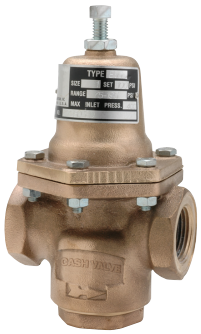
CASH VALVE™ CRYOGENIC VALVES AND CONTROLS

A broad range of pressure build regulators, pressure reducing valves, final line gas valves and combination pressure build economizer valves for cryogenic service.

Type A32

Type PB5



Type E55

Type B

FEATURES

- Seven models for pressure reducing or pressure build-up service.
- Five models for back-pressure service on economizer circuit.
- Three models for combined pressure building and economizer functions.
- Low temperature cut-off valves.
- Two models for final line gas service.
- High purity regulating valves for pressure reducing, back pressure and differential services.
- All parts commercially cleaned for cryogenic/oxygen service or high purity gas compatibility.
- Complementary 'Y' pattern strainers reduce maintenance costs.
- Cryogenic safety and shut-off valves also available.

GENERAL APPLICATION

A variety of controls for cryogenic systems including liquid and gas line-pressure build-up regulators, economizer (heat leak) back pressure valves, temperature safety valves, combination valves, shut-off valves and final-line/service-line regulators.

TECHNICAL DATA[1]

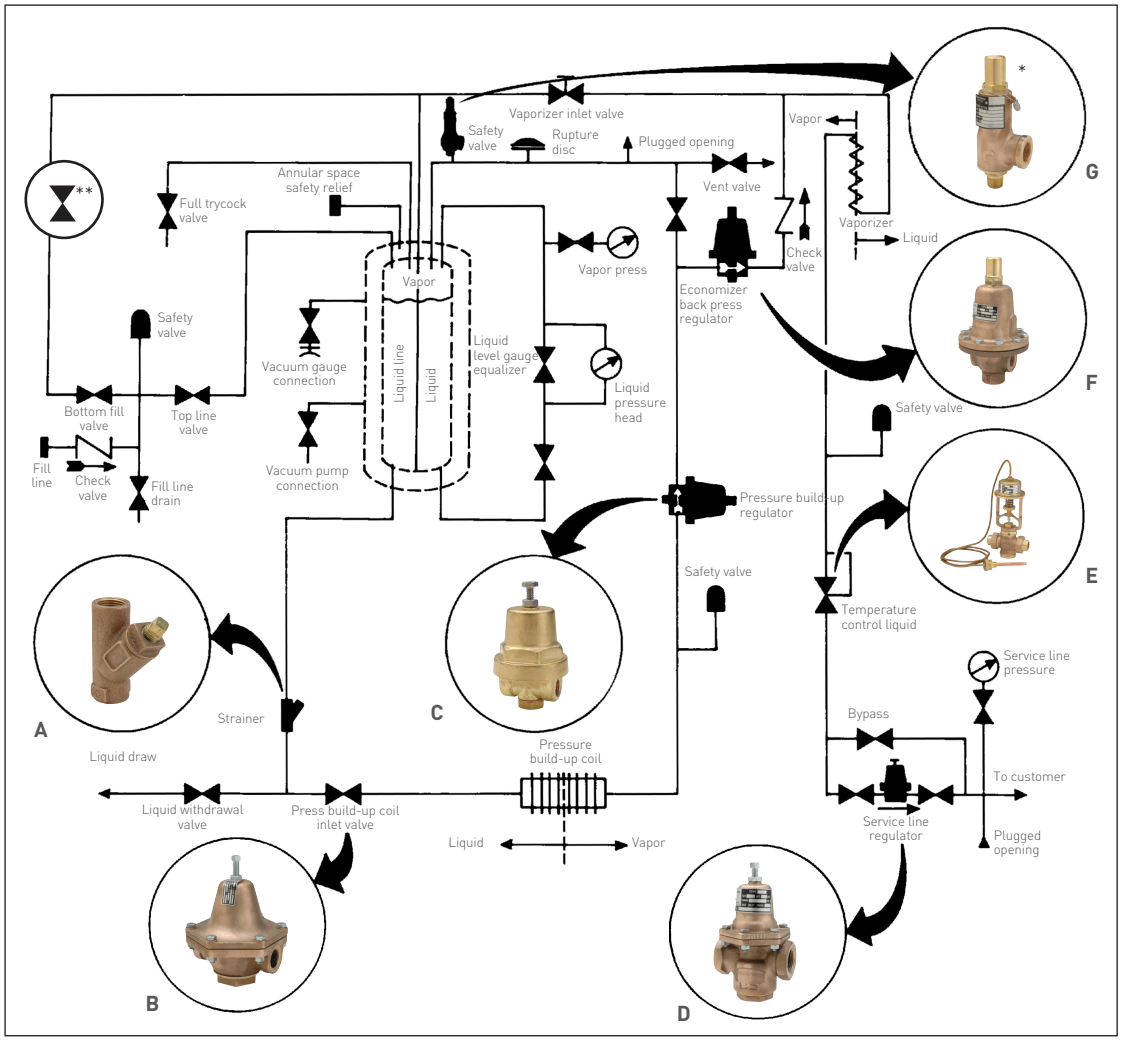
Materials:	Bronze, brass and stainless steel
Sizes:	¼ to 2 in. (8 to 50 mm)
Connections:	NPTF (BSP, BWE optional on some models)
Max initial pressure:	720 psi (49.6 bar)

Temperature ranges

Standard range:	150 to -320°F (65 to -195°C)
High purity valves:	400 to -425°F (204 to -254°C)

1. Refer to General Specifications Table in page 3 for more information.

LIQUID-GAS DISTRIBUTION SYSTEM SCHEMATIC DIAGRAM



A. Type SY-70C
B. Type B
C. Type A-32
D. Type E-55
E. Type LTC
F. Type FR
G. Type C-776

* Type C-776 cryogenic safety relief valve - for additional information, write or call for data sheet VCTDS-00515.

** Shut-off valve - for additional information, see page 28.

OVERVIEW

Cryogenics - the science of materials at extremely low temperatures - has become increasingly important to industry. One important aspect of this field is the liquification of normally gaseous elements which are used widely throughout the industry, including:

Oxygen	- used extensively in BOF furnaces in the steel industry, for metal cutting, as a rocket fuel and in medicine.
Acetylene	- widely used in welding.
Nitrogen	- used in refrigeration systems, for metal degassing, in aerosol packaging and in cryogenic surgery.
Hydrogen	- used as a rocket propellant and in the production of several metals.
Argon	- widely used in incandescent lamps and fluorescent tubes.
Helium	- used for arc welding, in the manufacture of electron tubes and in cryogenic research.
Carbon Dioxide	- used in refrigeration, to make aerosol tanks and in fire fighting.

Other cryogenic fluids include liquefied natural gas, fluorine, krypton, neon, methane and ethane.

The extensive range of Cash valves and controls is suitable for use in all the major areas of cryogenic converters, or 'dewars', which are either stationary or installed in over-the-road transport vehicles.

GENERAL SPECIFICATIONS

Product	Service	Body Material	Spring Chamber Material	Body Size, in. (mm)	Materials		Maximum Inlet Pressure, psi (bar)	Maximum Outlet Pressure, psi (bar)	Temperature, °F (°C)
					Diaphragm	Seat (Disc)			
A-31	Final Line Gas	Brass	Brass or Aluminum	⅛ to ⅜ (6 to 10)	NBR, Neoprene, or EPR	PTFE, FKM or NBR	300 (20.7)	250 (17.2)	-40 to 180 (-40 to 82)
A-32	Cryogenic	Brass or 303 SST	Brass or Aluminum	¼ and ⅜ (8 and 10)	Bronze or 316 SST	PTFE	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
A-32S	Final Line Gas	Brass	Aluminum	¼ and ⅜ (8 and 10)	NBR or EPR	NBR or PTFE	600 (41.4)	600 (41.4)	-40 to 180 (-40 to 82)
A-36	Cryogenic	Bronze or 316 SST	Bronze or 316 SST	¼ and ⅜ (8 and 10)	Bronze or 316 SST	PTFE	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
A-401	Cryogenic	Bronze	Brass	½ (15)	Bronze	PTFE	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
	Final Line Gas	Bronze	Brass	½ (15)	Bronze or Neoprene	PTE or FKM	600 (41.4)	600 (41.4)	-20 to 180 (-29 to 82)
B	Cryogenic	Bronze	Bronze	¼ to 2 (8 to 50)	Bronze or 316 SST	PTFE	400 (27.6)	250 (17.2)	-320 to 150 (-195 to 65)
	Final Line Gas	Bronze	Bronze	¼ to 2 (8 to 50)	NBR	NBR or EPM	400 (27.6)	150 (10.3)	0 to 180 (-17 to 82)
B95	Cryogenic	316 SST	316 SST	½ (15)	316 SST	PTFE	720 (49.6)	600 (41.4)	-320 to 150 (-195 to 65)
				¾ (20)	316 SST	PTFE	720 (49.6)	250 (17.2)	-320 to 150 (-195 to 65)
				1 (25)	316 SST	PTFE	720 (49.6)	400 (27.6)	-320 to 150 (-195 to 65)
	Final Line Gas	316 SST	316 SST	½ (15)	NBR	NBR	720 (49.6)	600 (41.4)	0 to 150 (-17 to 65)
				¾ (20)	NBR	NBR	720 (49.6)	250 (17.2)	0 to 150 (-17 to 65)
				1 (25)	NBR	NBR	720 (49.6)	400 (27.6)	0 to 150 (-17 to 65)
E-55	Cryogenic	Bronze	Bronze	1 ¼ to 2 (32 to 50)	316 SST	PTFE	400 (27.6)	300 (20.7)	-320 to 150 (-195 to 65)
	Final Line Gas	Bronze	Bronze	½ to 1 (15 to 25)	Neoprene	PTE or FKM	400 (27.6)	250 (17.2)	0 to 150 (-17 to 65)
				1 ¼ to 2 (32 to 50)	Neoprene	FKM	400 (27.6)	300 (20.7)	0 to 150 (-17 to 65)
FR	Cryogenic	Bronze or 316 SST	Bronze or 316 SST	½ to 2 (15 to 50)	Bronze or 316 SST	PTFE	400 (27.6)	400 (27.6)	-320 to 150 (-195 to 65)
	Cryogenic/ High Purity	316L SST	316 SST	¾ to 1 (20 to 25)	SST	SST	600 (41.4)	600 (41.4)	-425 to 400 (-254 to 204)
FR-6	Cryogenic	Bronze or 316 SST	Bronze or 316 SST	½ to 2 (15 to 50)	Bronze or 316 SST	PTFE	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
FRM	Cryogenic	Brass, 316 SST or 303 SST	Brass or Chrome Plated Brass	¼ and ⅜ (8 and 10)	Bronze or 316 SST	- - - -	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
FRM-2	Cryogenic	Brass or 316 SST	Brass or 316 SST	¼ to ½ (8 to 15)	Bronze or 316 SST	- - - -	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
G-60	Cryogenic	Bronze or 316 SST	Bronze or 316 SST	¼ to 1 ½ (8 to 40)	Bronze or 316 SST	PTFE	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
	Cryogenic/ High Purity	316L SST	316L SST	½ (15)	SST	Kel-F/PTFE	400 (27.6)	400 (27.6)	-425 to 400 (-254 to 204)
	Final Line Gas	Bronze	Bronze or 316 SST	¼ to 1 ½ (8 to 40)	Bronze, 316 SST, Monel® or NBR	PTFE, FKM or NBR	400 (27.6)	400 (27.6)	-20 to 180 (-29 to 82)
		316 SST	Bronze or 316 SST	¼ to 1 ½ (8 to 40)	Bronze, 316 SST, Monel® or NBR	PTFE, FKM or NBR	700 (48.3)	600 (41.4)	-20 to 180 (-29 to 82)
LTC	Cryogenic	Bronze	Bronze	½ to 2 (15 to 50)	Bronze	PTFE	400 (27.6)	400 (27.6)	-40 to 0 (-40 to -18)
PBE-1A	Cryogenic	Brass	Brass	¼ (8)	Bronze	- - - -	600 (41.4)	600 (41.4)	-320 to 150 (-195 to 65)
PBE-2	Cryogenic	Bronze	Bronze	½ (15)	Bronze	- - - -	400 (27.6)	250 (17.2)	-320 to 150 (-195 to 65)
		316 SST	316 SST	½ (15)	316 SST	- - - -	400 (27.6)	400 (27.6)	-320 to 150 (-195 to 65)
PBE-5	Cryogenic	Brass	Brass	½ (15)	Bronze	- - - -	650 (44.8)	600 (41.4)	-320 to 150 (-195 to 65)

THE PRESSURE BUILD-UP CIRCUIT

The build-up circuit in the converter maintains a pressure of approximately 25 psi (1.72 bar) above that required to drive the liquid to the final vaporizer and a pressure differential of approximately 25 psi (1.72 bar) or higher across the service line regulator. To do this, liquid is drawn into the pressure build-up coil, where it is warmed by ambient air and vaporized. The gas then passes through the pressure build-up regulator and into the top of the tank, where it begins to build up pressure because expansion is limited by the fixed volume.
When this pressure reaches the pressure build-up regulator's set point, the regulator cuts off, stopping vaporization and pressure build-up. As liquid is forced from the tank to the final vaporizer, pressure in the tank begins to drop and the pressure build-up regulator returns to operation.

The pressure build-up regulator may be located in the liquid line before the pressure build-up coil. As it is now used for liquid rather than gas service, it may have a smaller orifice or be a smaller-sized valve. Its operation is the same as that of a gas regulator with the exception that it regulates the liquid flow before the pressure build-up coil rather than the gas flow after the coil. When pressure in the tank drops, the liquid pressure build-up regulator opens, allowing liquid to flow through the pressure build-up coil and vaporize.

Pressure build-up regulators are available for most cryogenic system applications. The Type A-32 is a small ¼ in. (8 mm) pressure build-up valve; the larger Types B, G-60 and E-55 can be used for either liquid or gas.

The Type B is available in sizes from ¼ to 2 in. (8 to 50 mm), the Type G-60 from ¼ to 1½ in. (8 to 40 mm) and the Type E-55 from 1 ¼ to 2 in. (32 to 50 mm).

A-32 PRESSURE REDUCING OR PRESSURE BUILD-UP SERVICE

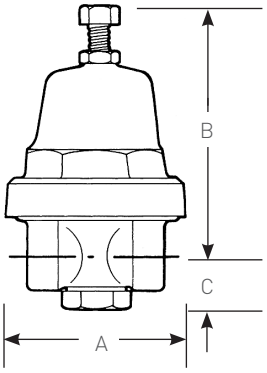
Construction
Brass forged body; brass or aluminum spring chamber; brass trim; bronze or stainless steel diaphragms; Polytetrafluoroethylene (PTFE) seat disc and diaphragm gasket; stainless steel pressure spring. All parts are commercially cleaned for cryogenic service.

Note: Also available in stainless steel and special construction for hi-purity service. Contact your sales representative.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 600 psi (41.4 bar)

PRESSURE RANGES

psi	bar
2 to 15	0.14 to 1.0
2 to 25	0.14 to 1.7
15 to 65	1.0 to 4.5
40 to 100	2.8 to 6.9
50 to 150	3.4 to 10.3
75 to 175	5.2 to 12.1
100 to 250	6.9 to 17.2
200 to 400	13.8 to 27.6
300 to 600	20.7 to 41.4



DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
¼	8	2.26	57.4	3.11	79.1	0.94	24.0	1 ⅛	0.51
⅜	10	2.26	57.4	3.11	79.1	0.94	24.0	1 ⅛	0.51

A-36 PRESSURE REDUCING OR PRESSURE BUILD-UP SERVICE

Construction

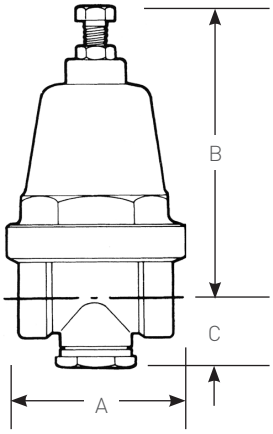
Bronze forged body and spring chamber; bronze diaphragms; PTFE seat disc and gaskets; stainless steel pressure spring and piston. All parts are commercially cleaned for cryogenic service.

Note: Also available in stainless steel and special construction for hi-purity service. Contact your sales representative.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 600 psi (41.4 bar)

PRESSURE RANGES

psi	bar
10 to 30	0.69 to 2.1
20 to 50	1.4 to 3.4
40 to 80	2.8 to 5.5
75 to 150	5.2 to 10.3
100 to 250	6.9 to 17.2
200 to 400	13.8 to 27.6
300 to 600	20.7 to 41.4



DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
¼	8	2.81	71.3	4.40	112	0.97	24.6	2 ½	1.13
⅜	10	2.81	71.3	4.40	112	0.97	24.6	2 ½	1.13

A-401 PRESSURE REDUCING OR PRESSURE BUILD-UP SERVICE

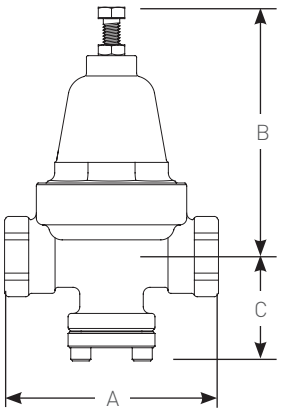
Construction

Bronze body and brass spring chamber; bronze diaphragms; PTFE seat disc and gaskets; stainless steel pressure spring. All parts are commercially cleaned for cryogenic service.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 600 psi (41.4 bar)

PRESSURE RANGES

psi	bar
20 to 60	1.4 to 4.1
40 to 80	2.6 to 5.5
75 to 125	5.2 to 8.6
100 to 250	6.9 to 17.2
200 to 400	13.8 to 27.6
300 to 600	20.7 to 41.4



DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
½	15	4.00	102	4.64	118	1.95	49.6	4 ½	1.68

STANDARD SPRING RANGES, psig (bar)

Spring Material	Type	1	2	3	4	5	6	7	8	9
SST	A32	2 to 15 (0.14 to 1.0)	2 to 25 (0.14 to 1.7)	15 to 65 (1.0 to 4.5)	40 to 100 (2.8 to 6.9)	50 to 150 (3.4 to 10.3)	75 to 175 (5.2 to 12.1)	100 to 250 (6.9 to 17.2)	200 to 400 (13.8 to 27.6)	300 to 600 (20.7 to 41.4)
	A36	10 to 30 (0.69 to 2.1)	20 to 50 (1.4 to 3.4)	40 to 80 (2.8 to 5.5)	75 to 150 (5.2 to 10.3)	100 to 250 (6.9 to 17.2)	200 to 400 (13.8 to 27.6)	300 to 600 (20.7 to 41.4)[1]	- - - -	- - - -
	A401	20 to 60 (1.4 to 3.4)	40 to 80 (2.8 to 5.5)	75 to 125 (5.2 to 8.6)	100 to 250 (6.9 to 17.2)	200 to 400 (13.8 to 27.6)	300 to 600 (20.7 to 41.4)	- - - -	- - - -	- - - -

1. Only available for Bronze body.

MODELS A32, A36, A401 SELECTION GUIDE

Example:	A36Z	B	C	S	Z	S	Z	T	H	01	–	E	1
Model													
A32Z A32 with bronze body													
A32E A32 with stainless steel body													
A36Z A36 (Bronze body)													
A36G A36 (SST body)													
A401 A401													
Size													
A ¼ in. (8 mm) (A32, A36)													
B ⅜ in. (10 mm) (A32, A36)													
C ½ in. (15 mm) (A401)													
Service													
C Cryogenic													
F Final line gas (A401)													
Body/connection style													
S Side inlet/side outlet - straight thru NPT													
B Side inlet/side outlet - straight thru BSPT													
Spring chamber material													
Z Bronze spring chamber													
B Brass (bead blasted) spring chamber													
G SST spring chamber													
Spring chamber style													
S Standard													
V Vented													
Diaphragm material													
G 316 SST (A32, A36)													
Z Bronze													
Seat material													
T PTFE													
V FKM (A401 final line only)													
Pressure screw style													
H Hex													
Variations													
01 Standard													
Design revision													
(-) Original design													
Spring material													
E Stainless steel													
Spring range													
Refer to table above													

B PRESSURE REDUCING OR PRESSURE BUILD-UP SERVICE

Construction

Bronze body, spring chamber, trim; bronze or stainless steel diaphragms; PTFE seat and diaphragm gasket; stainless steel pressure spring; stainless steel bolts and nuts; PTFE bottom-plug gasket; Monel® strainer screen. All parts are commercially cleaned for cryogenic service. Also available with BSP threads.

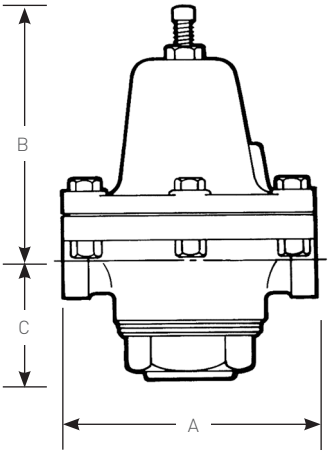
Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure
Type B: 400 psi (27.6 bar)
Type B95: 720 psi (49.6 bar)

Note: Type B95 available in stainless steel construction ½ to 1 in. (15 to 25 mm) size.

PRESSURE RANGES

Valve size		Maximum working ranges	
in.	mm	psi	bar
¼	8	10 to 30	0.69 to 2.1
		25 to 100	1.7 to 6.9
		50 to 200	3.4 to 13.8
		100 to 250	6.9 to 17.2
⅜	10	10 to 50	0.69 to 3.4
		40 to 150	2.8 to 10.3
		100 to 250	6.9 to 17.2
½	15	10 to 30	0.69 to 2.1
		20 to 75	1.4 to 5.2
		25 to 125	1.7 to 8.6
		100 to 200	6.9 to 13.8
		150 to 250	10.3 to 17.2
		250 to 400[1]	17.2 to 27.6[1]
		200 to 600[1]	13.8 to 41.4[1]
¾	20	10 to 30	0.69 to 2.1
		20 to 70	1.4 to 4.8
		30 to 100	2.1 to 6.9
		50 to 150	3.4 to 10.3
		100 to 225	6.9 to 15.5
		150 to 250	10.3 to 17.2
1	25	10 to 35	0.69 to 2.4
		20 to 60	1.4 to 4.1
		50 to 100	3.4 to 6.9
		50 to 150	3.4 to 10.3
		100 to 250	6.9 to 17.2
		200 to 400[1]	13.8 to 27.6[1]
1 ¼ and 1 ½	32 and 40	10 to 30	0.69 to 2.1
		20 to 40	1.4 to 2.8
		35 to 80	2.4 to 5.5
		75 to 150	5.2 to 10.3
2	50	5 to 20	0.34 to 1.4
		10 to 50	0.69 to 3.4
		20 to 100	1.4 to 6.9

1. Only available for Type B95.



DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
¼	8	3.03	76.9	3.29	83.5	1.73	44	3	1.35
⅜	10	3.87	98.4	4.87	124	1.61	40.9	5 ½	2.47
½	15	4.47	114	5.26	134	1.97	50.1	8	3.6
¾	20	5.09	129	5.26	134	1.83	46.4	10	4.5
1	25	5.75	146	6.25	159	2.03	51.6	16	7.2
1 ¼	32	6.19	157	6.13	156	2.63	66.8	20	9.0
1 ½	40	6.19	157	6.38	162	2.63	66.8	20	9.0
2	50	9.19	233	8.50	216	3.5	88.9	37	16.65

STANDARD SPRING RANGES, psig (bar)

Spring Material	Size in. (mm)	1	2	3	4	5	6
SST	¼ (8)	10 to 30 (0.69 to 2.1)	25 to 100 (1.7 to 6.9)	50 to 200 (3.4 to 13.8)	100 to 250 (6.9 to 17.2)	- - - -	- - - -
	⅜ (10)	10 to 50 (0.69 to 3.4)	40 to 150 (2.8 to 10.3)	100 to 250 (6.9 to 17.2)	- - - -	- - - -	- - - -
	½ (15)	10 to 30 (0.69 to 2.1)	20 to 75 (1.4 to 5.2)	25 to 125 (1.7 to 8.6)	100 to 200 (6.9 to 13.8)	150 to 250 (10.3 to 17.2)	- - - -
	¾ (20)	10 to 30 (0.69 to 2.1)	20 to 70 (1.4 to 4.8)	30 to 100 (2.1 to 6.9)	50 to 150 (3.4 to 10.3)	100 to 225 (6.9 to 15.5)	150 to 250 (10.3 to 17.2)
	1 (25)	10 to 35 (0.69 to 2.4)	20 to 60 (1.4 to 4.1)	50 to 100 (3.4 to 6.9)	50 to 150 (3.4 to 10.3)	100 to 250 (6.9 to 17.2)	- - - -
	1 ¼, 1 ½ (32, 40)	10 to 30 (0.69 to 2.1)	20 to 40 (1.4 to 2.8)	35 to 80 (2.4 to 5.5)	75 to 150 (5.2 to 10.3)	- - - -	- - - -
	2 (50)	5 to 20 (0.34 to 1.4)	10 to 50 (0.69 to 3.4)	20 to 100 (1.4 to 6.9)	- - - -	- - - -	- - - -
Steel	¼ (8)	2 to 25 (0.14 to 1.7)	20 to 60 (1.4 to 4.1)	30 to 100 (2.1 to 6.9)	50 to 150 (3.4 to 10.3)	- - - -	- - - -
	⅜ (10)	2 to 30 (0.14 to 2.1)	20 to 70 (1.4 to 4.8)	40 to 110 (2.8 to 7.6)	90 to 150 (6.2 to 10.3)	- - - -	- - - -
	½ (15)	2 to 30 (0.14 to 2.1)	10 to 50 (0.69 to 3.4)	30 to 125 (2.1 to 8.6)	50 to 150 (3.4 to 10.3)	- - - -	- - - -
	¾ (20)	2 to 20 (0.14 to 1.4)	10 to 35 (0.69 to 2.4)	30 to 75 (2.1 to 5.2)	50 to 110 (3.4 to 7.6)	105 to 150 (7.2 to 10.3)	- - - -
	1 (25)	2 to 20 (0.14 to 1.4)	10 to 45 (0.69 to 3.1)	20 to 60 (1.4 to 4.1)	55 to 100 (3.8 to 6.9)	90 to 150 (6.2 to 10.3)	- - - -
	1 ¼, 1 ½ (32, 40)	2 to 15 (0.14 to 1.0)	10 to 30 (0.69 to 2.1)	20 to 50 (1.4 to 3.4)	45 to 100 (3.1 to 6.9)	90 to 150 (6.2 to 10.3)	- - - -
	2 (50)	2 to 20 (0.14 to 1.4)	10 to 60 (0.69 to 4.1)	20 to 100 (1.4 to 6.9)	90 to 150 (6.2 to 10.3)	- - - -	- - - -

TYPE B SELECTION GUIDE

Example	B	Z	A	C	S	S	Z	T	S	01	–	E	1
Model													
B B valve													
Material of construction													
Z Bronze													
Valve size													
A ¼ in. (8 mm)													
B ⅜ in. (10 mm)													
C ½ in. (15 mm)													
D ¾ in. (20 mm)													
E 1 in. (25 mm)													
F 1 ¼ in. (32 mm)													
G 1 ½ in. (40 mm)													
H 2 in. (50 mm)													
Service													
C Cryogenic													
F Final line gas (O_2 clean adder required)													
Body style/connection style													
S Side inlet/side outlet - straight thru with NPT connections													
B Side inlet/side outlet - straight thru with BSPT connections													
C Side inlet/side outlet - straight thru with copper tube connections (⅜ in. only)													
Spring chamber style													
S Standard													
D with pressure screw cap and differential connection													
Diaphragm material													
B NBR (final line)													
Z Bronze (cryogenic)													
Seat material													
B NBR (final line gas)													
T PTFE (cryogenic)													
Pressure screw style													
S Standard													
Variation													
01 Standard													
Design revision													
(-) Indicates original design													
Spring material													
D Steel (final line gas)													
E SST (cryogenic)													
Spring range													
Refer to table above													

STANDARD SPRING RANGES, psig (bar)

Spring Material	Size, in. (mm)	1	2	3	4	5	6	7
SST	½ (15)	10 to 30 (0.69 to 2.1)	20 to 75 (1.4 to 5.2)	25 to 125 (1.7 to 8.6)	100 to 200 (6.9 to 13.8)	150 to 250 (10.3 to 17.2)	250 to 400 (17.2 to 27.6)	200 to 600 (13.8 to 41.4)
	¾ (20)	10 to 30 (0.69 to 2.1)	20 to 70 (1.4 to 4.8)	30 to 100 (2.1 to 6.9)	50 to 150 (3.4 to 10.3)	100 to 225 (6.9 to 15.5)	150 to 250 (10.3 to 17.2)	- - - -
	1 (25)	10 to 35 (0.69 to 2.4)	20 to 60 (1.4 to 4.1)	50 to 100 (3.4 to 6.9)	50 to 150 (3.4 to 10.3)	100 to 250 (6.9 to 17.2)	200 to 400 (13.8 to 27.6)	- - - -

TYPE B95 SELECTION GUIDE

Example:	B95	G	C	C	S	S	G	T	S	01	-	E	1

Model
B95 B95 valve

Material of construction
G 316 SST body and chamber

Valve size
C ½ in. (15 mm)
D ¾ in. (20 mm)
E 1 in. (25 mm)

Service
C Cryogenic

Body style/connection style
S Side inlet/side outlet - straight thru with NPT connections

Spring chamber style
S Standard
D with pressure screw cap and differential connection

Diaphragm material
G 316 SST (cryogenic)

Seat material
T PTFE (cryogenic)

Pressure screw style
S Standard

Variation
01 Standard

Design revision
(-) Indicates original design

Spring material
E Stainless steel

Spring range
Refer to table above

G-60 PRESSURE REDUCING OR PRESSURE BUILD-UP SERVICE

Construction

Threaded ends; bronze body, spring chamber, diaphragms; brass trim; stainless steel pressure spring and body seat; PTFE seat and gaskets; stainless steel bolts. Closing cap over screw provided. Also available with all system exposed internal parts in stainless steel. All parts are commercially cleaned for cryogenic service. Also available with BSP threads.

Note: Also available in stainless steel and special construction for hi-purity service. Contact your sales representative.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 600 psi (41.4 bar)

STANDARD SPRING RANGES

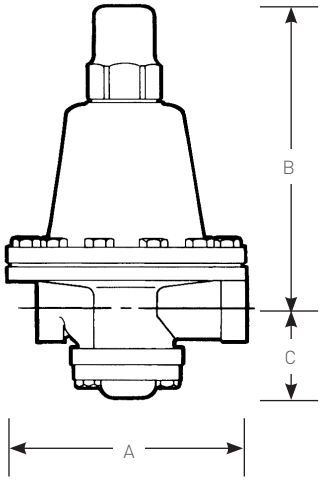
Spring Material	Valve size in.	Valve size mm	Maximum working ranges psi	Maximum working ranges bar
SST	¼ and ⅜	8 and 10	5 to 30	0.34 to 2.1
			15 to 65	1.0 to 5.2
			30 to 110	2.1 to 7.6
			75 to 200	5.2 to 13.8
			100 to 400[1]	6.9 to 27.6[1]
			100 to 600[1]	6.9 to 41.4[1]
	½	15	0 to 7	0 to 0.48
			5 to 70	0.34 to 4.8
			50 to 150	3.4 to 10.3
			50 to 250	3.4 to 17.2
			100 to 400	6.9 to 27.6
			200 to 500	13.8 to 34.5
	¾	20	0 to 10	0 to 0.69
			5 to 75	0.34 to 5.2
			50 to 200	3.4 to 13.8
			100 to 400[1]	6.9 to 27.6[1]
			100 to 600[1]	6.9 to 41.4[1]
	1	25	10 to 50	0.69 to 3.4
			50 to 200	3.4 to 13.8
			100 to 400[1]	6.9 to 27.6[1]
			100 to 600[1]	6.9 to 41.4[1]
	1 ¼ and 1 ½	32 and 40	5 to 15	0.34 to 1.0
			10 to 50	0.69 to 3.4
			30 to 75	2.1 to 5.2
			50 to 120	3.4 to 8.3
			75 to 150	5.2 to 10.3
			100 to 400[1]	6.9 to 27.6[1]

NOTE

1. Higher ranges are attained by modifying standard valve and/or using a different pressure spring. Contact your sales representative.

DIMENSIONS

Size in.	Size mm	Dimensions A in.	Dimensions A mm	Dimensions B in.	Dimensions B mm	Dimensions C in.	Dimensions C mm	Shipping weight lbs	Shipping weight kg
¼	8	4.00	102	6.23	158	2.15	54.6	9	4.05
⅜	10	4.00	102	6.48	165	2.15	54.6	9	4.05
½	15	4.75	121	7.63	194	2.30	58.4	16	7.20
¾	20	5.63	143	9.90	251	2.60	66.0	24	10.80
1	25	6.50	165	10.70	272	2.80	71.1	35	15.75
1 ¼	32	8.00	203	12.30	312	3.53	89.7	62 ½	28.35
1 ½	40	8.00	203	12.00	305	3.53	89.7	62 ½	28.35



TYPE G60 SELECTION GUIDE

Example:	G60Z	A	W	S	S	Z	Z	B	H	00	-	E	1

Model

G60Z G60 with bronze body

G60G G60 with 316 stainless steel body

Valve size

A	¼ in. (8 mm)	**E**	1 in. (25 mm)
B	⅜ in. (10 mm)	**F**	1 ¼ in. (32 mm)
C	½ in. (15 mm)	**G**	1 ½ in. (40 mm)
D	¾ in. (20 mm)		

Service

C Cryogenic service

F Final line gas (O_2 clean but not used in cryogenic service)

L Cryogenic/High Purity service

Body/connection style

S Side inlet/side outlet - straight thru with NPT connections

Spring chamber style

S Standard

C with pressure screw cap

D with pressure screw cap and differential connection

V Vented

W Vented with pressure screw cap

Spring chamber material

Z Bronze

G 316 stainless steel

Diaphragm material

B NBR (final line gas)

Z Bronze (cryogenic)

G 316 stainless steel (cryogenic)

L NBR with PTFE liner (final line gas)

Seat material

T PTFE (cryogenic)

V FKM (final line gas)

Pressure screw style

S Standard

Variation

01 Standard (303 stainless steel trim)
(303 SST seat ring, 303 SST pusher post button, 303 SST pusher post, 303 SST guide bushing, 303 SST piston and 316 SST bottom cap)

31 Brass trim
(303 SST seat ring, brass pusher post button, brass pusher post, 303 SST guide bushing, brass piston and bronze bottom cap)

Design revision

(-) Indicates original design

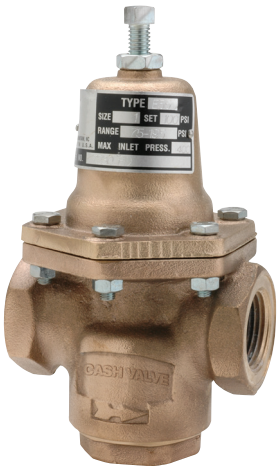
Spring material

E Stainless steel

Spring range

Refer to table on page 10

E-55 PRESSURE REDUCING, PRESSURE BUILD-UP OR FINAL-LINE GAS SERVICE



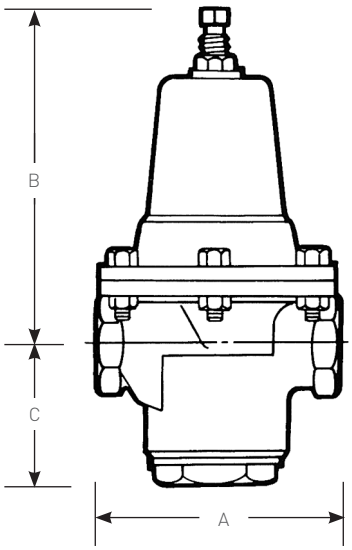
Construction - for pressure reducing or pressure build-up service
Bronze body, spring chamber, trim; stainless steel body seat and pressure spring; PTFE seat, O-rings and bottom plug gasket; stainless steel diaphragms, strainer screen and bolts. All parts are commercially cleaned for cryogenic service. Also available with BSP threads.

Size range:	1 ¼, 1 ½, 2 in. (32, 40, 50 mm)
Temperature rating:	150 to -320°F (65 to -195°C)
Maximum initial pressure:	400 psi (27.6 bar)

Construction - for final-line gas service
Bronze body, spring chamber and trim; stainless steel body seat and pressure spring; FKM and PTFE seat disc and PTFE bottom plug gasket; FKM O-ring and neoprene diaphragm with PTFE and FKM liner; Monel® strainer screen. All parts are commercially cleaned for oxygen service. Also available with BSP threads.

Size range:	½, ¾, 1, 1 ¼, 1 ½, 2 in. (15, 20, 25, 32, 40, 50 mm)
Temperature rating:	0 to 150°F (-17 to 65°C)
Maximum initial pressure:	400 psi (27.6 bar)

Note: Specification for final-line gas service is not for use on cold gas or liquid (less than 0°F).



STANDARD SPRING RANGES

Spring Material	Valve size in.	Valve size mm	Maximum working ranges psi	Maximum working ranges bar
SST	½, ¾, 1[1]	15, 20, 25[1]	10 to 35	0.69 to 2.4
			20 to 75	1.4 to 5.2
			75 to 125	5.2 to 8.6
			125 to 175	8.6 to 12.1
			75 to 250	5.2 to 17.2
	1 ¼, 1 ½, 2	32, 40, 50	20 to 70	0.69 to 4.8
			50 to 150	3.4 to 10.3
			75 to 175	5.2 to 12.1
			75 to 200	5.2 to 13.8
			150 to 300	10.3 to 20.7

1. Not applicable for Cryogenic service.

DIMENSIONS

Size in.	Size mm	Dimensions A in.	Dimensions A mm	Dimensions B in.	Dimensions B mm	Dimensions C in.	Dimensions C mm	Shipping weight lbs	Shipping weight kg
½	15	4.00	102	5.52	140	2.13	54.2	6	2.7
¾	20	4.00	102	5.31	135	2.19	55.6	6	2.7
1	25	4.00	102	5.53	140	2.13	54.2	6	2.7
1 ¼	32	5.50	140	8.75	222	3.16	80.2	17	7.7
1 ½	40	5.50	140	8.75	222	3.16	80.2	17	7.7
2	50	5.75	146	9.12	232	2.79	70.9	17	7.7

TYPE E-55 SELECTION GUIDE

Example:	E55	C	C	S	G	T	01	-	E	1

Model

E55 E-55 valve with bronze body and spring chamber

Valve size

C	½ in. (15 mm)	**F**	1 ¼ in. (32 mm)
D	¾ in. (20 mm)	**G**	1 ½ in. (40 mm)
E	1 in. (25 mm)	**H**	2 in. (50 mm)

Service

C Cryogenic (1 ¼ to 2 in.)

F Final line gas (all sizes)

Body style/connection style

S Side inlet/side outlet - straight thru with NPT connections

B Side inlet/side outlet - straight thru with BSPT connections

C Side inlet/side outlet - straight thru with NPT connections (enlarged port) 1 in. E-55 only

D Side inlet/side outlet - straight thru with BSPT connections (enlarged port) 1 in. E-55 only

Diaphragm material

G 316 SST (cryogenic) (1 ¼ to 2 in.)

N Neoprene with FKM diaphragm liner (final line gas)

L Neoprene with PTFE diaphragm liner (final line gas)

Seat material

T PTFE (cryogenic)

V FKM (final line gas)

Variation

01 Standard

Design revision

(-) Indicates original design

Spring material

E SST

Spring range

Refer to table on page 12

THE ECONOMIZER CIRCUIT

The economizer back pressure regulator is set from 10 to 25 psi (0.69 to 1.7 bar) above the set pressure of the pressure build-up regulator. When no gas is being used and heat leakage in the tank causes a gas pressure build-up, the excess pressure is by-passed into the final vaporizer line to conserve gas rather than allow the safety valve in the pressure build-up circuit to relieve the excess gas into the atmosphere.

Five types of back pressure valves are available for this circuit: the Type FRM, low flows, maximum of 600 psi (41.4 bar); Type FRM-2, medium flows, maximum of 400 psi (27.6 bar); Type FRM-2 (HP) high pressure, medium flows, maximum of 600 psi (41.4 bar); Type FR, large flows, maximum of 400 psi (27.6 bar) and the Type FR-6, maximum of 600 psi (41.4 bar).

FRM BACK PRESSURE OR ECONOMIZER SERVICE

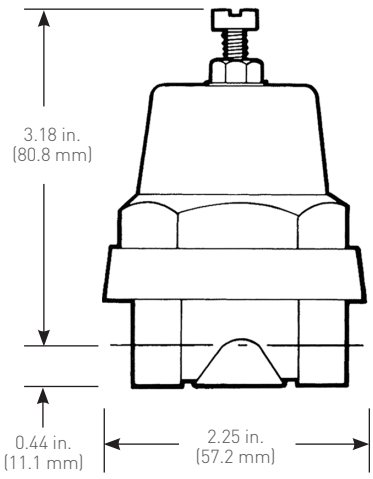
Construction
Threaded ends; 2-way, side inlet-side outlet; 2-way, side inlet-bottom outlet; 3-way, 2 side inlets-bottom outlet; forged brass body; bronze diaphragms; stainless steel seat disc, seat ring and pressure spring; PTFE diaphragm gasket. All parts commercially cleaned for cryogenic service.

Note: Also available in stainless steel and special construction for hi-purity service. Contact your sales representative.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum set pressure: 600 psi (41.4 bar)

PRESSURE RANGES

psi	bar
2 to 25	0.14 to 1.7
15 to 65	1.0 to 4.5
40 to 100	2.8 to 6.9
50 to 150	3.4 to 10.3
75 to 175	5.2 to 12.1
100 to 250	6.9 to 17.2
200 to 400	13.8 to 27.6
200 to 600	13.8 to 41.4
300 to 600	20.7 to 41.4



DIMENSIONS

Description	Size		Shipping weight	
	in.	mm	lbs	kg
Side inlet, side outlet	¼	8	1⅛	0.51
Side inlet, side outlet	⅜	10	1⅛	0.51
Side inlet, bottom outlet	¼	8	1⅛	0.51
Side inlet, bottom outlet	⅜	10	1⅛	0.51
2 Side inlets, bottom outlet	¼	8	1⅛	0.51
2 Side inlets, bottom outlet	⅜	10	1⅛	0.51

* Use valve numbers for pressures to 175 psi (12.1 bar) only. Consult factory for other numbers.

FRM-2, FRM-2 (HP) BACK PRESSURE OR ECONOMIZER SERVICE

Construction

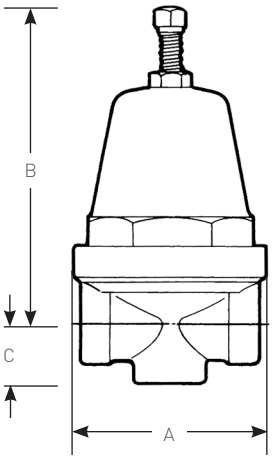
Threaded ends; 2-way, side inlet-side outlet; 2-way, side inlet-bottom outlet; 3-way, 2 side inlets-bottom outlet; forged brass body; brass spring chamber; stainless steel seat disc, seat ring and pressure spring; bronze diaphragms; PTFE diaphragm gasket. All parts commercially cleaned for cryogenic service.

Note: FRM-2 available in stainless steel and special construction for hi-purity service. Contact your sales representative.

Temperature rating:	150 to -320°F (65 to -195°C)
Maximum set pressure	
FRM-2:	400 psi (27.6 bar)
FRM-2HP:	600 psi (41.4 bar)

PRESSURE RANGES

Size	Maximum working ranges	
	psi	bar
FRM-2		
All sizes	0 to 30	0 to 2.1
All sizes	20 to 50	1.4 to 3.5
All sizes	40 to 80	2.8 to 5.5
All sizes	75 to 150	5.2 to 10.3
All sizes	100 to 275	6.9 to 19.0
	200 to 400	13.8 to 27.6
FRM-2HP		
All sizes	300 to 600	20.7 to 41.4



DIMENSIONS

Description	Size		Dimensions						Shipping weight	
			A		B		C			
	in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
FRM-2										
Side inlet, side outlet	¼	8	2.81	71.4	4.45	113	0.78	19.8	2 ½	1.13
Side inlet, side outlet	⅜	10	2.81	71.4	4.69	119	0.78	19.8	2 ½	1.13
Side inlet, side outlet	½	15	2.96	75.2	4.79	122	1.13	28.7	3 ½	1.58
Side inlet, bottom outlet	¼	8	2.81	71.4	4.45	113	0.78	19.8	2 ½	1.13
Side inlet, bottom outlet	⅜	10	2.81	71.4	4.69	119	0.78	19.8	2 ½	1.13
Side inlet, bottom outlet	½	15	2.96	75.2	4.79	122	1.13	28.7	3 ½	1.58
2 Side inlets, bottom outlet	¼	8	2.81	71.4	4.45	113	0.78	19.8	2 ½	1.13
2 Side inlets, bottom outlet	⅜	10	2.81	71.4	4.69	119	0.78	19.8	2 ½	1.13
2 Side inlets, bottom outlet	½	15	2.96	75.2	4.79	122	1.13	28.7	3 ½	1.58
FRM-2HP										
Side inlet, side outlet	¼	8	2.81	71.4	4.45	113	0.78	19.8	2 ½	1.13
Side inlet, bottom outlet	¼	8	2.81	71.4	4.45	113	0.78	19.8	2 ½	1.13
Side inlet, side outlet	⅜	10	2.81	71.4	4.69	119	0.78	19.8	2 ½	1.13
Side inlet, bottom outlet	⅜	10	2.81	71.4	4.69	119	0.78	19.8	2 ½	1.13
Side inlet, side outlet	½	15	2.96	75.2	4.79	122	1.13	28.7	3 ½	1.58
Side inlet, bottom outlet	½	15	2.96	75.2	4.79	122	1.13	28.7	3 ½	1.58

STANDARD SPRING RANGES, psig (bar)

Spring Material	Model	1	2	3	4	5	6	7	8	9
SST	FRM	2 to 25 (0.14 to 1.7)	15 to 65 (1.0 to 4.5)	40 to 100 (2.8 to 6.9)	50 to 150 (3.4 to 10.3)	75 to 175 (5.2 to 12.1)	100 to 250 (6.9 to 17.2)	200 to 400 (13.8 to 27.6)	200 to 600 (13.8 to 41.4)	300 to 600 (20.7 to 41.4)
	FRM-2	0 to 30 (0 to 2.1)	20 to 50 (1.4 to 3.5)	40 to 80 (2.8 to 5.5)	75 to 150 (5.2 to 10.3)	100 to 275 (6.9 to 19.0)	200 to 400 (13.8 to 27.6)	300 to 600 (20.7 to 41.4)	- - - -	- - - -

FRM, FRM-2 SELECTION GUIDE

Example:	FRM-	A	W	Z	S	A	S	B	F	02	–	D	1

Model
FRM- FRM
FRM2 FRM-2

Size
A ¼ in. (8 mm) (all)
B ⅜ in. (10 mm) (all)
C ½ in. (15 mm) (FRM-2)

Service
C Cryogenic (FRM, FRM-2)

Material of construction
Z Brass
G 316 SST (FRM, FRM-2)
E 303 SST (FRM)

Body/connection style
S Side inlet/side outlet (all) NPT
R 2 side inlets/bottom outlet (FRM, FRM-2) NPT
E Side inlet/bottom outlet (FRM, FRM-2) NPT
B Side inlet/side outlet (BSPT)
P Side inlet/side outlet ¼ NPT - 0.082 wall pipe (FRM-2)
T Side inlet/side outlet ⅜ NPT - 0.035 wall pipe (FRM-2)
V Side inlet/side outlet ⅝ NPT - 0.049 wall pipe (FRM-2)

Spring chamber material
Z Brass spring chamber
G SST spring chamber (FRM-2)
C Chrome plated

Spring chamber style
S Standard
W Without vent hole

Diaphragm material
G 316 SST
Z Bronze

Pressure screw style
F Fillister (FRM only)
H Hex
T T-handle (FRM)

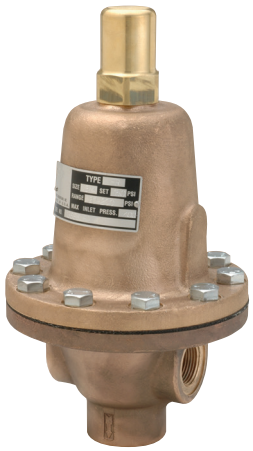
Variations
03 303 Stainless steel trim with PTFE diaphragm gasket (metal diaphragms only)
04 303 Stainless steel trim with 6 x 0.005 thick bronze diaphragms
05 303 Stainless steel trim with Nylon inserted locknut
13 316 Stainless steel trim with PTFE diaphragm gasket (metal diaphragms only)
23 Monel® trim with PTFE diaphragm gasket (metal diaphragms only)
32 Remote sensing

Design revision
(-) Original design

Spring material
E Stainless steel

Spring range
Refer to table above

FR, FR-6 BACK PRESSURE OR ECONOMIZER SERVICE



Construction

Threaded ends; 3-way, 2 side inlets-bottom outlet; bronze or stainless steel body, spring chamber and diaphragms; brass or stainless steel body seat; stainless steel seat disc, seat ring and pressure spring; PTFE O-ring and diaphragm gasket; stainless steel bolts; pressure-tight closing cap. All parts are commercially cleaned for cryogenic service. Also available with BSP threads.

FR Series valves are available in various pressure control and temperature ranges and are designated as follows:

- Type FR has a bronze body as standard, is suitable for pressure of 0 to 400 psig (0 to 27.6 barg) and maximum temperatures 150 to 450°F (65 to 232°C)[1].
- Type FR-6 incorporates a diaphragm ring mounted above the diaphragm to accomodate higher back pressure ranges: 200 to 600 psig (13.8 to 41 barg); 150 to 450°F (65 to 232°C)[1].

1. Requires special diaphragm ring and pressure plate.

Note: Also available in stainless steel and special construction for hi-purity systems. Contact your sales representative.

Temperature rating: 150 to -320°F (65 to -195°C)

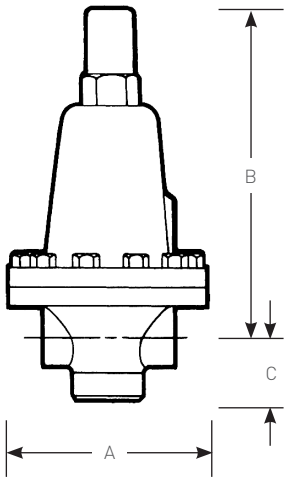
STANDARD SPRING RANGES, psig (bar)

Spring Material	Type	Size, in. (mm)	1	2	3	4	5	6
SST	FR	½ (15)	0 to 20 (0 to 1.4)	10 to 50 (0.69 to 3.4)	40 to 90 (2.8 to 6.2)	75 to 200 (5.2 to 13.8)	100 to 300 (6.9 to 20.7)	100 to 400 (6.9 to 27.6)
		¾ (20)	0 to 10 (0 to 0.69)	0 to 15 (0 to 1.0)	10 to 70 (0.69 to 4.8)	50 to 175 (3.4 to 12.1)	100 to 265 (6.9 to 18.3)	- - - -
		1 (25)	0 to 15 (0 to 1.0)	10 to 35 (0.69 to 2.4)	20 to 75 (1.4 to 5.2)	40 to 200 (2.8 to 13.8)	50 to 250 (3.4 to 17.2)	- - - -
		1 ¼ (32)	0 to 15 (0 to 1.0)	10 to 30 (0.69 to 2.1)	20 to 85 (1.4 to 5.9)	40 to 125 (2.8 to 8.6)	50 to 250 (3.4 to 17.2)	- - - -
		1 ½, 2 (40, 50)	0 to 15 (0 to 1.0)	5 to 20 (0.34 to 1.4)	10 to 55 (0.69 to 3.8)	30 to 100 (2.1 to 6.9)	40 to 160 (2.8 to 11.0)	100 to 250 (6.9 to 17.2)
	FR-6	½ (15)	200 to 600 (13.8 to 41.4)	- - - -	- - - -	- - - -	- - - -	- - - -
		¾, 1, 1 ¼, 1 ½, 2 (20, 25, 32, 40, 50)	200 to 400 (13.8 to 27.6)	- - - -	- - - -	- - - -	- - - -	- - - -

MAXIMUM INITIAL PRESSURE

Type	psi	bar
FR-½ in. (15 mm)	400	27.6
FR-¾ in. (20 mm)	265	18.3
FR-1 to 2 in. (25 to 50 mm)	250	17.2
FR-6	400	27.6
	600	41.4

Maximum set pressure: See below. For higher pressures, contact your sales representative.



DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
½	15	4.75	121	6.73	171	1.62	41.1	9 ½	4.27
¾	20	5.63	143	7.92	201	2.00	50.8	14 ¾	6.64
1	25	6.50	165	10.26	261	2.25	57.2	23 ½	10.58
1 ¼	32	6.50	165	10.39	264	2.38	60.5	24 ½	11.03
1 ½	40	7.50	191	10.76	273	2.63	66.8	33	14.85
2	50	7.50	191	11.01	280	3.00	76.2	35 ½	15.98

FR SERIES SELECTION GUIDE

Example	FR-	Z	A	W	S	S	Z	Z	B	H	01	–	E	1
Model														
FR- FR														
FR6 FR-6														
Material of construction														
Z Bronze (FR, FR-6)														
G 316 SST (FR, FR-6)														
Valve size														
C ½ in. (15 mm)														
D ¾ in. (20 mm)														
E 1 in. (25 mm)														
F 1 ¼ in. (32 mm)														
G 1 ½ in. (40 mm)														
H 2 in. (50 mm)														
Service														
C Cryogenic service														
Body/connection style														
S 2 side inlets/bottom outlet - with NPT connections														
Spring chamber style														
S Standard														
C with pressure screw cap														
D with differential connection														
V Vented														
W Vent in wall / no cap														
Spring chamber material														
Z Bronze														
G 316 Stainless steel														
Diaphragm material														
Z Bronze (cryogenic)														
G 316 Stainless steel (cryogenic)														
Body seat material														
E 303 Stainless steel														
G 316 Stainless steel														
Z Brass														
Pressure screw style														
S Standard														
Variation														
04 303 Stainless steel trim with PTFE O-ring and diaphragm gasket (ball seat, seat ring)														
14 316 Stainless steel trim with PTFE O-ring and diaphragm gasket (ball seat, seat ring)														
Design revision														
(-) Indicates original design														
Spring material														
E Stainless steel														
Spring range														
Refer to table on page 17														

COMBINATION PRESSURE BUILDER-ECONOMIZER

PBE Series regulators combine the pressure building and economizer functions into one unit. The economizer phase starts at the point at which the pressure build level is reached, assuring a smooth transition between the two functions. For sizing information, please request engineering data sheets 1074 (PBE-1A) and 1077 (PBE-2).

PBE-1A COMBINATION PRESSURE BUILDER-ECONOMIZER

Construction

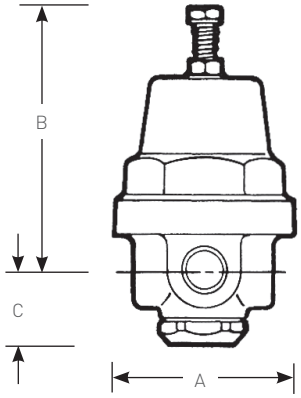
Forged brass body and spring chamber; brass and stainless steel trim; bronze diaphragm; stainless steel pressure spring. All parts are commercially cleaned for oxygen service.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 600 psi (41.4 bar)

PRESSURE RANGES

psi	bar
15 to 65	1.0 to 4.5
50 to 175	3.4 to 12.1
150 to 350	10.3 to 24.1
300 to 600	20.7 to 41.4

DIMENSIONS



Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
¼	8	2.26	57.4	3.16	80.2	0.90	22.9	1.4	0.65
Low pressure - ranges to 175 psig (12.1 bar)									
High pressure - ranges 150 to 600 psig (10.3 to 41.4 bar)									

CAPACITY INFORMATION

		Air (SCFM)	
Inlet - psig	Outlet - psig	10% Droop	20% Droop
25	15	4.1	5.8
45	20	4.3	7.0
	30	4.6	7.6
75	50	7.0	11.1
	65	8.0	12.0
125	50	8.3	14.7
	75	9.4	17.4
175	50	9.6	19.4
	75	11.2	21.6
	100	11.9	22.8
225	150	39.3	56.7
	200	31.1	48.0
275	150	42.4	66.7
	225	40.2	64.5
325	150	46.1	75.5
	275	44.0	75.3
475	275	47.8	79.2
	400	47.8	73.9
575	275	55.2	96.0
	500	54.6	89.6

NOTE

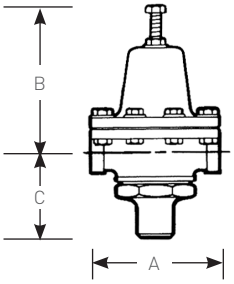
1. To obtain capacities for regulators using metal diaphragms, multiply the table values by 0.7

PBE-2 COMBINATION PRESSURE BUILDER-ECONOMIZER

Construction

Bronze or stainless steel body, spring chamber, trim and diaphragms; PTFE seat and diaphragm gasket; stainless steel economizer seat; stainless steel spring, nuts and bolts. All parts are commercially cleaned for oxygen service.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 400 psi (27.6 bar)



PRESSURE RANGES

psi	(kg/sq cm)
10 to 30	0.69 to 2.1
20 to 75	1.4 to 5.2
25 to 125	1.7 to 8.6
100 to 200	6.9 to 13.8
150 to 250	10.3 to 17.2
200 to 400*	13.8 to 27.6*

*Only for stainless steel body

DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
½	15	5.04	128	5.26	134	3.01	76.6	9	4.08

CAPACITY INFORMATION

Inlet - psig	Outlet - psig	Air (SCFM)	
		10% Droop	20% Droop
15	10	8.7	11.0
30	10	9.7	14.9
	20	12.4	22.3
	25	13.7	21.3
55	25	25.8	38.4
	50	25.5	41.9
75	25	27.3	41.2
	65	37.6	55.5
100	50	41.7	64.3
	75	48.5	77.1
125	50	42.5	66.0
	75	54.9	87.2
	100	61.5	95.1
150	125	77.5	114.5
200	125	90.8	140.2
	150	96.4	149.5
250	175	103.1	176.1
	225	119.3	197.0

NOTE

1. To obtain capacities for regulators using metal diaphragms, multiply the table values by 0.7

PBE-5 COMBINATION PRESSURE BUILDER-ECONOMIZER

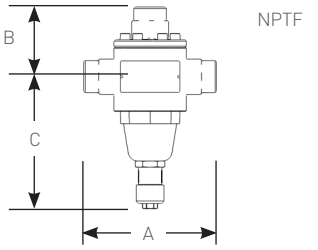
Construction

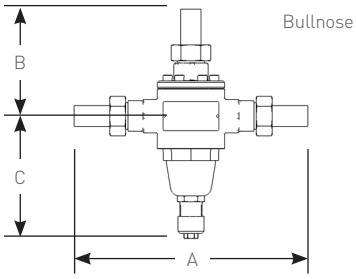
Forged brass body, bronze spring chamber; brass and stainless steel trim; bronze diaphragms; stainless steel pressure spring; graduated adjustment screw. All parts are commercially cleaned for oxygen service.

Temperature rating: 150 to -320°F (65 to -195°C)
Maximum initial pressure: 650 psi (44.8 bar)

PRESSURE RANGES

psi	bar
0 to 30	0 to 2.1
20 to 50	1.4 to 3.4
40 to 80	2.8 to 5.5
75 to 150	5.2 to 10.3
100 to 275	6.9 to 19.0
200 to 350	13.8 to 24.1
300 to 600	20.7 to 41.4





DIMENSIONS

	Size		Dimensions						Shipping weight	
			A		B		C			
	in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
NPTF										
	½	15	5.19	131.8	5.23	132.9	2.76	70.2	7	3.2
Bullnose										
	½	15	149.5	3794	68.25	1734	78.25	1985	8	3.6

Note: 300 to 600 psi (20.7 to 41.4 bar) range, high pressure
Ranges to 350 psi (24.1 bar), low pressure

CAPACITY INFORMATION

		Air, SCFM	
Inlet - psig	Outlet - psig	10% Droop	20% Droop
10	2	0.4	0.5
	5	0.4	0.5
30	20	2.7	3.6
50	20	3.1	4.4
	25	3.4	4.8
	40	8.6	11.5
75	40	10.4	13.7
	60	11.3	16.5
100	75	20.9	28.9
150	75	29.4	40.9
	100	39.4	55.6
	125	32.9	48.8
200	100	50.5	67.8
	125	53.3	76.5
	150	55.9	80.4
250	125	65.5	90.1
	150	71.2	99.6
	200	78.5	118.4
300	200	94.1	133.3
	250	94.5	136.8
600	300	169.9	258.1
	500	183.1	298.9

NOTE

1. To obtain capacities for regulators using metal diaphragms, multiply the table values by 0.7

STANDARD SPRING RANGE, psig (bar)

Spring Material	Type	1	2	3	4	5	6	7
SST	PBE-1A	15 to 65 (1.0 to 4.5)	50 to 175 (3.4 to 12.1)	150 to 350 (10.3 to 24.1)	300 to 600 (20.7 to 41.4)	- - - -	- - - -	- - - -
	PBE-2	10 to 30 (0.69 to 2.1)	20 to 75 (1.4 to 5.2)	25 to 125 (1.7 to 8.6)	100 to 200 (6.9 to 13.8)	150 to 250 (10.3 to 17.2)	200 to 400 (13.8 to 27.6)*	- - - -
	PBE-5	0 to 30 (0 to 2.1)	20 to 50 (1.4 to 3.4)	40 to 80 (2.8 to 5.5)	75 to 150 (5.2 to 10.3)	100 to 275 (6.9 to 19.0)	200 to 350 (13.8 to 24.1)	300 to 600 (20.7 to 41.4)

* Only available with PBE-2 SST body

TYPES PBE-1, PBE-2, PBE-5 SELECTION GUIDE

Example:	PBE1	A	Z	3	S	01	–	E	1

Model
PBE1 PBE-1A valve
PBE2 PBE-2 valve
PBE5 PBE-5 valve

Valve size
A ¼ in. (8 mm) (PBE-1A)
C ½ in. (15 mm) (PBE-2; PBE-5)

Body and spring chamber
Z Brass/bronze (all)
G 316 SST (PBE-2)

Economizer outlet side (see diagram below)
2 Left hand (PBE-1A)
3 Right hand; PB out l/h (PBE-1A)
B Bottom (PBE-2; PBE-5)

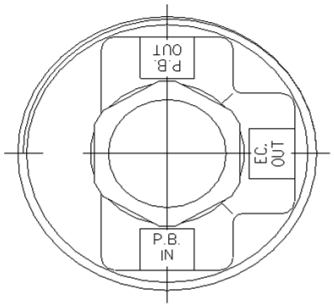
Option
S Standard
C with check (PBE-2, PBE-5)

Variation
01 Standard
02 With tube end connections (PBE-5)

Design revision
(-) Indicates original design (PBE-2; PBE-5)
B With active economizer (PBE-1A)

Spring material
E Stainless steel

Spring range
Refer to table above



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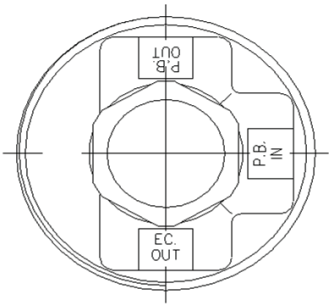


3

LOW TEMPERATURE CUT-OFF VALVES

The temperature control valve between the vaporizer and service line regulator is designed to cut off the gas flow if the gas temperature drops below a pre-determined point, usually -20°F (-29°C), often caused by a rapid or quick gas draw. If the temperature drops below the temperature control valve's setting, the valve closes to prevent excessively cold gas from reaching the service end of the system. In particular, the cold gas is prevented from contacting the final-line regulator, which is not constructed or intended for such low-temperature conditions. The valve opens automatically when gas temperature rises above the set point.

The Type LTC temperature control valve is a double-port valve with a range of 0 to -40°F (-18 to -40°C) for low temperature cut-off. As it is subject to ambient temperature under normal conditions, it will normally be in a wide-open position. A copper well is recommended for each installation, which allows the removal of the capillary bulb without depressurizing the system.

Note: Valve seat closure may take several seconds under normal operating conditions. In addition, Type LTC fails in the closed position.

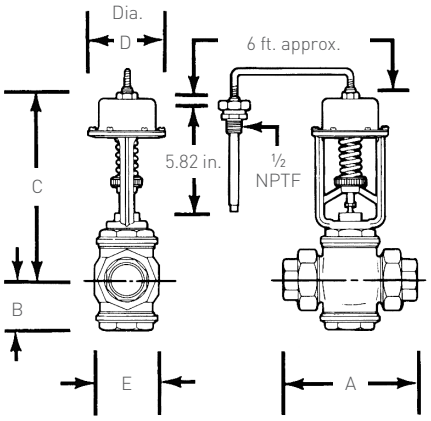
LTC REVERSE-ACTING TEMPERATURE REGULATOR FOR CRYOGENIC SERVICE

Construction

Brass union ends; bronze body and trim; copper capillary armor and bellows; PTFE gasket and packing; stainless steel spring; copper bulb and capillary.
Copper bulb is ½ x 5.82 in. (15 x 147.83 mm). All parts are commercially cleaned for oxygen service. A copper well is available as an option and is recommended for each cryogenic application.

Maximum operating limits

Operating temperature range is 0 to -40°F (-18 to -40°C); standard setting is -20°F (-29°C). Maximum temperature limit is 300°F (149°C); minimum temperature limit is -320°F (-196°C). Maximum body pressure on all sizes is 400 psi (27.6 bar); however, for proper operation, maximum pressure differentials as shown on page 24 must be observed.



DIMENSIONS

Size		Dimensions									
		A		B		C		D		E	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
½	15	6.04	153.42	2.08	52.84	9.80	248.92	4.31	109.48	2.50	63.50
¾	20	6.04	153.42	2.08	52.84	9.80	248.92	4.31	109.48	2.50	63.50
1	25	6.04	153.42	2.08	52.84	9.80	248.92	4.31	109.48	2.50	63.50
1¼	32	7.61	193.30	2.75	69.85	10.47	265.94	4.31	109.48	3.56	90.43
1½	40	7.61	193.30	2.75	69.85	10.47	265.94	4.31	109.48	3.56	90.43
2	50	8.58	217.43	3.12	79.25	10.84	275.34	4.31	109.48	4.31	109.48

Note: Also available: Separable well - ask for part number 17960.
Thermal system repair kit - ask for part number 18052.

TYPE LTC MAXIMUM PRESSURE DIFFERENTIALS

		Temperature setting					
Valve size		0°F	-18°C	-20°F	-29°C	-40°F	-40°C
in.	mm	psi	bar	psi	bar	psi	bar
½ to ¾	15 to 20	400	27.6	400	27.6	400	27.6
1	25	275	19.0	400	27.6	400	27.6
1¼ to 1½	32 to 40	275	19.0	350	24.1	350	24.1
2	50	275	19.0	275	19.0	300	24.1

Note: It requires approximately 15°F (-9°C) change in temperature to fully close valve.

TYPE LTC CAPACITY INFORMATION (SCFH) OXYGEN SERVICE - 50 PSI AND 100 PSI LEVELS

		50 psi level				100 psi level			
Size, in. (mm)	C_V	1 psid	2 psid	5 psid	10 psid	1 psid	2 psid	5 psid	10 psid
½ (15)	9.0	4109	5788	9044	12530	5480	7734	12147	16986
¾ (20)	9.0	4109	5788	9044	12530	5480	7734	12147	16986
1 (25)	13.0	5935	8361	13064	18100	7916	11171	17546	24535
1¼ (32)	37.5	17122	24119	37684	52211	22835	32223	50612	70775
1½ (40)	37.5	17122	24119	37684	52211	22835	32223	50612	70775
2 (50)	52.5	23970	33767	52757	73095	31969	45113	70857	99085

TYPE LTC CAPACITY INFORMATION (SCFH) OXYGEN SERVICE - 150 PSI AND 200 PSI LEVELS

		150 psi level				200 psi level			
Size, in. (mm)	C_V	1 psid	2 psid	5 psid	10 psid	1 psid	2 psid	5 psid	10 psid
½ (15)	9.0	6572	9280	14605	20495	7506	10602	16705	23485
¾ (20)	9.0	6572	9280	14605	20495	7506	10602	16705	23485
1 (25)	13.0	9492	13404	21096	29603	10842	15315	24129	33922
1¼ (32)	37.5	27382	38665	60853	85394	31274	44177	69604	97853
1½ (40)	37.5	27382	38665	60853	85394	31274	44177	69604	97853
2 (50)	52.5	38334	54130	85195	119552	43784	61847	97445	136994

Note: psid values are pressure drops across valve.

TO DETERMINE CAPACITY

Determine operating pressure level at the valve and the maximum allowable pressure drop across the valve. Then refer to table above reading down the appropriate column to the selected pipe size. As an example: you are operating at a 150 psi pressure level and the maximum allowable pressure drop across the valve is 2 psi. Look at the second table under the 150 psi level and 2 psid column. For a 1¼" pipe size, the capacity would be 38,665 SCFH. Note: the values shown in the table are for oxygen gas; all capacity figures are standard cubic feet per hour. To determine capacity figures for other gases, consult the conversion chart below and multiply the chart capacities by the factor given.

GAS CONVERSION FACTORS

Gas	Oxygen	Nitrogen	Hydrogen	Helium	Argon
Factor	1.000	1.075	4.000	2.860	0.893

TYPE LTC SELECTION GUIDE

Example:	LTC	C	S	–	01	A
Model						
LTC LTC valve						
Valve size						
C ½ in. (15 mm)						
D ¾ in. (20 mm)						
E 1 in. (25 mm)						
F 1¼ in. (32 mm)						
G 1½ in. (40 mm)						
H 2 in. (50 mm)						
Connection type						
S NPT threaded union ends						
B BSPT threaded union ends						
Design revision						
(-) Indicates original design						
Variation						
01 Catalog standard						
02 With Thermowell						
Temperature range						
A -40 to 0°F (-40 to -18°C)						

FINAL LINE CIRCUIT (HOUSE LINE)

Liquid is forced into the vaporizer through the liquid line by the action of the vapor pressure in the tank. The liquid in the vaporizer is warmed by ambient air (or sometimes by steam) and changed into gas, which is then distributed through the final-line regulator. As the gas is at or near ambient temperature, the diaphragm and seat in the regulator can be furnished in standard rubber materials.

A-31 PRESSURE REDUCING VALVE FOR FINAL-LINE GAS SERVICE

Construction
Brass forged body, brass piston; NBR seat disc and diaphragm; aluminum spring chamber; stainless steel spring. All parts are commercially cleaned for oxygen service. Standard valve has side inlet-side outlet connections. Also available with side gauge connections.

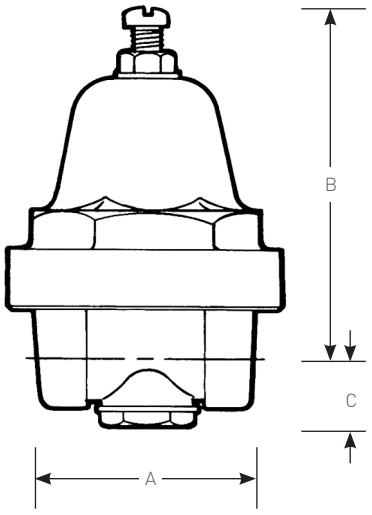
Temperature rating: 180 to -40°F (82 to -40°C)
Maximum initial pressure: 300 psi (20.7 bar)

STANDARD SPRING RANGES, psig (bar)

Spring Material	Type	1	2	3	4	5	6	7	8	9
Steel	A16	2 to 30 (0.14 to 2.1)	10 to 50 (0.69 to 3.4)	25 to 90 (1.7 to 6.2)	80 to 120 (5.5 to 8.3)	100 to 180 (6.9 to 12.4)	- - - -	- - - -	- - - -	- - - -
	A31, A31S, A32	2 to 30 (0.14 to 2.1)	10 to 50 (0.69 to 3.4)	30 to 90 (2.1 to 6.2)	80 to 120 (5.5 to 8.3)	100 to 180 (6.9 to 12.4)	- - - -	- - - -	- - - -	- - - -
	A31VR (in/hg)	0 to 15 (0 to 0.5)	10 to 30 (0.34 to 1.0)	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
SST	A31	2 to 15 (0.14 to 1.0)	2 to 25 (0.14 to 1.7)	15 to 65 (1.0 to 4.5)	40 to 100 (2.8 to 6.9)	50 to 150 (3.4 to 10.3)	75 to 175 (5.2 to 12.1)	100 to 250 (6.9 to 17.2)	- - - -	- - - -
	A32	2 to 15 (0.14 to 1.0)	2 to 25 (0.14 to 1.7)	15 to 65 (1.0 to 4.5)	40 to 100 (2.8 to 6.9)	50 to 150 (3.4 to 10.3)	75 to 175 (5.2 to 12.1)	100 to 250 (6.9 to 17.2)	200 to 400 (13.8 to 27.6)	300 to 600 (20.7 to 41.4)
	A31S	2 to 15 (0.14 to 1.0)	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -

DIMENSIONS

Size		Dimensions						Shipping weight	
		A		B		C			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
¼	8	2.30	58.3	3.29	83.5	0.84	21.3	1⅛	0.51



A16, A31, A31S, A31VR, A32S SELECTION GUIDE

Example:	A16-	A	W	S	A	S	B	B	F	02	-	D	1

Model

A16-	A16	**A31V**	A31VR
A31-	A31	**A32S**	A32S
A31S	A31S		

Size

Y	⅛ in. (6 mm) (A31, A31S)
A	¼ in. (8 mm) (A16, A31, A31S, A31VR, A32S)
B	⅜ in. (10 mm) (A16, A31, A31S)

Service

W	Water/air
F	Final line gas (A31)
V	Vacuum service (A32VR)

Body/connection style

S	Side inlet/side outlet - straight thru (A16, A31)
R	Side inlet/side outlet - straight thru with right side gauge port (A31S)
L	Side inlet/side outlet - straight thru with left side gauge port (A16, A31S)
B	Side inlet/bottom outlet with straight thru gauge connection (A31VR)

Spring chamber material

A	Aluminum spring chamber (A16, A31, A31S, A32S)
Z	Brass spring chamber (A31, A31VR only)

Spring chamber style

S	Standard
N	Non-vented
P	Panel mount

Diaphragm material

B	NBR (A16, A31, A31S, A32S)	**R**	EPR (A31VR, A32S)
L	NBR with PTFE liner (A31, A31S)	**F**	EPR with PTFE liner (A31VR)
N	Neoprene (A31, A31S)		
T	Neoprene with PTFE liner (A31, A31S)		

Seat material

B	NBR (A16, A31, A31S, A32S)	**S**	Silicone (A31VR)
T	PTFE (A31, A32S)	**K**	Kalrez (A31VR)
V	FKM (A31, A31S)		

Pressure screw style

F	Fillister (A16, A31, A31S, A32S)	**K**	Knurled (A31VR)
T	T-handle (A31, A31S)	**W**	Handwheel plastic (A21)
H	Hex (A31, A31S)		

Variations

01	Standard	**11**	Standard variation with inlet screen (A31)
02	Balanced piston (A31, A31S)	**12**	Balanced piston with inlet screen (A31)

Design revision

(-)	Original design

Spring material

D	Carbon steel (Industrial or final line gas service only)
E	Stainless steel

Spring range

Refer to table on page 26

HIGH PURITY REGULATING VALVES

A line of high purity regulating valves for electronic grade and other high purity gases is also available. This includes pressure reducing valves, back pressure valves and valves suitable for differential service.
Valve bodies are investment cast 316L stainless steel, with internal trim 316L bar stock.
Interior (wetted) surface finish is 15 micro inch or better. The finish is electropolished. Also, all maintenance may be carried out without removing the valve from the line.

Sizes are ½ and 1½ in. (15 and 40 mm), butt weld ends, 0.065 wall (½ in. size, 0.049 wall). Spring ranges are typically up to 400 psig (27.6 bar) control.

Temperature limits are 400 to -425°F (204 to -254°C). All valves are cleaned for high purity gas compatibility.

Contact your sales representative for additional information and pricing.

Reference:
G60HP-pressure build service
FRHP-economizer service

C-776 SAFETY VALVE

Type C-776 cryogenic safety valves are available in sizes from ½ to 2 in.(15 to 50 mm).

Request data sheet VCTDS-00515 for details.

2300 SHUT-OFF VALVE

Type 2300 is a brass shut-off globe style valve with ¼, ⅜ and ½ in. (8, 10 and 15 mm) NPTF connections. It offers the option of a stainless steel stub end inlet connection with a ⅜ in. (10 mm) NPTF outlet connection.

Temperature rating:	150 to -320°F (65 to 195°C)
Maximum inlet pressure:	700 psig (48.3 bar)

TYPE 2300 SELECTION GUIDE

Example:	2300	A	S	P	–	01
Model						
2300 2300 shut-off valve						
Valve size						
A ¼ in. (8 mm)						
B ⅜ in. (10 mm)						
C ½ in. (15 mm)						
Body connection						
S Side in/side out withNPT connections						
B Side in/side out withBSPP connections						
1 Inlet ⅜ sch.10 x 1.125 long pipe/outlet ⅜ NPT						
2 Inlet ⅜ sch.10 x 2.125 long pipe/outlet ⅜ NPT						
3 Inlet ⅜ sch.10 x 3.375 long pipe/outlet ⅜ NPT						
4 Inlet and outlet ⅜ sch.10 x 1.125 long pipe						
5 Inlet ½ sch. 5S x 2.125 long pipe/outlet ½ NPT						
Handwheel colors						
P Plain						
B Blue						
G Green						
R Red						
Design revision						
(-) Indicates original design						
Variation						
01 Standard						
02 With 4 in. (102 mm) extended stem						

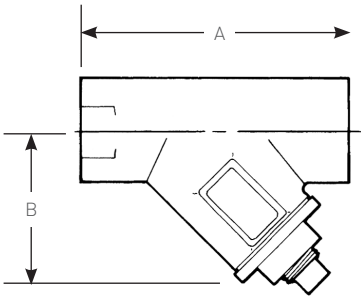
SY-70C 'Y' PATTERN STRAINERS

These strainers are suited for most cryogenic applications. Installed in the line ahead of automatic regulators, they protect valve seats, gauges, meters, regulators and other equipment from most foreign material to reduce maintenance costs and replacement expense.

Construction

ASTM B62 high-tensile cast bronze body, 100 mesh Monel® strainer screen; a brass blowoff plug is shipped with each strainer. All parts are commercially cleaned for cryogenic service.

Temperature rating: 150 to -320°F (65 to 195°C)
Maximum set pressure: 400 psi (27.6 bar)



DIMENSIONS

Strainer size		Blow off plug size		Dimensions				Shipping weight	
				A		B			
in.	mm	in.	mm	in.	mm	in.	mm	lbs	kg
½	15	¼	8	2 15/16	74.68	1 27/32	46.99	0.6	0.27
¾	20	¼	8	3⅝	91.95	1 15/16	49.53	1.3	0.59
1	25	⅜	10	4½	114.30	2¾	69.85	2	0.91
1¼	32	⅜	10	5⅛	130.30	3 11/32	85.09	3.1	1.41
1½	40	½	15	5 13/16	147.58	3¾	95.25	4.1	1.86
2*	50	¾	20	6 13/16	172.58	4 13/16	122.68	9	4.08

Capacity information

Capacity information is available on request. Write to the factory supplying full valve and application specifications.

NOTE

NPTF, also referred to as 'Dryseal' thread, is designed to provide a more leak-free seal without the use of PTFE tape or other sealant compound. NPTF threads are interchangeable with NPT threads and are standard on all Cash Valve products.