	11213	14189	17156	25310	44183	63997	104047	382774
200	506	887	1352	2220	3458	5675	8106	12372	15657	18930	27927	48753	70617	114809	422365
220	553	970	1478	2428	3783	6206	8866	13532	17125	20705	30545	53323	77236	125571	461956
240	601	1054	1605	2636	4107	6738	9626	14692	18592	22479	33163	57893	83856	136333	501547
260	648	1137	1732	2844	4431	7270	10385	15852	20060	24254	35781	62463	90475	147095	541138
285	707	1241	1890	3104	4836	7935	11335	17301	21894	26472	39053	68175	98749	160547	590627
300	743	1303	1985	3260	5079	8334	11905	18171	22995	27803	41016	71603	103714	168618	
320	790	1386	2112	3469	5403	8866	12665	19331	24463	29577	43634	76173	110333	179380	
340	838	1469	2239	3677	5728	9398	13425	20490	25930	31352	46252	80743	116953	190142	
360	885	1553	2365	3885	6052	9930	14185	21650	27398	33126	48870	85313	123572	200904	
380	933	1636	2492	4093	6376	10462	14944	22810	28866	34901	51488	89882	130191	211665	
400	980	1719	2619	4301	6700	10994	15704	23970	30333	36675	54106	94452	136811	222427	
420	1028	1802	2745	4509	7024	11526	16464	25129	31801	38449	56723	99022	143430	233189	
440	1075	1885	2872	4717	7348	12058	17224	26289	33269	40224	59341	103592	150050	243951	
460	1122	1968	2999	4925	7673	12589	17984	27449	34736	41998	61959	108162	156669	254713	
480	1170	2052	3125	5133	7997	13121	18744	28609	36204	43773	64577	112732	163288	265475	
500	1217	2135	3252	5341	8321	13653	19503	29768	37671	45547	67195	117302	169908	276236	
600	1454	2551	3886	6382	9942	16313	23303	35567	45010	54420	80284	140152	203005	330045	
700	1691	2966	4519	7422	11563	18972	27102	41366	52348	63292	93373	163002	236102	383855	
740	1786	3133	4772	7839	12211	20036	28621	43685	55283	66841	98608	172141	249340	405378	
800	1929	3382	5153	8463	13184	21632	30901	47164	59686	72164	106462	185851	269199	437664	
850	2047	3590	5469	8983	13994	22962	32800	50064	63355	76601	113006	197276	285747	464568	
900	2166	3798	5786	9503	14804	24292	34700	52963	67024	81037	119551	208701	302296	491473	
1000	2403	4214	6420	10544	16245	26951	38499	58762	74362	89909	132640	231551	335393	545282	
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	
1480	3541	6210	9460	15538	24206	39717	56735	86596	109586	132496	195468	341229	494258	803566	
2000	4774	8372	12754	20949	32634	53547	76491	116749	147744	178632	263531				
2500	5960	10451	15922	26151	40738	66845	95486	145742	184435	222994	328976				
2700	6434	11283	17189	28232	43980	72164	103085	157340	199111	240739	355154				
2750	6552	11491	17506	28752	44791	73494	104984	160239	202780	245175	361699				
3000	7145	12531	19089	31353	48843	80143	114482	174736	221126	267356	394422				
3324	7913	13878	21142	34724	54094	88760	126791	193523	244901	296102	436830				
3500	8331	14610	22257	36556	56947	93441	133478	203729	257817	311717	459867				
3705	8817	15462	23555	38689	60270	98893	141266	215616	272860	329906	486700				
3983	9476	16618	25316	41581	64776										
4292	10209	17903	27274	44796	69784										
4500	10702	18768	28592	46960	73156										
5000	11887	20847	31759	52163	81260										
5500	13073	27449	34926	57365	89365										
5774	13723	28813	36662	60216	93806										
6000	14259	29939	38094	62567	97469										

F7000 FLOW CAPACITIES (SCFM)

10% OVERPRESSURE, 60 DEGREE F, Z=1.0, NATURAL GAS (MW=19)

VALVE SIZE ORIFICE AREA(in ²) K(=.90xKd)	1 x 2	1-1/2x3	2x3	3x4	4x6	6x8	8x10	12x16
	0.72	1.77	2.95	6.60	11.43	26.06	45.66	111.87
	0.824	0.824	0.824	0.824	0.824	0.824	0.824	0.824

Set Pressure (psig)	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	425	1046	1744	3901	6756	15403	26988	66122
20	490	1206	2010	4497	7789	17758	31114	76232
25	555	1366	2277	5094	8822	21301	35241	86343
30	620	1526	2543	5690	9855	22469	39368	96453
35	691	1702	2837	6347	10991	25059	43907	107575
40	763	1878	3130	7003	12127	27650	48446	118696
50	906	2230	3717	8315	14400	32832	57525	140939
60	1049	2582	4303	9627	16673	38013	66603	163182
66	1120	2758	4596	10283	17809	40604	71142	174303
70	1192	2934	4890	10940	18945	43195	75682	185425
80	1263	3110	5183	11596	20082	45785	80221	196546
90	1478	3638	6063	13564	23490	53557	93839	229911
100	1621	3990	6649	14876	25763	58739	102917	252154
120	1907	4693	7822	17501	30308	69102	121074	296639
140	2192	5397	8995	20125	34853	79465	139231	341125
160	2335	5749	9582	21438	37126	84646	148309	363368
180	2764	6805	11342	25374	43944	100191	175545	430097
200	3050	7509	12515	27999	48489	110553	193702	474582
220	3336	8213	13688	30623	53034	120916	211859	519068
240	3622	8917	14861	33248	57580	131279	230016	563554
260	3908	9620	16034	35873	62125	141642	248173	608040
285	4265	10500	17500	39153	67806	154596	270869	663647
300	4480	11028	18380	41122	71215	162368	284487	
320	4766	11732	19553	43746	75760	172731	302644	
340	5052	12436	20726	46371	80306	183094	320801	
360	5338	13140	21899	48995	84851	193457	338958	
380	5623	13843	23072	51620	89396	203820	357115	
400	5909	14547	24246	54244	93941	214183	375272	
420	6195	15251	25419	56869	98486	224546	393429	
440	6481	15955	26592	59493	103032	234908	411586	
460	6767	16659	27765	62118	107577	245271	429743	
480	7053	17363	28938	64742	112122	255634	447900	
500	7339	18067	30111	67367	116667	265997	466057	
600	8768	21586	35976	80490	139393	317812	556841	
700	10198	25105	41842	93612	162119	369626	647626	
740	10770	26513	44188	98861	171210	390352	683940	
800	11628	28624	47707	106735	184845	421441	738411	
850	12342	30384	50640	113296	196208	447348	783804	
900	13057	32144	53573	119585	207571	473256	829196	
1000	14487	35663	59438	132980	230297	525070	919981	
1200	17346	42701	71169	159225	275750	628699	1101551	
1300	18775	46221	77034	172348	298476	680514	1192336	
1480	21349	52555	87592	195969	339382	773780	1355748	
ORIFICE AREA	0.72	1.403	2.239	5.405	10.30			
2000	28823	56164	89630	216369	412323			
2200	31686	61743	98534	237863	453281			
ORIFICE AREA	0.521	1.403	2.239	5.405	10.30			
2500	26036	70112	111889	270103	514719			
2700	28108	75691	120792	291596	555678			
2750	28626	77086	123018	296969	565917			
3000	31215	84060	134148	323836	617115			
3324	34572	93098	148571	358655	683468			
3500	36395	98007	156406	377569	719512			
3705	38518	103726	165533	399600	761494			
ORIFICE AREA	0.521	0.95	1.773					
3983	41398	75486	140881					
4292	44599	81323	151774					
4500	46754	85251	159106					
5000	51933	94696	176732					
5500	57113	104140	194358					
5774	59951	109316	204017					
6000	62292	113584	211984					

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F8000 FLOW CAPACITIES (SCFM)

10% OVERPRESSURE, 60 DEGREE F, Z=1.0, NATURAL GAS (MW=19)

VALVE SIZE ORIFICE AREA (in ²) K(= .90xKd)	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	W
	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	78.81
	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878	0.878
Set Pressure (psig)	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	49634
20	97	171	260	427	665	1091	1559	2379	3011	3641	5371	9376	13581	22080	57224
25	110	193	294	484	753	1236	1766	2695	3410	4123	6083	10620	15382	25008	64813
30	123	216	329	540	842	1381	1972	3011	3810	4606	6796	11863	17183	27937	72402
35	137	241	367	602	939	1540	2200	3358	4249	5137	7579	13231	19165	31158	80750
40	151	266	405	665	1036	1699	2427	3705	4688	5669	8363	14599	21146	34379	89099
50	180	315	481	789	1230	2018	2882	4399	5567	6731	9930	17335	25108	40821	105795
60	208	365	556	914	1424	2336	3337	5093	6446	7793	11497	20070	29071	47264	122492
66	225	395	602	989	1540	2527	3610	5510	6973	8430	12437	21712	31449	51129	132510
70	237	415	632	1038	1618	2654	3792	5788	7324	8855	13064	22806	33034	53706	139188
80	251	440	670	1101	1715	2814	4019	6135	7763	9386	13848	24174	35015	56927	147537
90	293	515	784	1288	2006	3291	4702	7176	9081	10980	16198	28277	40959	66591	172581
100	322	564	860	1412	2200	3610	5156	7870	9960	12042	17765	31013	44921	73033	189278
120	379	664	1011	1661	2588	4247	6066	9259	11717	14167	20900	36485	52847	85918	222671
140	435	764	1163	1910	2976	4883	6976	10647	13474	16291	24034	41956	60772	98803	256064
160	464	813	1239	2035	3170	5202	7431	11342	14353	17353	25601	44692	64734	105245	272761
180	549	963	1467	2409	3752	6157	8795	13424	16988	20540	30302	52899	76622	124572	322850
200	606	1062	1618	2658	4141	6794	9705	14813	18746	22665	33437	58370	84547	137457	356243
220	662	1162	1770	2907	4529	7431	10615	16201	20503	24789	36571	63842	92472	150342	389636
240	719	1261	1922	3156	4917	8068	11524	17590	22260	26914	39705	69313	100398	163227	423029
260	776	1361	2073	3405	5305	8705	12434	18979	24017	29038	42839	74785	108323	176112	456422
285	847	1485	2263	3717	5790	9501	13571	20714	26213	31694	46757	81624	118229	192218	498164
300	890	1560	2377	3904	6081	9978	14254	21756	27531	33287	49108	85728	124173	201881	
320	946	1660	2528	4153	6469	10615	15163	23144	29289	35412	52242	91199	132098	214766	
340	1003	1759	2680	4402	6857	11252	16073	24533	31046	37536	55376	96670	140024	227651	
360	1060	1859	2832	4651	7246	11889	16983	25921	32803	39661	58510	102142	147949	240535	
380	1117	1958	2983	4900	7634	12526	17893	27310	34560	41785	61645	107613	155874	253420	
400	1173	2058	3135	5149	8022	13162	18802	28698	36317	43910	64779	113085	163799	266305	
420	1230	2158	3287	5399	8410	13799	19712	30087	38074	46034	67913	118556	171724	279190	
440	1287	2257	3439	5648	8798	14436	20622	31475	39831	48159	71047	124028	179650	292075	
460	1344	2357	3590	5897	9186	15073	21531	32864	41589	50283	74181	129499	187575	304959	
480	1401	2456	3742	6146	9574	15710	22441	34252	43346	52408	77316	134971	195500	317844	
500	1457	2556	3894	6395	9962	16347	23351	35641	45103	54532	80450	140442	203425	330729	
600	1741	3054	4652	7641	11903	19531	27899	42583	53889	65155	96121	167799	243051	395153	
700	2025	3552	5411	8887	13844	22715	32448	49526	62674	75777	111792	195156	282677	459577	
740	2139	3751	5714	9385	14620	23989	34267	52303	66189	80027	118061	206099	298527	485346	
800	2309	4049	6169	10132	15784	25899	36997	56468	71460	86400	127463	222514	322303	524001	
850	2451	4298	6548	10755	16755	27491	39271	59940	75853	91711	135299	236192	342116	556213	
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	
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	
1480	4240	7435	11326	18603	28981	47552	67927	103678	131203	158633	234027	408543	591759	962083	
2000	5716	10024	15270	25081	39072	64110	91580	139780	176889	213871	315517				
2500	7135	12513	19063	31310	48775	80031	114323	174492	220818	266984	393873				
2700	7703	13509	20580	33801	52656	86400	123420	188378	238389	288229	425215				
2750	7845	13758	20959	34424	53626	87992	125694	191849	242782	293540	433051				
3000	8555	15003	22855	37538	58478	95952	137066	209205	264747	320096	472228				
3324	9474	16616	25312	41574	64766	106269	151803	231699	293212	354513	523003				
3500	9974	17492	26647	43767	68181	111873	159809	243918	308675	373209	550584				
3705	10556	18512	28202	46321	72159	118401	169133	258151	326686	394985	582710				
3983	11345	19897	30310	49784	77554	127253									
4292	12222	21435	32654	53633	83551	137093									
4500	12813	22471	34232	56224	87587	143716									
5000	14232	24960	38024	62453	97290	159637									
5500	15652	27449	41816	68681	106993	175558									
5774	16430	28813	43894	72095	112311	184283									
6000	17071	29939	45608	74910	116697	191479									

F7000 LIQUID CAPACITIES (GPM)

10% OVERPRESSURE, 60 DEGREE F, G=1.0, K_v=1.00, WATER

VALVE SIZE	1 x 2	1-1/2x3	2x3	3x4	4x6	6x8	8x10	12x16
ORIFICE AREA(in²)	0.720	1.770	2.950	6.600	11.430	26.060	45.660	111.870
K(=.90xKd)	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634

Set Pressure (psig)	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
15	73	181	302	675	1168	2664	4667	11435
30	100	245	408	913	1582	3607	6319	15483
50	128	316	527	1179	2042	4656	8158	19988
100	182	447	745	1668	2888	6585	11537	28267
150	223	548	913	2042	3537	8065	14130	34620
200	257	632	1054	2538	4084	9312	16316	39976
250	287	707	1179	2637	4567	10412	18242	44694
285	307	755	1258	2815	4876	11116	19477	47721
350	340	837	1395	3120	5403	12319	21584	
400	363	894	1491	3335	5776	13170	23075	
450	385	949	1581	3538	6127	13969	24474	
500	406	1000	1667	3729	6458	14724	25798	
550	426	1049	1748	3911	6773	15443	27057	
600	445	1096	1826	4085	7074	16129	28261	
650	463	1140	1900	4252	7363	16788	29415	
700	481	1183	1972	4412	7641	17422	30525	
750	498	1225	2041	4567	7909	18033	31596	
800	514	1265	2108	4717	8169	18625	32632	
850	530	1304	2173	4862	8420	19198	33637	
900	545	1342	2236	5003	8664	19754	34612	
950	560	1378	2297	5140	8902	20296	35560	
1000	575	1414	2357	5274	9133	20823	36484	
1200	629	1549	2582	5777	10005	22810	39966	
1480	699	1721	2868	6416	11111	25332	44385	
ORIFICE AREA	0.72	1.403	2.239	5.405	10.300			
2000	814	1585	2530	6108	11639			
2200	853	1663	2654	6406	12207			
ORIFICE AREA	0.521	1.403	2.239	5.405	10.300			
2500	658	1773	2829	6829	13013			
3000	721	1942	3099	7480	14255			
3500	779	2097	3347	8080	15397			
3705	801	2158	3444	8313	15842			
ORIFICE AREA	0.521	0.950	1.773					
4000	833	1518	2833					
5000	931	1697	3168					
6000	1020	1859	3470					

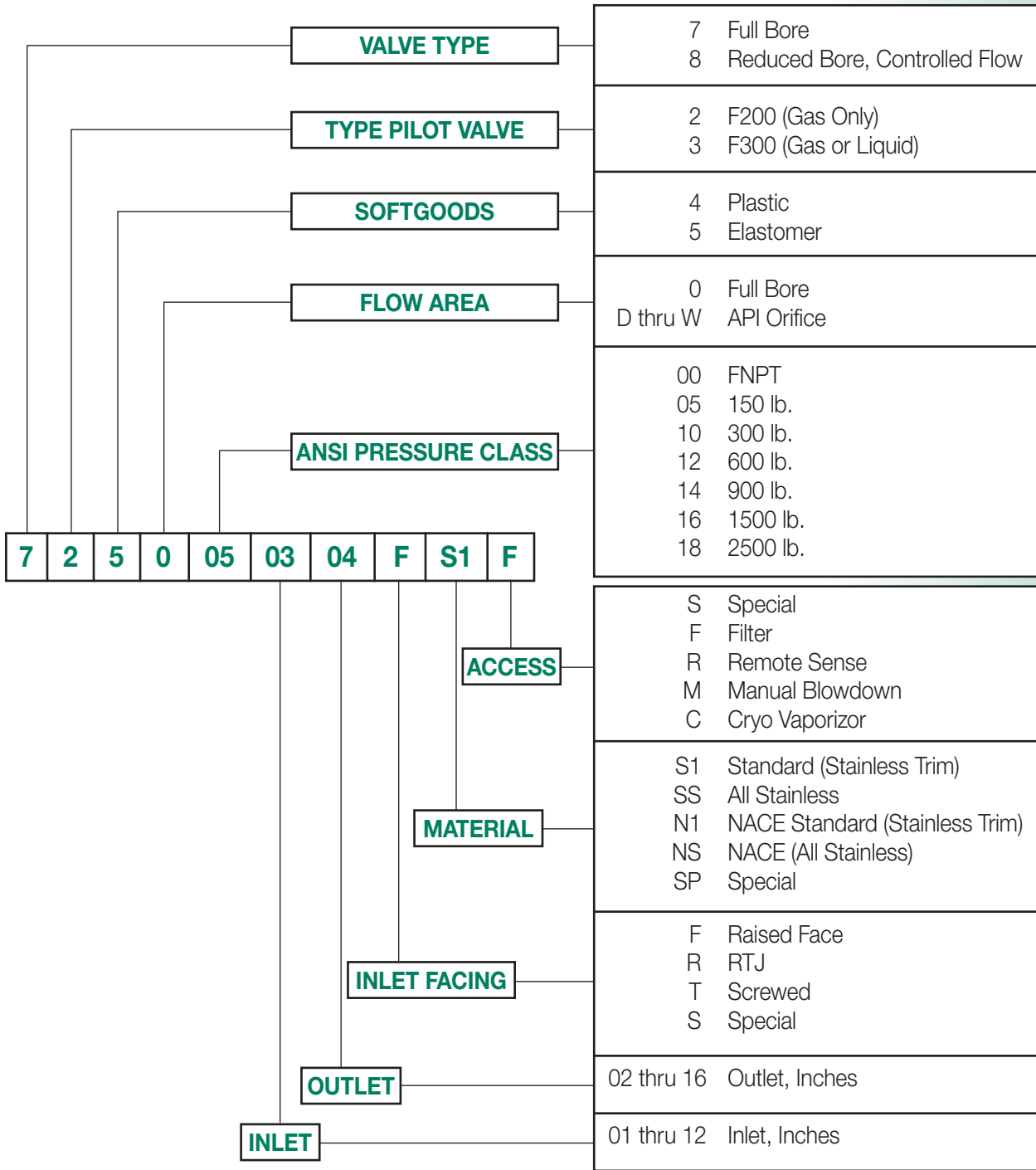
F8000 LIQUID CAPACITIES [GPM]

10% OVERPRESSURE, 60 DEGREE F, G=1.0, K_v=1.00, WATER

VALVE SIZE ORIFICE AREA (in ²) K(=.90xKd)	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	W
Set Pressure (psig)	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
15	19	33	51	83	129	212	303	462	585	707	1043	1822	2639	4290	11118
30	26	45	68	112	175	287	410	626	792	958	1413	2466	3573	5808	15053
50	33	58	88	145	226	371	529	808	1023	1236	1824	3184	4612	7499	19434
100	47	82	125	205	319	524	749	1143	1446	1749	2580	4503	6523	10604	27483
150	57	100	153	251	391	642	917	1400	1771	2141	3159	5515	7989	12988	33660
200	66	116	177	290	452	741	1059	1616	2045	2473	3648	6368	9224	14997	38867
250	74	130	197	324	505	829	1184	1807	2287	2765	4079	7120	10313	16767	43455
285	79	138	211	346	539	885	1264	1929	2441	2952	4355	7602	11011	17902	46397
350	87	153	234	384	598	981	1401	2138	2706	3271	4826	8425	12203	19839	
400	93	164	250	410	639	1048	1497	2286	2892	3497	5159	9006	13045	21209	
450	99	174	265	435	678	1112	1588	2424	3068	3709	5472	9553	13837	22496	
500	104	183	279	459	714	1172	1674	2555	3234	3910	5768	10069	14585	23712	
550	110	192	293	481	749	1229	1756	2680	3392	4101	6050	10561	15297	24870	
600	114	201	306	502	782	1284	1834	2799	3542	4283	6319	11030	15977	25976	
650	119	209	318	523	814	1336	1909	2914	3687	4458	6577	11481	16629	27036	
700	124	217	330	543	845	1387	1981	3024	3826	4626	6825	11914	17257	28057	
740	127	223	340	558	869	1426	2037	3109	3934	4757	7017	12250	17743	28847	
800	132	232	353	580	904	1482	2118	3232	4090	4946	7296	12737	18449	29994	
850	136	239	364	598	931	1528	2183	3332	4216	5098	7521	13129	19017	30917	
900	140	246	375	615	958	1572	2246	3428	4339	5246	7739	13509	19568	31813	
950	144	253	385	632	985	1616	2308	3522	4457	5389	7951	13880	20104	32685	
1000	148	259	395	648	1010	1657	2368	3614	4573	5529	8157	14240	20626	33534	
1200	162	284	432	710	1107	1816	2594	3959	5010	6057	8936	15599	22595	36735	
1300	180	315	480	789	1229	2016	2880	4396	5564	6727	9924	17324	25093	40796	
1480	195	343	522	858	1336	2193	3132	4781	6050	7315	10791				
2000	209	366	558	917	1429	2344	3348	5111	6468	7820	11536				
2200	219	384	586	962	1498	2458	3512	5360	6783	8201	12099				
2500	234	410	624	1025	1597	2621	3744	5714	7231	8743	12898				
3000	256	449	684	1123	1750	2871	4101	6259	7921	9577	14129				
3500	276	485	739	1213	1890	3101	4429	6761	8556	10344	15261				
3705	284	499	760	1248	1944	3190	4557	6956	8803	10643	15701				
4000	296	518	790	1297	2020	3315									
5000	330	579	883	1450	2259	3706									
6000	362	635	967	1588	2474	4060									

PART NUMBERING

The following part numbering system is to be used when ordering a FLOW SAFE F7000 or F8000, with F200 or F300 Pilot Valves:



EXAMPLES:

DESCRIPTION

1. 4"x 6", Modulating-type Pilot Valve; Set Pressure=600 psig, Natural Gas Service, Carbon Steel, NACE, 300# RF Inlet, 150# RF Outlet, 'M' Orifice, Buna-N Seals, Filter

2. 3"x4", Snap-Acting-type Pilot Valve; Set Pressure=75 psig, Cryogenic N2 Service, Stainless Steel, 150# RF Inlet, 150# RF Outlet, Full Bore, Teflon Main Valve Seat

3. 1-1/2"x3", Modulating-type Pilot Valve; Set Pressure=50 psig, 60°F, Fresh Water Service, Stainless Steel, 1-1/2" FNPT Inlet, 2" FNPT Outlet, 'G' Orifice, Teflon Seat

DESIGNATION

835M100406FN1F@600 psig
with Buna-N Seat & Elastomers

DESIGNATION

7240050304FSS@75 psig
with Teflon Seat

DESIGNATION

834G001503TSS@50 psig
with Teflon Seat



COMPANY _____

REF. NO. _____

FLOW SAFE REF. NO. _____

SPECIFICATION SHEET AND ORDER FORM

PLEASE ANSWER ALL QUESTIONS	SKETCH AREA/COMMENTS		
SERVICE CONDITIONS	TAG NO.		
	QTY.		
	SERVICE MEDIA		
	MOLECULAR WEIGHT		
	SPECIFIC GRAVITY		
	COMPRESSIBILITY FACTOR		
	VISCOSITY		
	REQUIRED CAPACITY	SCFM	
		LB/HR.	
		GPM	
	SET PRESSURE	PSIG	
		BARS	
	ALLOWABLE OVERPRESSURE	%	
	REQUIRED BLOWDOWN	%	
	BACK PRESSURE	PSIG BARS	
RELIEVING TEMPERATURE	°F °C		
REQD CLEAN LEVEL	LOX <input type="checkbox"/> GOX <input type="checkbox"/>		
VALVE SELECTION	BODY MATERIAL		
	SEAT & SOFT GOODS		
	TRIM MATERIAL		
	CONNECTION NUMBERS		
	OPTION NUMBERS		
	SIZE INLET/OUTLET		
	FLANGE FACING	RF <input type="checkbox"/> SF 64-125 RMS <input type="checkbox"/> 126-250RMS <input type="checkbox"/>	
	ORIFICE SELECTED	ORIFICE CALCULATED	
	VALVE ASSEMBLY NUMBER		
	ACCESSORIES		
MODIFICATIONS			

**PHOTOCOPY FOR YOUR RECORDS — SEND OR FAX COPY TO FLOW SAFE INC,
OR YOUR AUTHORIZED REPRESENTATIVE**

OTHER PRODUCTS

F7000/8000 Series
Safety Relief Valve –
IM Construction



F84/85 Series
Safety Relief Valve

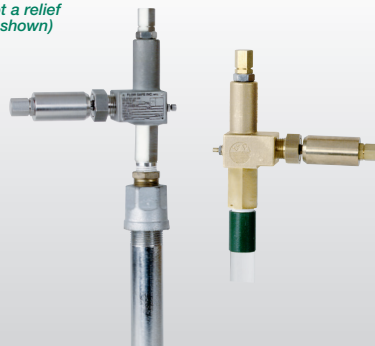


F70U Series
Unloader Valve



F80M Series with Whistle

(This is not a relief
device as shown)



F70PR Series
Pressure Relief Valve



F84L Series
Liquid Relief Valve



FLOW SAFE, INC
"Environmental Performance for Industry"

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Orchard Park, NY 14127

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Sales (716) 662-2585
Fax (716) 667-3642
Internet www.flowsafe.com

YOUR AUTHORIZED REPRESENTATIVE: