

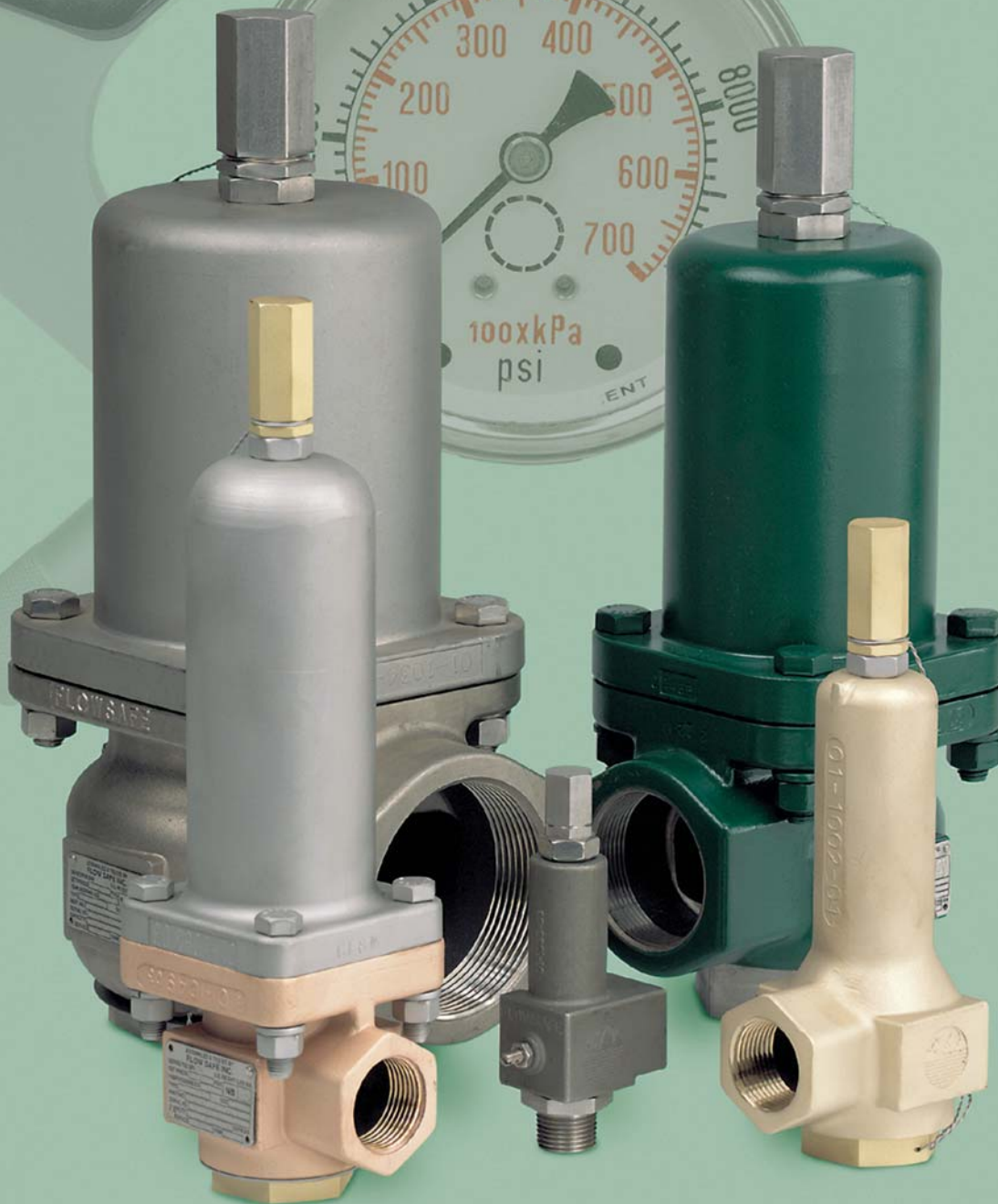


FLOW SAFE, Inc.

"Environmental Performance for Industry"

F80 Series

**"Enhanced Performance"
Conventional-Style Safety Valves**



- SNAP-ACTING PERFORMANCE
- REPEATABLE, BUBBLE-TIGHT, SOFT-SEAT DESIGN
- ADJUSTABLE BLOWDOWN
- 15 TO 10,313 PSIG
- -423°F TO +525°F
- VARIETY OF MATERIALS AND END CONNECTIONS AVAILABLE
- SUPERIOR FLOW CAPACITIES - NATIONAL BOARD CERTIFIED
- BUILT TO ASME VIII

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INTRODUCTION

Today's industrial needs are being driven by requirements for leak-tight valves to reduce fugitive emissions and to save product. **FLOW SAFE** F80 Series "Enhanced Performance" safety valves have accurate operational characteristics, and are engineered to provide superior performance for today's industry.

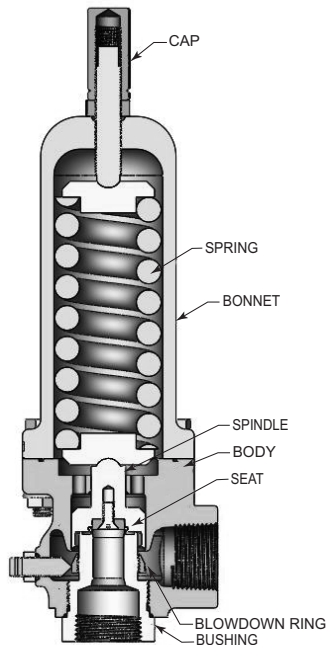
The F80 Series design features include:

- Soft seats
- Bubble-tight to 98% of set point
- Adjustable blowdown
- High capacities through large nozzle
- Integral nozzle/inlet bushing
- All valves bear ASME "UV" stamp at 15 psig and above
- Full lift at set pressure
- Full open until reseal
- Set pressures to 10,313 psig
- -423°F to +525°F temperature range
- A variety of materials and end connections available
- Repeatable reseating
- Cost-effective repairability
- For your safety... All lift lever kits are packed!

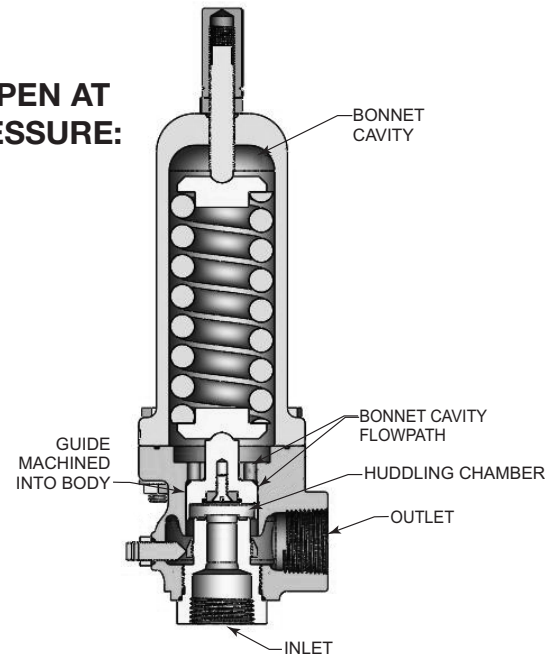
The policy of **FLOW SAFE** and its authorized assemblers is a commitment to value through:

- Environmentally Compatible Products
- Cost-Efficient Design with Minimal Parts
- Quality Products, Readily Available
- "No Hassle" Service

CLOSED:



FULL OPEN AT SET PRESSURE:



In any pressurized system, there is the potential for a pressure rise that could damage the piping or vessel. Pressure relief valves are recognized as an acceptable means of restricting this rise by venting excess pressure from the system.

The **F80 Series** safety valves are **state-of-the-art, cost-efficient, high capacity, soft seated** valves, designed to meet the critical needs of today's industry. A **bubble-tight** seal is achieved through the use of an elastomeric or plastic seat. The **F80 Series** uses a compression spring opposing the system inlet pressure acting on the valve's effective seat area to establish the set pressure. When system pressure overcomes the spring preload, an initial escape of fluid (simmer) occurs past the seat. Simmer continues as significant pressure develops within the huddling chamber, and forces the valve into **full lift**, at the "popping" pressure.

The blowdown ring acts, along with the body bore, to create a restriction in the flowpath to the valve outlet. Pressure also flows between the spindle and body into the bonnet cavity, to assist the spring to reseat the valve. The sliding fit between these two parts assures that the bonnet cavity pressurization lags the pressure buildup under the spindle, to assure full lift.

A **unique** design feature allows these pressures, coupled with the areas they act on, to

move the spindle to, and remain at, full lift at set pressure.

As inlet pressure decays, the net lifting force is reduced to a point where the spindle begins to move downward. Again, the small clearance between the spindle and the body guide allows bonnet pressure to increase the closing force on the spindle, accelerating the closure and causing a sharp reseat action. Extensive testing has verified that the spindle **opens fully** at set, **remains in full lift** during flow, and **closes sharply** on reseat.

Blowdown is readily controlled by adjusting the blowdown ring. Raising the ring increases the bonnet cavity pressure and shortens blowdown, i.e., reseating pressure closer to popping pressure. Lowering the ring lengthens blowdown. Set pressure is not affected by the blowdown ring position.

The **F80 Series** blowdown can be adjusted and set to a maximum twenty percent. Standard FLOWSAFE valves are shipped with seven to ten percent blowdown. Other blowdown settings can be provided at the customer's request.

FLOWSAFE is proud to offer the **F80 Series** safety valves to industry. We are confident that these valves present a **cost-effective** and **reliable** solution to your needs, for pressure relief and pollution control.

SERVICE ENVELOPE •

F84 AND F85 SERIES

ORIFICE			-1	-2	-3	-4	-4	-6(D)	-8(E)	-F	-G	-H	-J
ORIFICE DIA (in)			.062	.138	.209	.289	.289	.436	.577	.718	.919	1.149	1.467
ORIFICE AREA (in ²)			.003	.015	.034	.065	.065	.149	.261	.405	.664	1.036	1.689
MAX SET PRESSURE (PSIG)	M BODY	BRASS	6600	4072	890	350	—	—	—	—	—	—	—
		CS	10,313	4072	890	350	—	—	—	—	—	—	—
		SS	10,313	4072	890	350	—	—	—	—	—	—	—
		NACE	10,313	4072	890	350	—	—	—	—	—	—	—
	MED BODY	BRASS	—	—	—	—	3500	2900	1125	—	—	—	—
		CS	—	—	—	—	4921	2900	1125	—	—	—	—
		SS	—	—	—	—	4921	2900	1125	—	—	—	—
		NACE	—	—	—	—	4921	2900	1125	—	—	—	—
	LARGE BODY	BRASS	—	—	—	—	5000	4500	2600	500	500	382	298
		CS	—	—	—	—	9612	5774*	4292	839	668	382	298
		SS	—	—	—	—	9612	5774*	4292	839	668	382	298
		NACE	—	—	—	—	9612	5774*	4292	839	668	382	298
	X-LARGE BODY	BRASS	—	—	—	—	—	—	—	—	—	450	450
		CS	—	—	—	—	—	—	—	5000	3705	2750	2700
		SS	—	—	—	—	—	—	—	5000	3705	2750	2700
		NACE	—	—	—	—	—	—	—	5000	3705	2750	2700
SERVICE TEMP RANGE (°F)	F84	BRASS	-325 TO 406		* 6100 psig with 3/4" FNPT inlet M – MICRO MED – INTEGRAL BODY AND BONNET LARGE – BOLTED BONNET FOR INTERMEDIATE PRESSURE SERVICE X-LARGE – BOLTED BONNET FOR HIGH PRESSURE SERVICE								
		CS	-20 TO 525										
		SS	-423 TO 525										
		NACE	-423 TO 525										
	F85	BRASS	-65 TO 406										
		CS	-20 TO 500										
		SS	-65 TO 500										
		NACE	-65 TO 500										

- NACE TRIM AVAILABLE IN ACCORDANCE WITH MR0175.
- FLANGED VALVE RATINGS IN ACCORDANCE WITH ASME B16.5

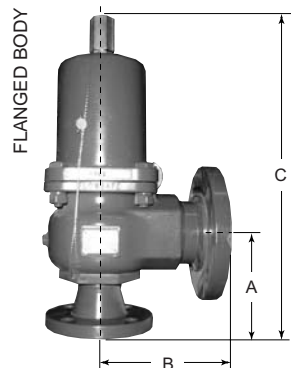
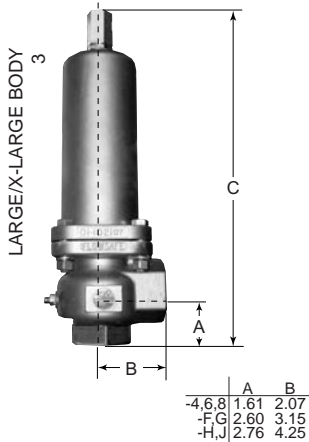
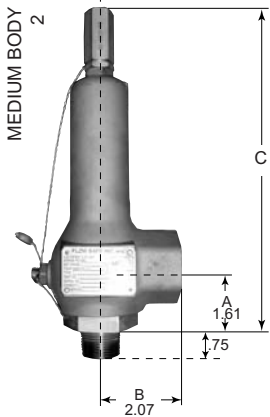
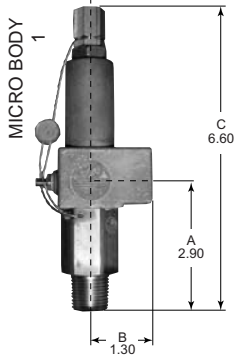
SEAT DATA •

F84 AND F85 SERIES

VALVE SERIES	MATERIAL	PROCESS TEMPERATURE (°F)		PRESSURE (PSIG)	
		MAX	MIN	MAX	MIN
F84 PLASTIC SEAT	VESPEL®	500	-423	9612	1000
	PEEK	525	0	9612	500
	TEFLON®/PTFE	400	-423	500	15
	KEL-F/PCTFE	400	-423	3000	500
F85 ELASTOMER SEAT	BUNA-N	275	-30	1500	15
	VITON®	400	-30	1500	15
	ETHYL PROP	325	-65	2500	15
	KALREZ®	500	0	2500	15
	POLYURETHANE	225	-60	10,313	500

- FOR LOWER PRESSURES, TEMPERATURES, AND CHEMICAL COMPATIBILITY CONSULT **FLOW SAFE** ENGINEERING.
- TEFLON® AND VESPEL® ARE REGISTERED TRADEMARKS OF THE DUPONT COMPANY.
- KALREZ® AND VITON® ARE REGISTERED TRADEMARKS OF DUPONT DOW ELASTOMERS.

THREADED CONNECTIONS



ORIFICE SIZE	BODY SIZE	SET PRESS. RANGE (PSIG)	W T. (lbs)	MAX "C" DIMENSION								OUTLET CONN. FNPT	
				INLET CONNECTION									
				1/2" FNPT	3/4" FNPT	1" FNPT	1-1/2" FNPT	2" FNPT	1/2" MNPT	3/4" MNPT	1" MNPT		
-1	M	100-10,313	1.0	—	—	—	—	—	—	6.60	6.60	—	1/2" OR 3/4"
-2	M	15-4072	1.0	—	—	—	—	—	—	6.60	6.60	—	
-3	M	15-890	1.0	—	—	—	—	—	—	6.60	6.60	—	
-4	M	15-350	1.0	—	—	—	—	—	—	6.60	6.60	—	
-4	MED	15-4921	5.0	8.75	8.75	8.75	—	—	—	8.75	8.75	8.75	1"
-4	LARGE	4922-9612	12	—	11.90	11.90	—	—	—	—	—	—	
-6	MED	15-2900	5.0	—	8.75	8.75	—	—	—	—	8.75	8.75	1"
-6	LARGE	2901-6100	12	—	11.90	11.90	—	—	—	—	—	—	
-8	MED	15-1125	5.0	—	8.75	8.75	—	—	—	—	8.75	8.75	1"
-8	LARGE	1126-4292	12	—	11.90	11.90	—	—	—	—	—	—	
-F	LARGE	15-839	29	—	—	—	14.42	—	—	—	—	—	2"
-F	X-LARGE	840-5000	33	—	—	—	17.80	—	—	—	—	—	
-G	LARGE	15-668	29	—	—	—	14.42	—	—	—	—	—	2"
-G	X-LARGE	669-3705	33	—	—	—	17.80	—	—	—	—	—	
-H	LARGE	15-382	48	—	—	—	15.04	15.04	—	—	—	—	3"
-H	X-LARGE	383-2750	55	—	—	—	22.25	22.25	—	—	—	—	
-J	LARGE	15-298	48	—	—	—	—	15.04	—	—	—	—	3"
-J	X-LARGE	299-2700	55	—	—	—	—	22.25	—	—	—	—	

PHOTO 1 DENOTES MICRO BODY IN -1, -2, -3, -4 ORIFICES.

PHOTO 2 DENOTES MEDIUM BODY IN SIZES -4, -6, -8 ORIFICES.

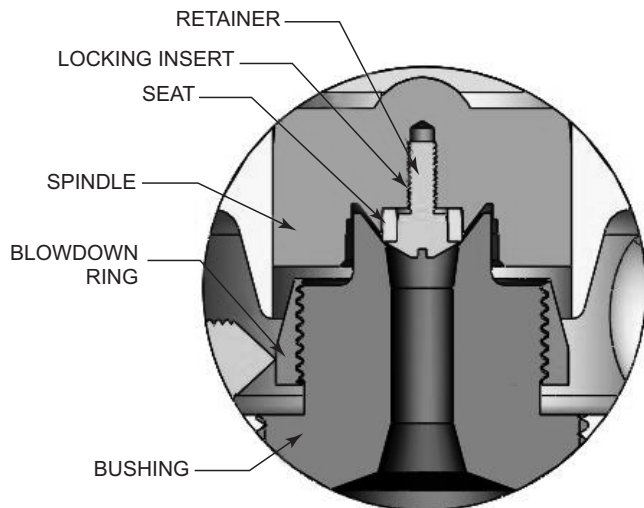
PHOTO 3 DENOTES LARGE AND X-LARGE BODY SIZES ON -4, -6, -8 -F, -G, -H, -J ORIFICES.

FLANGED CONNECTIONS

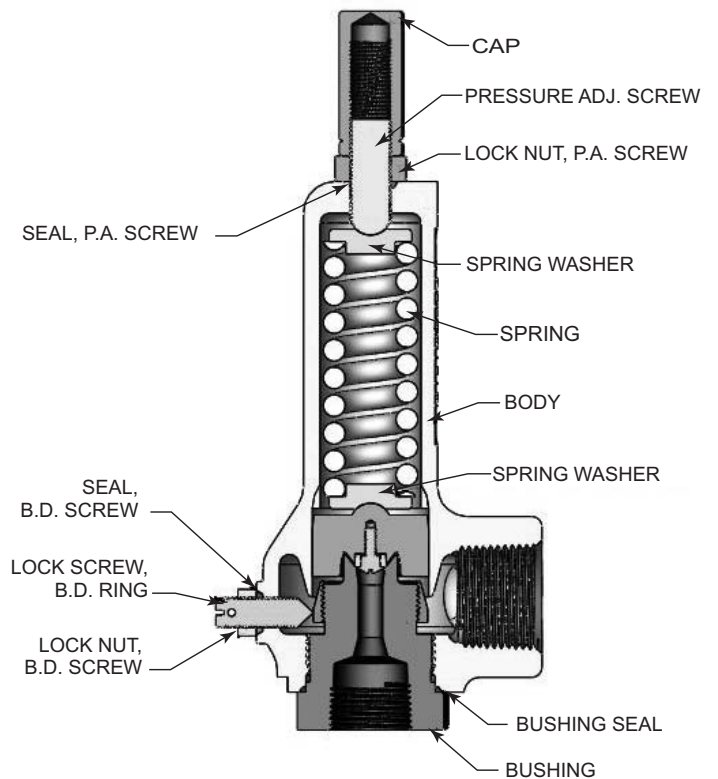
ORIFICE SIZE	MEDIUM BODY/LARGE BODY				X-LARGE BODY				OUTLET CONN
	A	B	C	WT (lbs)	A	B	C	WT (lbs)	
-4	5.72	6.75	16.2	22	—	—	—	—	1"
-6	5.72	6.75	16.2	22	—	—	—	—	1"
-8	5.72	6.75	16.2	22	—	—	—	—	1"
-F	4.87	4.75	16.7	45	5.25	5.06	20.4	60	2"
-G	4.87	4.75	16.7	45	5.25	5.06	20.4	60	2"
-H	5.37	6.50	17.5	67	6.56	7.00	25.9	94	3"
-J	5.37	6.50	17.5	67	6.56	7.00	25.9	94	3"

- ALL DIMENSIONS AND WEIGHTS ARE FOR MAXIMUM FLANGE RATING CONDITIONS.
- API 526 AND CUSTOM DIMENSIONS AVAILABLE ON REQUEST.
- RF AND RTJ ARE AVAILABLE AS STANDARD.
- ALL CONNECTION DIMENSIONS ARE FOR STANDARD FLOW SAFE VALVES.
- DIMENSIONS OF FLANGED F80M "MICRO" VALVES AVAILABLE UPON REQUEST.

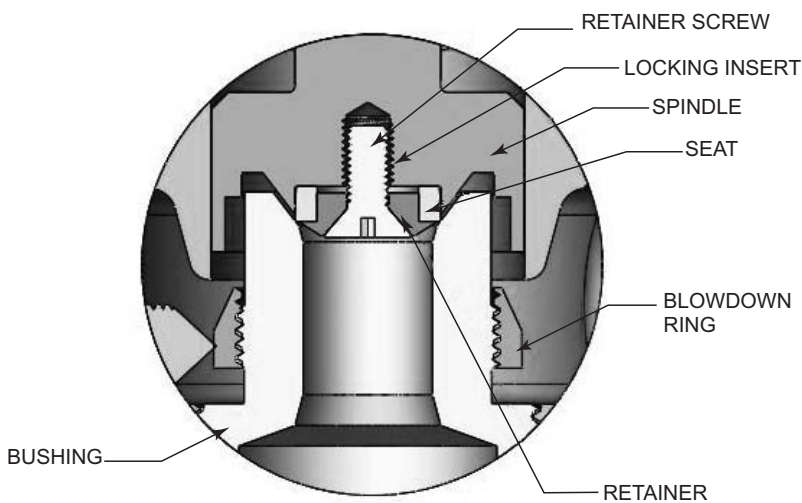
MEDIUM BODY



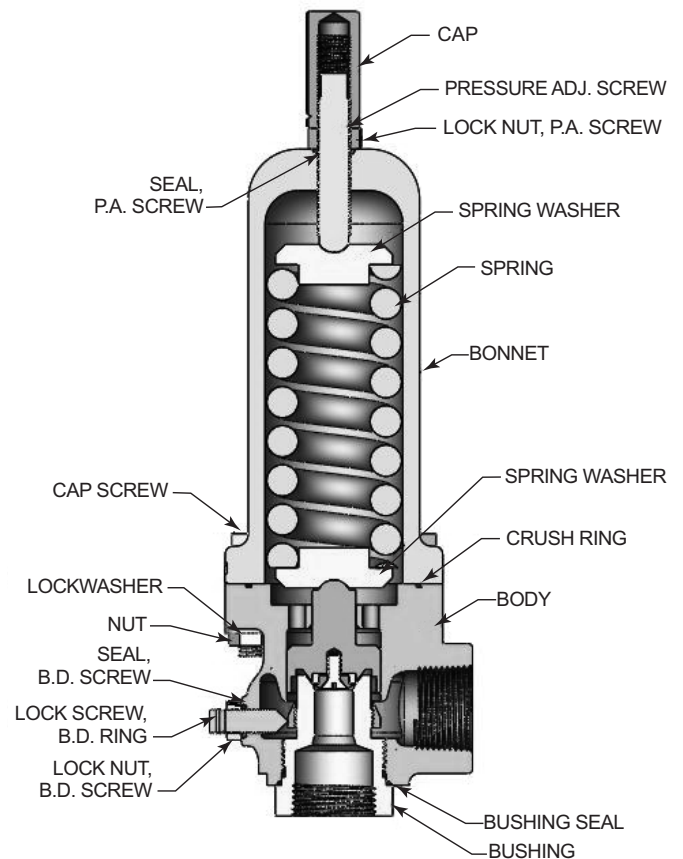
SPINDLE / SEAT DETAIL



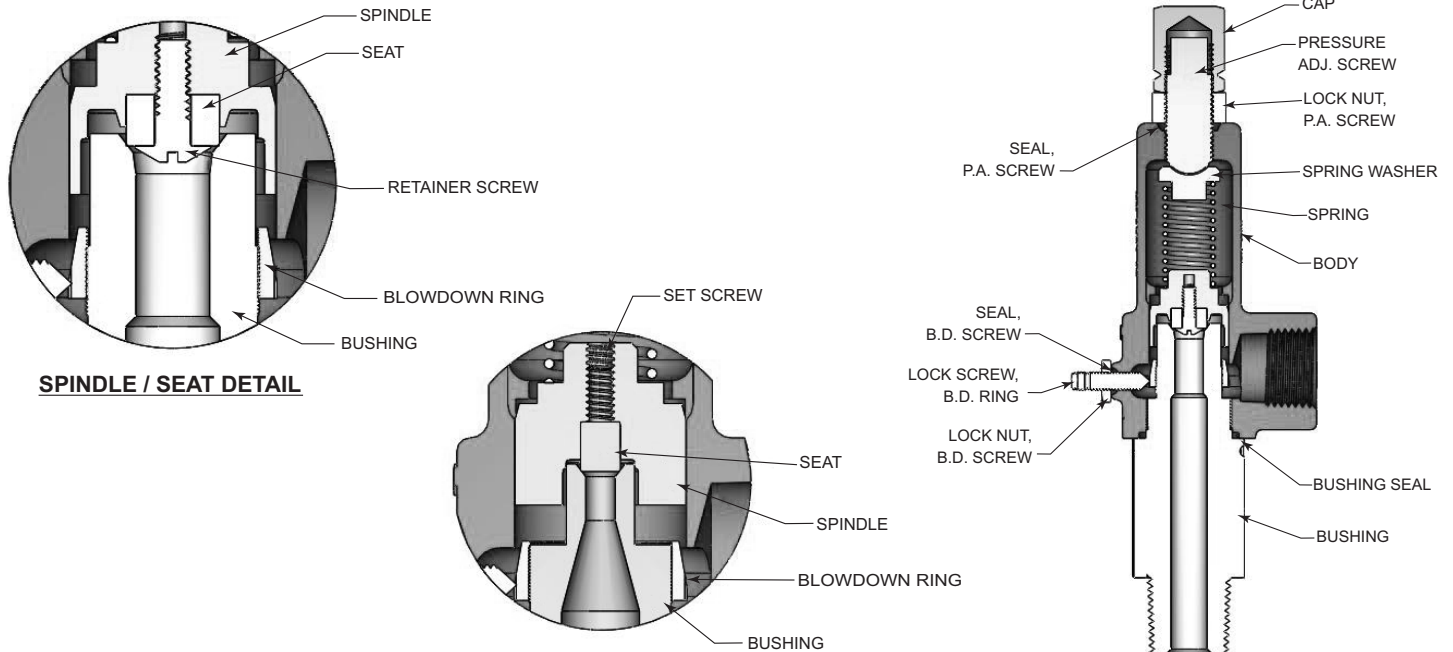
LARGE / X-LARGE BODY



SPINDLE / SEAT DETAIL



MICRO BODY (F84M SERIES)



SPINDLE / SEAT DETAIL

F84M-1 &
F84M-2 (>890 PSIG)
ONLY

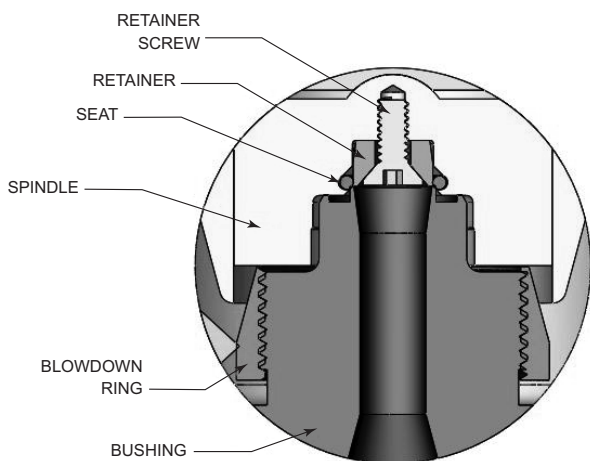
MATERIALS

F84 -1, -2, -3, -4, -6, -8, -F, -G, -H, -J ORIFICES

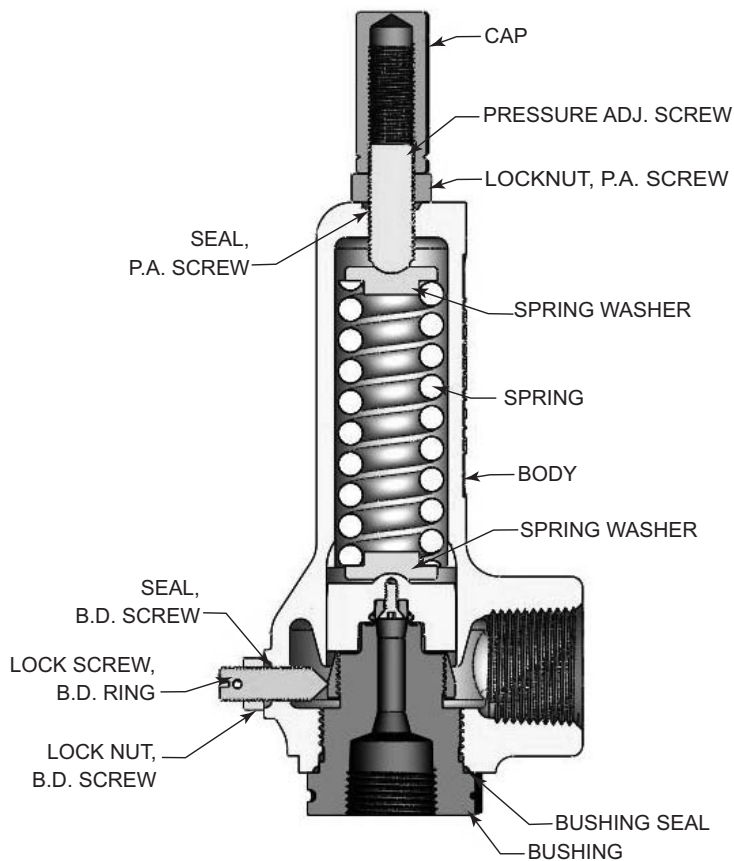
PART NAME	BRASS	CARBON STEEL (NACE)	STAINLESS STEEL (NACE)
BODY	SB-61	SA-351 CF8M	SA-351 CF8M
BONNET	SA-351 CF8M	SA-351 CF8M	SA-351 CF8M
SPRING WASHER	B16	STEEL (316 SS)	316 SS
SPRING	302/304/17-7 SS	STEEL (INCONEL)	302/304/17-7 SS (INCONEL)
SPINDLE	B16	316 SS	316 SS
SEAT (See Page 4)	PLASTIC	PLASTIC	PLASTIC
BUSHING	B16	SA-479 316 ¹	SA-479 316 ¹
BUSHING SEAL	PTFE	PTFE	PTFE
RETAINER	B16	316 SS	316 SS
RETAINER SCREW	BRASS / MONEL	304 / 316 SS	304 / 316 SS
LOCKING INSERT	304 SS	304 SS (INCONEL)	304 SS (INCONEL)
PRESSURE ADJ. SCREW	B16	STEEL (316 SS)	316 SS
LOCK NUT, P.A. SCREW	SS	SS	SS
SEAL, P.A. SCREW	PTFE	PTFE	PTFE
CAP	B16	316 SS	316 SS
BLOWDOWN RING	B16	316 SS	316 SS
LOCK SCREW, B.D. RING	MONEL	316 SS	316 SS
SEAL, B.D. SCREW	PTFE	PTFE	PTFE
LOCK NUT, B.D. SCREW	SS	SS	SS
CAP SCREW	SA-193 B8	SA-193 B8	SA-193 B8
NUT	SA-194 GR. 8	SA-194 GR. 8	SA-194 GR. 8
LOCKWASHER	SS	SS	SS
CRUSH RING	PTFE	PTFE	PTFE

¹Grade 316/316L used for welded construction

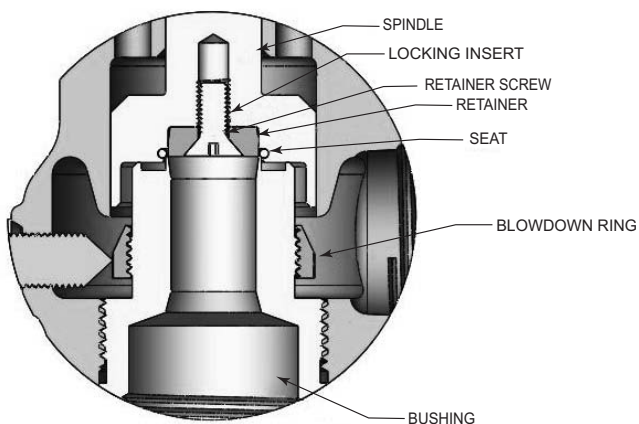
MEDIUM BODY



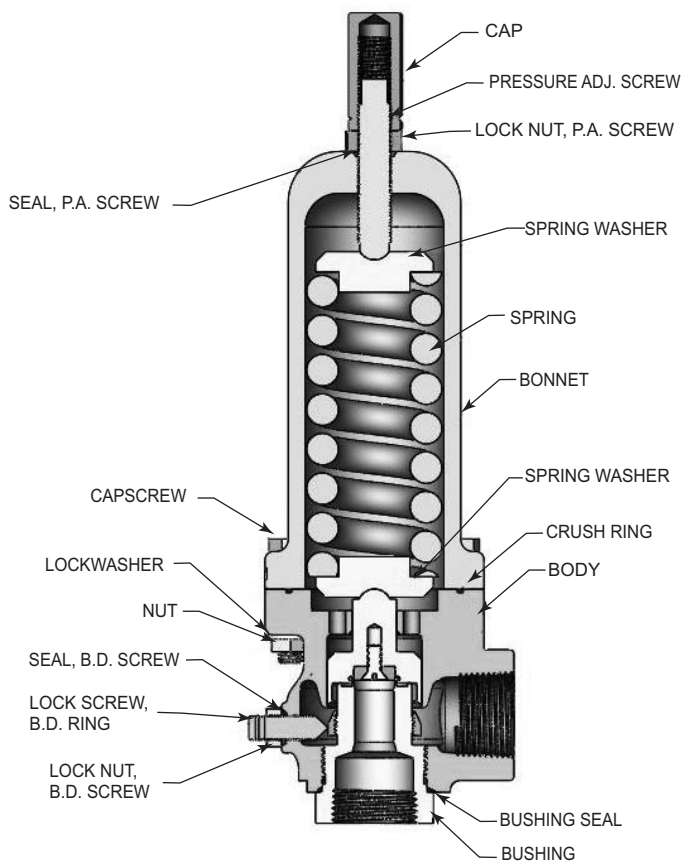
SPINDLE / SEAT DETAIL



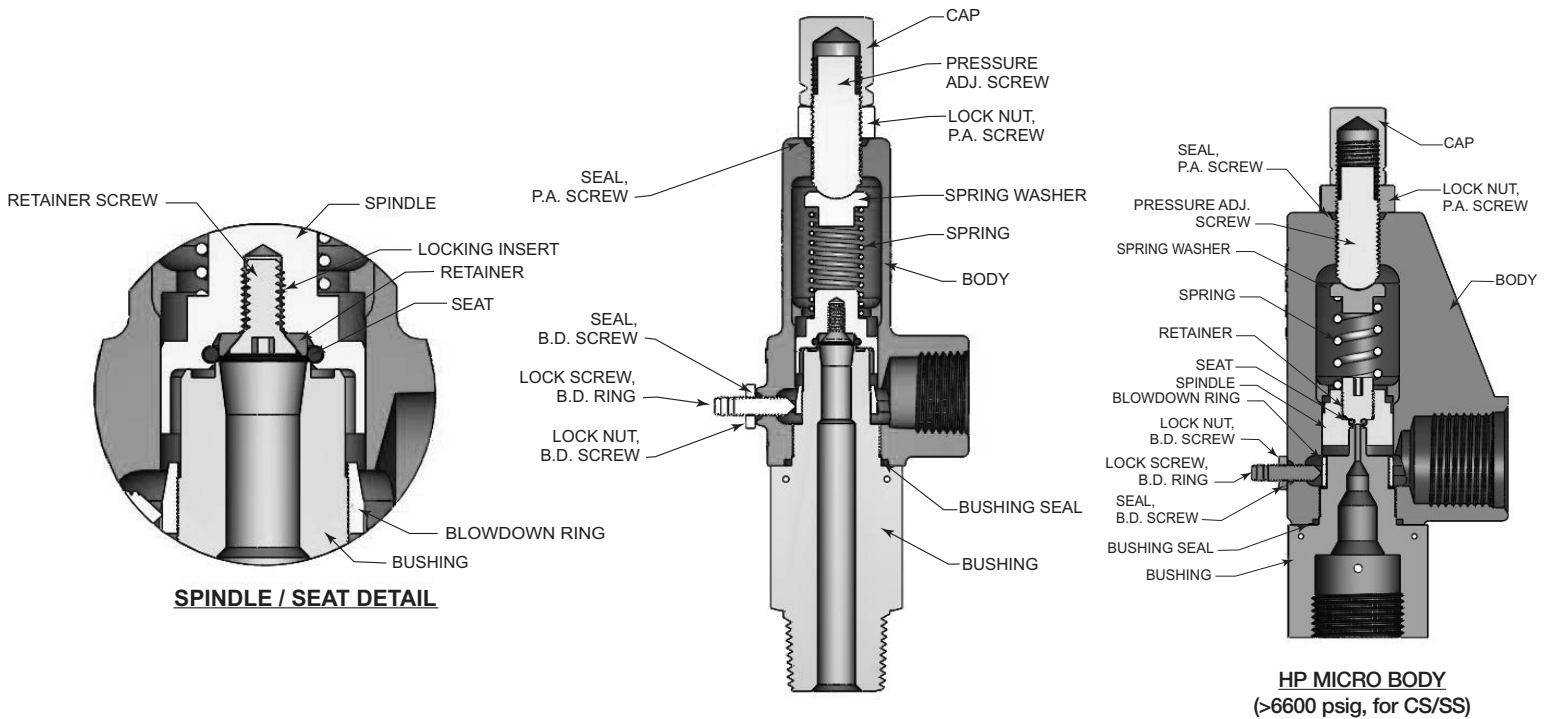
LARGE / X-LARGE BODY



SPINDLE / SEAT DETAIL



MICRO BODY (F85M SERIES)



HP MICRO BODY
(>6600 psig, for CS/SS)

MATERIALS

F85 -1, -2, -3, -4, -6, -8, -F, -G, -H, -J ORIFICES

PART NAME	BRASS	CARBON STEEL (NACE)	STAINLESS STEEL (NACE)
BODY	SB-61	SA-351 CF8M	SA-351 CF8M
BONNET	SA-351 CF8M	SA-351 CF8M	SA-351 CF8M
SPRING WASHER	B16	STEEL (316 SS)	316 SS
SPRING	302/304/17-7 SS	STEEL (INCONEL)	302/304/17-7 SS (INCONEL)
SPINDLE	B16	316 SS	316 SS
SEAT (See Page 4)	ELASTOMER	ELASTOMER	ELASTOMER
BUSHING	B16	SA-479 316 ¹	SA-479 316 ¹
BUSHING SEAL	PTFE	PTFE	PTFE
RETAINER	B16	316 SS	316 SS
RETAINER SCREW	BRASS / MONEL	304 / 316 SS	304 / 316 SS
LOCKING INSERT	304 SS	304 SS (INCONEL)	304 SS (INCONEL)
PRESSURE ADJ. SCREW	B16	STEEL (316 SS)	316 SS
LOCK NUT, P.A. SCREW	SS	SS	SS
SEAL, P.A. SCREW	PTFE	PTFE	PTFE
CAP	B16	316 SS	316 SS
BLOWDOWN RING	B16	316 SS	316 SS
LOCK SCREW, B.D. RING	MONEL	316 SS	316 SS
SEAL, B.D. SCREW	PTFE	PTFE	PTFE
LOCK NUT, B.D. SCREW	SS	SS	SS
CAP SCREW	SA-193 B8	SA-193 B8	SA-193 B8
NUT	SA-194 GR. 8	SA-194 GR. 8	SA-194 GR. 8
LOCKWASHER	SS	SS	SS
CRUSH RING	PTFE	PTFE	PTFE

¹Grade 316/316L used for welded construction

INLET/OUTLET SELECTIONS •

THREADED F84/F85 SERIES

ORIFICE	BODY SIZE	F84 ASSEMBLY NUMBER	F85 ASSEMBLY NUMBER	ORIFICE SIZE		CONNECTIONS	
				DESIGNATION	AREA (IN ²)	INLET	OUTLET
-1	MICRO	01-2183M-10X	01-2184M-10X	-1	.003	1/2 MNPT	1/2 FNPT
		01-2183M-11X	01-2184M-11X			1/2 MNPT	3/4 FNPT
		01-2183M-21X	01-2184M-21X			3/4 MNPT	3/4 FNPT
-2	MICRO	01-2188M-10X	01-2185M-10X	-2	.015	1/2 MNPT	1/2 FNPT
		01-2188M-11X	01-2185M-11X			1/2 MNPT	3/4 FNPT
		01-2188M-21X	01-2185M-21X			3/4 MNPT	3/4 FNPT
-3	MICRO	01-2189M-10X	01-2186M-10X	-3	.034	1/2 MNPT	1/2 FNPT
		01-2189M-11X	01-2186M-11X			1/2 MNPT	3/4 FNPT
		01-2189M-21X	01-2186M-21X			3/4 MNPT	3/4 FNPT
-4	MICRO	01-2190M-10X	01-2187M-10X	-4	.065	1/2 MNPT	1/2 FNPT
		01-2190M-11X	01-2187M-11X			1/2 MNPT	3/4 FNPT
		01-2190M-21X	01-2187M-21X			3/4 MNPT	3/4 FNPT
-4	MEDIUM (B)	01-1155F-10X	01-1165F-10X	-4	.065	1/2 FNPT	1 FNPT
		01-1155F-20X	01-1165F-20X			3/4 FNPT	
01-1155F-30X		01-1165F-30X	1 FNPT				
01-1155M-10X		01-1165M-10X	1/2 MNPT				
01-1155M-20X		01-1165M-20X	3/4 MNPT				
01-1155M-30X		01-1165M-30X	1 MNPT				
-4	LARGE (C)	01-1158F-20X	01-1168F-20X	-4	.065	3/4 FNPT	1 FNPT
		01-1158F-30X	01-1168F-30X			1 FNPT	
-6	MEDIUM (B)	01-1156F-20X	01-1166F-20X	-6	.149	3/4 FNPT	1 FNPT
		01-1156F-30X	01-1166F-30X			1 FNPT	
		01-1156M-20X	01-1166M-20X			3/4 MNPT	
		01-1156M-30X	01-1166M-30X			1 MNPT	
-6	LARGE (C)	01-1159F-20X	01-1169F-20X	-6	.149	3/4 FNPT	1 FNPT
		01-1159F-30X	01-1169F-30X			1 FNPT	
-8	MEDIUM (B)	01-1157F-20X	01-1167F-20X	-8	.261	3/4 FNPT	1 FNPT
		01-1157F-30X	01-1167F-30X			1 FNPT	
		01-1157M-20X	01-1167M-20X			3/4 MNPT	
		01-1157M-30X	01-1167M-30X			1 MNPT	
-8	LARGE (C)	01-1160F-20X	01-1170F-20X	-8	.261	3/4 FNPT	1 FNPT
		01-1160F-30X	01-1170F-30X			1 FNPT	
-F	L (D)	01-1161F-40X	01-1171F-40X	-F	.405	1-1/2 FNPT	2 FNPT
		01-1161F-41X	01-1171F-41X			1-1/2 FNPT	
-G	L (D)	01-1162F-40X	01-1172F-40X	-G	.664	1-1/2 FNPT	2 FNPT
		01-1162F-41X	01-1172F-41X			1-1/2 FNPT	
-H	L (E)	01-1163F-40X	01-1173F-40X	-H	1.036	1-1/2 FNPT	3 FNPT
		01-1163F-50X	01-1173F-50X			2 FNPT	
-H	XL (E)	01-1163F-41X	01-1173F-41X	-H	1.036	1-1/2 FNPT	3 FNPT
		01-1163F-51X	01-1173F-51X			2 FNPT	
-J	L (E)	01-1164F-50X	01-1174F-50X	-J	1.689	2 FNPT	3 FNPT
		01-1164F-51X	01-1174F-51X			2 FNPT	

• THE "X" IN THE PART NUMBER REPRESENTS THE MATERIAL CONFIGURATIONS AVAILABLE (SEE PG. 19). THE SUBMITTAL DRAWING, AVAILABLE FROM YOUR AREA REP, LISTS ALL MATERIALS AND THEIR ASSOCIATED SPECIFICATIONS IN DETAIL FOR CUSTOMER REVIEW. PAGE 19 ALSO SHOWS HOW TO PROPERLY INCORPORATE CONNECTION SIZE AND TYPE INTO THE PART NUMBERING SYSTEM.

SIZING DATA •

F80 SERIES

Below are properties of common gases and sizing formulas to enable calculation of required orifice size for an F80 safety valve. This sizing method conforms with ASME Section VIII and API RP 520 – Part I.

On pages 13 through 18 are capacity charts for some of the most common gases, including air, nitrogen, oxygen, hydrogen, natural gas, and carbon dioxide. These charts can be used for direct selection of safety valve orifice size without the need for calculation.

In addition, **FLOWSIZE**, the Flow Safe relief valve sizing program, may be used to quickly and accurately determine required valve size.

Gas	Mol. Wt. (M)	Specific Heat Ratio (Cp/Cv)	Gas Constant (C)
Acetylene	26	1.28	345
Air	29	1.40	356
Ammonia	17	1.30	347
Argon	40	1.66	377
Benzene	78	1.10	327
Carbon Disulphide	76	1.21	338
Carbon Dioxide	44	1.29	346
Carbon Monoxide	28	1.40	356
Chlorine	71	1.36	352
Cyclohexane	84	1.08	324
Ethane	30	1.19	336
Ethylene	28	1.24	341
Helium	4	1.66	377
Hexane	86	1.08	324
Hydrochloric Acid	36.5	1.40	356

Gas	Mol. Wt. (M)	Specific Heat Ratio (Cp/Cv)	Gas Constant (C)
Hydrogen	2	1.41	357
Hydrogen Sulphide	34	1.32	348
Iso Butane	58	1.11	328
Methane	16	1.31	348
Methyl Alcohol	32	1.20	337
Methyl Chloride	50.5	1.20	337
N-Butane	58	1.19	336
Natural Gas	19	1.27	345
Nitrogen	28	1.40	356
Oxygen	32	1.40	356
Pentane	72	1.09	325
Propane	44	1.13	330
Sulphur Dioxide	64	1.27	344
Water Vapor/Steam	18	1.33	350

• NOTE: FOR CORROSION COMPATIBILITY WITH THESE GASES, CONSULT **FLOW SAFE ENGINEERING**.

FORMULAS •

<p>VAPORS OR GASES (capacity in scfm)</p> $A = \frac{V\sqrt{MTZ}}{6.32 CKP_1}$ <p>VAPORS OR GASES (capacity in lbs/hr)</p> $A = \frac{W\sqrt{TZ}}{CKP_1\sqrt{M}}$ <p>CONVERSION</p> $W = \left(\frac{M}{6.32}\right)V$	<p>A = Valve orifice area (in²)</p> <p>V = Flow capacity (SCFM at 14.7 PSIA, 60°F)</p> <p>W = Flow capacity (lbs/hr)</p> <p>M = Molecular weight of flowing media</p> <p>T = Inlet temperature, absolute (°F + 460)</p> <p>Z = Compressibility factor (1 if unknown)</p> <p>C = Gas constant</p> <p>K = Derated valve coefficient of discharge (.878) = .90 * K_d</p> <p>K_d = Certified valve coefficient (.975)</p> <p>P₁ = Pressure at valve inlet during flow (PSIA) (set pressure + overpressure + P_a)</p> <p>P_a = Atmospheric Pressure (14.7 PSIA)</p>
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- P₁ IS THE PRESSURE AT THE VALVE INLET DURING THE RELIEF CYCLE. IT MAY VARY SLIGHTLY FROM THE PROCESS PRESSURE DUE TO PIPING FRICTIONAL LOSSES AND CROSS SECTIONAL AREA CHANGES. THESE LOSSES SHOULD BE DETERMINED FOR ACCURATE SIZING AND TO ENSURE PROPER VALVE ACTION.
- FORMULAS LISTED ARE FOR CRITICAL FLOW CALCULATIONS WITH NO CORRECTION FOR RUPTURE DISK INSTALLATION. FOR SUBCRITICAL CONDITIONS CONTACT **FLOW SAFE ENGINEERING** FOR APPLICABILITY AND METHODOLOGY.
- TO ACCURATELY AND QUICKLY SIZE FLOW SAFE VALVES, USE **FLOWSIZE** - THE FLOW SAFE RELIEF VALVE SIZING PROGRAM.

GAS & VAPOR

The following procedure is recommended in sizing & selecting *FLOW SAFE* valves:

(1.) Determine the operating conditions:

- V = Flow Capacity (SCFM), or
- W = Flow Capacity (lbs/hr)
- M = Molecular Weight of flowing media
- T = Inlet Temperature, (°R=°F+460)
- Z = Compressibility factor (See AGA Handbook) (Z = 1.0, if unknown)
- C = Gas Constant (p.11)
- K = Valve Coefficient of Discharge (.878)
- P₁ = Pressure at valve inlet during flow (psia) (Set pressure + Overpressure + P_a)
- Overpressure =10% or 3 psi, whichever is greater
- Type Fluid: _____

(2.) Calculate the required valve orifice area(A) for the operating conditions:

$$A = \frac{V\sqrt{MTZ}}{6.32 CKP_1} \quad \text{Capacity(V) in SCFM}$$

$$A = \frac{W\sqrt{TZ}}{CKP_1\sqrt{M}} \quad \text{Capacity(W) in LBS/HR}$$

(3.) Select an orifice area equal or greater than A:

Orifice Size:	-1	-2	-3	-4	-6	-8	F	G	H	J
Area(in ²):	.003	.015	.034	.065	.149	.261	.405	.664	1.036	1.689

(4.) Select the body size to handle the set pressure (Page 4), and the selected orifice.

(5.) Determine the connection size & type (threaded or flanged).

(6.) Select the materials based upon the fluid pressure, temperature, and corrosivity (Page 7 or 9).

(7.) Determine the Assembly Part Number (Page 10 or 19) XX-XXXXX-XXX

(8.) Complete the Specification Sheet & Order Form (Back Cover)
Important: Include the piping configuration if possible

EXAMPLE #1: F85 Series

Fluid: Natural Gas (M:19, C:345)
 Set Pressure: 200 psig Overpressure=10%
 Inlet Temperature (T): 100°F = 100+460 = 560°R
 Back Pressure: Atmospheric W=5200 lb/hr
 P₁=200+20+14.7 = 234.7 psia, Z=1.0, K=.878

$$A = \frac{5200\sqrt{560 \times 1.0}}{234.7(345)(.878)\sqrt{19}} = .397 \text{ in}^2$$

- Use an “F” orifice, with a flow area of .405 in².
- From Page 4, a Large body is required for 200 psig with “F” orifice and elastomer seat (F85).
- Connection type: Flanged, 1-1/2 x 2 (ASME CLASS 150 OK).
- For natural gas, standard *FLOW SAFE* F85-F Materials are satisfactory. See Page 9.
 Wetted metal parts: **Carbon Steel**
 Seat: **Elastomer(Buna-N)**
- Select the F85 Valve Assembly Number (Page 19):
P/N: 01-1171O-402
- Complete the Specification Sheet & order form.

EXAMPLE #2: F84 Series

Fluid: Cryogenic Nitrogen Vapor (M:28, C:356)
 Set Pressure: 200 psig Overpressure=10%
 Inlet Temperature (T): -320°F = -320+460 = 140°R
 V: 4500 SCFM, Z = 1.0, K = .878
 Back Pressure: Atmospheric

$$A = \frac{4500\sqrt{(28 \times 140 \times 1.0)}}{6.32(356)(.878)234.7} = .608 \text{ in}^2$$

- Use a “G” orifice, with a flow area of .664 in².
- From Page 4, a Large body with plastic seat is required for 200 psig and -320°F with “G” orifice.
- Connection type: Threaded, 1-1/2 x 2.
- For cryogenic N₂ vapor, standard *FLOW SAFE* F84 Materials are satisfactory. See Page 7.
 Wetted metal parts: **Brass**
 Seat: **Plastic (Teflon)**
- Select the F84 Valve Assembly Number (Page 10 or 19):
P/N: 01-1162F-401
- Complete the Specification Sheet & order form.

CAPACITIES •

STANDARD CU.FT. PER MINUTE, 3 PSI/10% OVERPRESSURE, AT 60°F

AIR M = 29 T = 520 Z = 1 C = 356 K = 0.878 #/HR = 4.59 x SCFM										F80 SERIES
ORIFICE SIZE AREA (IN ₂)	-1 0.003	-2 0.015	-3 0.034	-4 0.065	-6 0.149	-8 0.261	-F 0.405	-G 0.664	-H 1.036	-J 1.689
SET PRESSURE	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	1.6	7.9	18	34	78	137	213	349	545	888
25	2.1	10	23	45	102	179	278	456	712	1160
50	3.4	17	38	73	167	293	454	744	1162	1894
75	4.7	23	53	102	233	408	633	1038	1620	2641
100	6.0	30	68	130	299	524	812	1332	2078	3388
150	8.7	43	98	188	431	754	1171	1919	2995	4882
200	11	57	128	245	563	985	1529	2507	3911	6377
250	14	70	158	303	694	1216	1887	3094	4828	7871
300	17	83	189	360	826	1447	2246	3682	5745	9366
400	22	110	249	475	1090	1909	2962	4857	7578	12354
500	27	136	309	590	1354	2371	3679	6032	9411	15343
750	41	203	459	878	2013	3526	5471	8969	13994	22815
890	48	240	543	1039	2382	4172	6474	10614	16561	26999
1000	54	269		1166	2672	4680	7262	11907	18577	30286
1500	80	402		1741	3990	6989	10846	17781	27743	45230
2000	107	534		2316	5308	9299	14429	23656	36909	60174
2500	133	667		2891	6627	11608	18012	29531	46075	75117
2700	144	720		3121	7154	12531	19445	31881	49742	81094
2750	147	733		3178	7286	12762	19804	32468	50658	
3000	160	800		3466	7945	13917	21595	35406		
3500	187	933		4041	9263	16226	25179	41280		
3705	197	987		4277	9804	17173	26648	43689		
4000	213	1065		4616	10582	18535	28762			
4072	217	1084		4699	10771	18868	29278			
4292	229			4952	11351	19884	30854			
5000	266			5766	13218		35928			
5774	307			6657	15259					
6000	319			6916						
7000	372			8067						
8000	425			9217						
9000	478			10367						
9612	511			11071						
10313	548									

CAPACITIES •

STANDARD CU.FT. PER MINUTE, 3 PSI/10% OVERPRESSURE, AT 60°F

NITROGEN M = 28 T = 520 Z = 1 C = 356 K = 0.878 #/HR = 4.43 x SCFM										F80 Series
ORIFICE SIZE AREA (IN. ₂)	-1 0.003	-2 0.015	-3 0.034	-4 0.065	-6 0.149	-8 0.261	-F 0.405	-G 0.664	-H 1.036	-J 1.689
SET PRESSURE	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	1.6	8.0	18	35	80	140	217	355	555	904
25	2.1	10.5	24	45	104	182	283	464	724	1181
50	3.4	17	39	74	170	298	462	758	1182	1927
75	4.8	24	54	103	237	415	644	1057	1649	2688
100	6.1	31	69	133	304	533	827	1356	2115	3448
150	8.8	44	100	191	438	768	1191	1953	3048	4969
200	12	58	131	250	573	1003	1556	2551	3981	6490
250	14	71	161	308	707	1238	1921	3149	4913	8010
300	17	85	192	367	841	1473	2285	3747	5846	9531
400	22	112	253	484	1109	1943	3015	4943	7712	12573
500	28	139	314	601	1377	2413	3744	6139	9578	15615
750	41	206	467	894	2048	3588	5567	9128	14242	23219
890	49	244	553	1057	2424	4246	6589	10802	16854	27477
1000	55	274		1186	2719	4763	7391	12117	18906	30823
1500	82	409		1771	4061	7113	11038	18096	28234	46031
2000	109	544		2357	5402	9463	14684	24075	37563	61239
2500	136	679		2942	6744	11813	18331	30054	46891	76447
2700	147	733		3176	7281	12753	19790	32445	50622	82530
2750	149	746		3235	7415	12988	20154	33043	51555	
3000	163	814		3527	8086	14163	21978	36032		
3500	190	949		4113	9427	16513	25624	42011		
3705	201	1004		4353	9977	17477	27119	44462		
4000	217	1084		4698	10769	18864	29271			
4072	221	1104		4782	10962	19202	29796			
4292	233			5040	11552	20236	31401			
5000	271			5868	13452		36564			
5774	313			6774	15529					
6000	325			7039						
7000	379			8209						
8000	433			9380						
9000	487			10551						
9612	520			11267						
10313	558									

CAPACITIES •

STANDARD CU.FT. PER MINUTE, 3 PSI/10% OVERPRESSURE, AT 60°F

OXYGEN M = 32 T = 520 Z = 1 C = 356 K = 0.878 #/HR = 5.06 x SCFM										F80 Series
ORIFICE SIZE AREA (IN.)	-1 0.003	-2 0.015	-3 0.034	-4 0.065	-6 0.149	-8 0.261	-F 0.405	-G 0.664	-H 1.036	-J 1.689
SET PRESSURE	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	1.5	7.5	17	33	75	131	203	333	519	846
25	2.0	9.8	22	43	97	171	265	434	677	1104
50	3.2	16	36	69	159	279	432	709	1106	1803
75	4.5	22	51	97	222	389	603	988	1542	2514
100	5.7	29	65	124	285	498	773	1268	1978	3225
150	8.3	41	94	179	410	718	1115	1827	2851	4648
200	10.8	54	122	234	536	938	1456	2387	3724	6071
250	13	67	151	288	661	1158	1797	2946	4596	7493
300	16	79	179	343	787	1378	2138	3505	5469	8916
400	21	104	237	453	1038	1817	2820	4624	7214	11761
500	26	130	294	562	1289	2257	3502	5742	8959	14606
750	39	193	437	836	1916	3356	5208	8538	13322	21719
890	46	228	517	989	2267	3972	6163	10104	15765	25702
1000	51	256		1110	2543	4455	6913	11335	17685	28832
1500	76	382		1657	3798	6654	10325	16927	26411	43058
2000	102	509		2205	5053	8852	13736	22520	35137	57283
2500	127	635		2752	6308	11050	17147	28113	43862	71509
2700	137	686		2971	6810	11930	18511	30350	47353	77200
2750	140	698		3026	6936	12149	18853	30909	48225	
3000	152	761		3299	7563	13249	20558	33705		
3500	178	888		3847	8818	15447	23969	39298		
3705	188	940		4071	9333	16348	25368	41591		
4000	203	1014		4394	10073	17645	27380			
4072	206	1032		4473	10254	17962	27872			
4292	218			4714	10806	18929	29373			
5000	253			5489	12583		34203			
5774	292			6337	14526					
6000	304			6584						
7000	354			7679						
8000	405			8774						
9000	455			9869						
9612	486			10539						
10313	522									

CAPACITIES •

STANDARD CU.FT. PER MINUTE, 3 PSI/10% OVERPRESSURE, AT 60°F

HYDROGEN $M = 2$ $T = 520$ $Z = 1$ $C = 357$ $K = 0.878$ $\#/HR = 0.316 \times SCFM$ **F80 SERIES**

ORIFICE SIZE AREA (IN ²)	-1 0.003	-2 0.015	-3 0.034	-4 0.065	-6 0.149	-8 0.261	-F 0.405	-G 0.664	-H 1.036	-J 1.689
SET PRESSURE	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	6.0	30	68	131	299	524	814	1334	2081	3393
25	7.9	39	89	170	391	685	1062	1742	2717	4430
50	13	64	146	278	638	1117	1734	2843	4436	7231
75	18	90	203	388	890	1558	2418	3965	6186	10085
100	23	115	260	498	1141	1999	3102	5086	7936	12938
150	33	166	375	718	1645	2881	4471	7330	11436	18644
200	43	216	490	937	2148	3763	5839	9573	14936	24350
250	53	267	605	1157	2652	4645	7207	11816	18436	30057
300	64	318	720	1376	3155	5526	8575	14060	21936	35763
400	84	419	950	1816	4162	7290	11312	18546	28937	47176
500	104	520	1179	2255	5169	9054	14049	23033	35937	58588
750	155	774	1754	3353	7686	13463	20890	34250	53438	87120
890	183	916	2075	3968	9095	15932	24721	40531	63238	103097
1000	205	1027		4451	10203	17872	27732	45466	70938	115651
1500	307	1534		6647	15237	26689	41415	67900	105940	172714
2000	408	2041		8843	20270	35507	55098	90333	140941	229778
2500	509	2547		11039	25304	44325	68781	112766	175943	286841
2700	550	2750		11917	27318	47852	74254	121740	189943	309666
2750	560	2801		12137	27821	48734	75622	123983	193443	
3000	611	3054		13235	30338	53143	82464	135200		
3500	712	3561		15431	35372	61961	96147	157633		
3705	754	3769		16331	37436	65576	101757	166831		
4000	814	4068		17627	40406	70779	109830			
4072	828	4141		17943	41131	72049	111800			
4292	873			18909	43346	75929	117820			
5000	1016			22019	50474		137196			
5774	1173			25419	58267					
6000	1219			26411						
7000	1422			30803						
8000	1624			35195						
9000	1827			39587						
9612	1951			42275						
10313	2093									

CAPACITIES •

STANDARD CU.FT. PER MINUTE, 3 PSI/10% OVERPRESSURE, AT 60°F

NATURAL GAS $M = 19$ $T = 520$ $Z = 1$ $C = 345$ $K = 0.878$ #/HR = 3.00 x SCFM **F80 SERIES**

ORIFICE SIZE AREA (IN ²)	-1 0.003	-2 0.015	-3 0.034	-4 0.065	-6 0.149	-8 0.261	-F 0.405	-G 0.664	-H 1.036	-J 1.689
SET PRESSURE	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	1.9	9	21	41	94	164	255	418	652	1064
25	2.5	12	28	53	123	215	333	546	852	1389
50	4.0	20	46	87	200	350	544	891	1391	2267
75	5.6	28	64	122	279	489	758	1243	1939	3162
100	7.2	36	82	156	358	627	973	1595	2488	4056
150	10	52	118	225	516	903	1402	2298	3586	5846
200	14	68	154	294	674	1180	1831	3001	4683	7635
250	17	84	190	363	831	1456	2260	3705	5780	9424
300	20	100	226	432	989	1733	2689	4408	6878	11213
400	26	131	298	569	1305	2286	3547	5815	9073	14791
500	33	163	370	707	1621	2839	4405	7222	11268	18370
750	49	243	550	1051	2410	4221	6550	10739	16755	27315
890	57	287	651	1244	2852	4995	7751	12708	19827	32325
1000	64	322		1395	3199	5603	8695	14255	22242	36261
1500	96	481		2084	4777	8368	12985	21289	33216	54152
2000	128	640		2773	6356	11133	17275	28323	44190	72044
2500	160	799		3461	7934	13898	21565	35356	55165	89935
2700	172	862		3737	8565	15004	23281	38170	59554	97092
2750	176	878		3805	8723	15280	23710	38873	60652	
3000	192	958		4150	9512	16662	25855	42390		
3500	223	1117		4838	11091	19427	30146	49424		
3705	236	1182		5120	11738	20561	31904	52308		
4000	255	1275		5527	12669	22192	34436			
4072	260	1298		5626	12896	22590	35053			
4292	274			5929	13591	23806	36941			
5000	319			6904	15826		43016			
5774	368			7970	18269					
6000	382			8281						
7000	446			9658						
8000	509			11035						
9000	573			12412						
9612	612			13255						
10313	656									

CAPACITIES •

STANDARD CU.FT. PER MINUTE, 3 PSI/10% OVERPRESSURE, AT 60°F

CARBON DIOXIDE M = 44 T = 520 Z = 1 C = 346 K = 0.878 #/HR = 6.96 x SCFM F80 SERIES

ORIFICE SIZE AREA (IN ²)	-1 0.003	-2 0.015	-3 0.034	-4 0.065	-6 0.149	-8 0.261	-F 0.405	-G 0.664	-H 1.036	-J 1.689
SET PRESSURE	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
15	1.2	6	14	27	62	108	168	276	430	701
25	1.6	8	18	35	81	141	220	360	561	915
50	2.7	13	30	58	132	231	358	587	917	1494
75	3.7	19	42	80	184	322	500	819	1278	2084
100	4.7	24	54	103	236	413	641	1051	1640	2673
150	6.8	34	78	148	340	595	924	1515	2363	3852
200	8.9	45	101	194	444	778	1207	1978	3086	5032
250	11	55	125	239	548	960	1489	2442	3809	6211
300	13	66	149	284	652	1142	1772	2905	4533	7390
400	17	87	196	375	860	1506	2337	3832	5979	9748
500	22	108	244	466	1068	1871	2903	4759	7426	12106
750	32	160	362	693	1588	2782	4317	7077	11042	18002
890	38	189	429	820	1879	3292	5108	8375	13067	21303
1000	42	212		920	2108	3693	5730	9395	14658	23897
1500	63	317		1373	3148	5515	8558	14030	21890	35688
2000	84	422		1827	4189	7337	11385	18666	29123	47479
2500	105	526		2281	5229	9159	14212	23301	36355	59270
2700	114	568		2462	5645	9888	15343	25155	39248	63987
2750	116	579		2508	5749	10070	15626	25619	39971	
3000	126	631		2735	6269	10981	17040	27936		
3500	147	736		3189	7309	12803	19867	32572		
3705	156	779		3375	7736	13550	21026	34472		
4000	168	841		3642	8349	14625	22694			
4072	171	856		3708	8499	14888	23101			
4292	180			3907	8957	15689	24345			
5000	210			4550	10430		28349			
5774	242			5252	12040					
6000	252			5457						
7000	294			6365						
8000	336			7272						
9000	378			8180						
9612	403			8735						
10313	433									

01 - X XXXX - XXXX

CONFIGURATION

1-STD(No Lift Lever)
2-Micro, Extended Inlet
4-w/Lift Lever

SEAT TYPE / ORIFICE SIZE

PLASTIC (F84)

F84M Series	(-1)	MICRO	183
F84M Series	(-2)	MICRO	188
F84M Series	(-3)	MICRO	189
F84M Series	(-4)	MICRO	190
F84 Series	(-4)	MED	155
F84 Series	(-6)	MED	156
F84 Series	(-8)	MED	157
F84 Series	(-4)	LRG/X-LRG	158
F84 Series	(-6)	LRG/X-LRG	159
F84 Series	(-8)	LRG/X-LRG	160
F84 Series	(-F)	LRG/X-LRG	161
F84 Series	(-G)	LRG/X-LRG	162
F84 Series	(-H)	LRG/X-LRG	163
F84 Series	(-J)	LRG/X-LRG	164

ELASTOMER (F85)

F85M Series	(-1)	MICRO	184
F85M Series	(-2)	MICRO	185
F85M Series	(-3)	MICRO	186
F85M Series	(-4)	MICRO	187
F85 Series	(-4)	MED	165
F85 Series	(-6)	MED	166
F85 Series	(-8)	MED	167
F85 Series	(-4)	LRG/X-LRG	168
F85 Series	(-6)	LRG/X-LRG	169
F85 Series	(-8)	LRG/X-LRG	170
F85 Series	(-F)	LRG/X-LRG	171
F85 Series	(-G)	LRG/X-LRG	172
F85 Series	(-H)	LRG/X-LRG	173
F85 Series	(-J)	LRG/X-LRG	174

ALL SAFETY RELIEF VALVES SHOWN IN THIS CATALOG ARE CAREFULLY SET AND TESTED PRIOR TO SHIPMENT. THE **FLOW SAFE** TESTING DEPARTMENT INCLUDES PNEUMATIC FACILITIES FOR TESTING VALVES WITH SET PRESSURES UP TO OVER 10,000 PSIG. UNLESS OTHERWISE SPECIFIED BLOWDOWN IS FACTORY SET AT 7-10%. TEST REPORTS ON EACH VALVE ARE AVAILABLE UPON REQUEST.

- GRAYLOC® IS A REGISTERED TRADEMARK OF GRAYLOC PRODUCTS.
- REFLANGE® IS A REGISTERED TRADEMARK OF REFLANGE INC.
- SWAGELOK® IS A REGISTERED TRADEMARK OF SWAGELOK COMPANY.
- VCR FITTINGS ARE MANUFACTURED BY THE SWAGELOK COMPANY.

OTHER

4 = NACE Trim

Special Outlet (See Inlet Connection Codes):

Outlet code not used if inlet and outlet are both NPT or both flanged. Code also omitted for FNPT outlet with Inlet Conn. \overline{O} or below.

Examples: 01-1165O-203 =

F85-4, SS, 3/4" CRF flange x 1" CRF flange

01-2189V-102 =

F84M-3, CS, 1/2" VCR (male) x 1/2" FNPT

MATERIAL

1 = Brass
2 = Carbon Steel
3 = Stainless Steel
5 = Aluminum
6 = Special

SIZE

0 = M/MED/LARGE
1 = X-LARGE or
3/4" MICRO OUTLET

INLET DIAMETER (in)

0 = 1/4
1 = 1/2
2 = 3/4
3 = 1
4 = 1-1/2
5 = 2
6 = 3
7 = 4
8 = 2-1/2

INLET CONNECTION

M = MNPT
F = FNPT
O = FLANGED, RF
R = FLANGED, RTJ
V = VCR (male nut)
VF = VCR (female nut)
S = SAE
G = GRAYLOC HUB
L = REFLANGE HUB
BP = BRITISH PIPE THREAD
MS = MS33649
W = BUTT WELD
SW = SOCKET WELD
T = SANITARY
SL = SWAGELOK TUBE FITTING
B or AC = FEMALE CONED/THREADED
SP = SPECIAL



FLOW SAFE
"Environmental Performance for Industry"

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 (M)			
	SPECIFIC GRAVITY			
	COMPRESSIBILITY FACTOR (Z)			
	VISCOSITY			
	REQUIRED CAPACITY	SCFM		
		LB/HR.		
		GPM		
	SET PRESSURE	PSIG		
		BAR		
	ALLOWABLE OVERPRESSURE	%		
	REQUIRED BLOWDOWN	%		
BACK PRESSURE	PSIG	BAR		
RELIEVING TEMPERATURE	°F	°C		
REQD CLEAN LEVEL	<input checked="" type="checkbox"/> LOX <input type="checkbox"/>	<input type="checkbox"/> GOX <input type="checkbox"/>		
VALVE SELECTION	BODY MATERIAL			
	SEAT & SOFT GOODS			
	TRIM MATERIAL			
	SIZE INLET/OUTLET			
	FLANGE FACING	RF <input type="checkbox"/> RTJ <input type="checkbox"/>		
	ORIFICE SELECTED	ORIFICE CALCULATED		
	VALVE ASSEMBLY NUMBER			
	ACCESSORIES			
MODIFICATIONS				



FLOW SAFE, Inc.
"Environmental Performance for Industry"

S-3865 Taylor Road, Orchard Park, NY 14127, USA

www.flowsafe.com

(716) 662-2585 Sales

(716) 662-2580 Fax

Forward inquiries to: info@flowsafe.com

Your Authorized Representative:

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