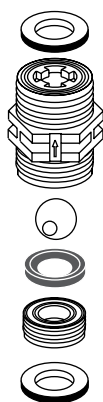
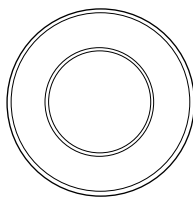


Motor Pump Spare Parts

Sigma 1, 2, & 3



Valve
Complete



Complete liquid ends include pump head, valves, mounting screws, diaphragm and backplate. Clamping nuts and inserts are not included with complete liquid ends, complete valves or spare parts kits. Spare parts kits include:

PVT Liquid ends

- 1 Diaphragm
- 1 Suction valve
- 1 Discharge valve
- 2 Valve balls
- 1 Set of o-rings

SST Liquid ends

- 1 Diaphragm
- 2 Valve balls
- 1 Set of o-rings, complete (sleeve rings, ball seat rings)

Material Code	Liquid End Complete	Spare Parts Kit	Valve Complete	Diaphragm
12017, 12035, 10050 with Liquid end FM 50				
PVT	1010560	1010541	1002267	1010279
SST	1010561	1010555	QTY = 4	1010279
SST*		1010554		1010279
10022, 10044, 07065 with Liquid end FM 65				
PVT	1010562	1010542	1002267	1010282
SST	1010563	1010557	809459	1010282
SST*		1010556		1010282
07042, 04084, 04120 with Liquid end FM 120				
PVT	1010565	1010543	792517	1010285
SST	1010566	1010559	809404	1010285
SST*		1010558		1010285
12050 with Liquid end FM 130				
PVT	792755	740324	792517	792495
SST	792761	740328	809404	792495
SST*		740326		
12090, 12130 with Liquid end FM 130				
PVT	7792755	740324	792517	792495
SST	792761	740328	809404	792495
SST*		740326		
07120, 07220 with Liquid end FM 350				
PVT	792756	740325	740615	792496
SST	792762	740329	803708	792496
SST*		740327		
04350 with Liquid end FM 350				
PVT	7792756	740325	740615	792496
SST	792762	740329	803708	792496
SST*		740327		
120145, 120190, 120270, with Liquid end FM 330 - DN 25				
PVT	1005298	1005308	740615	1004604
SST	1005300	1005312	803708	1004604
SST*		1005310		1004604
070410, 070580, 040830, with Liquid end FM 1000 - DN 32				
PVT	1005297	1005309	1002806	1002835
SST	1005299	1005313	1002811	1002835
SST*		1005311		1002835

Liquid End Version	Material Code	Complete Liquid End	Spare Parts Kit	Valve Complete Suction (Spare valves only)	Valve Complete Discharge	Packing set
Sigma HK						
08 (For pump versions 32002, 23004, & 10006)	S	1000584	1001572	803792	803793	1000565
12.5 (For pump versions 14006, 10011, & 05016)	S	910420	910470	803792	803793	485401
25 (For pump versions 07012, 04522, & 02534)	S	910421	910471	803792	803793	485402
50 (For pump versions 04022, 02541, & 01264)	S	910422	910472	803794	803795	485403

Duragauge® Pressure Gauge Type 1279, ASME B 40.1 Grade 2A ($\pm 0.5\%$ of span)

- 4½" full-size bourdon tube
- Patented Duratube™ with as-welded tube construction controls stress for longer life
- "Round Cap Tip" construction lowers stresses for longer life
- Easily adjustable, self-locking micrometer pointer
- Burn-resistant phenol turret case
- Exclusive Teflon coated 400 series stainless steel rotary movement for longer life
- New PLUS!™ Performance Option:
 - Liquid-filled performance in a dry gauge
 - Fights vibration and pulsations without liquid-filled headaches

- See pages 6-7 for details
- Order as option XLL
- Epoxy-coated system for superior corrosion resistance

Type 1279 Duragauge® pressure gauge is offered in 4½" phenolic case for superior chemical and heat resistance. Solid-front case design with blow-out back for safety. Dry, liquid-filled, hermetically sealed, weatherproof or **PLUS!** options available. Field convertible to liquid-fill with conversion kit (detailed on page 243). All case styles provide full temperature compensation.



BOURDON SYSTEM SELECTION

Ordering Code	Bourdon Tube & Tip Material ⁽¹⁾ (all joints TIG welded except "A")	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn. ⁽²⁾
A	Phosphor Bronze Tube-Brass Tip, Silver Braze	Brass	C-Tube	12/1000	1/4, 1/2
R	316L stainless steel	1019 steel	C-Tube	12/1500	1/4, 1/2
			Helical	2000/20,000	1/4, 1/2
S	316L stainless steel	316L stainless steel	C-Tube	12/1500	1/4, 1/2
			Helical	2000/20,000	1/4, 1/2
P ⁽³⁾	K Monel	Monel 400	C-Tube	15/1500	1/4, 1/2
			Helical	2000/30,000	1/4, 1/2 ⁽⁴⁾

(1) For selection of the correct bourdon system material, see the media application table on page 243.

(2) Other connections available on application.

(3) Use for applications where NACE standard MR-01-75 is specified.

(4) 30,000 psi range supplied with 1/4 high pressure connection, 1/2 NPT optional.

STANDARD RANGES

Pressure psi	Compound psi
0/15	30 in.Hg/15 psi
0/30	30 in.Hg/30 psi
0/60	30 in.Hg/60 psi
0/100	30 in.Hg/100 psi
0/160	30 in.Hg/150 psi
0/200	30 in.Hg/300 psi
0/300	
0/400	Vacuum
0/600	30/0 in.Hg
0/800	34/0 ftH ₂ O
0/1000	
0/1500	
0/2000	
0/3000	
0/5000	
0/10,000	
0/20,000	
0/30,000	

NOTE:
Equivalent standard
kg/cm², and kPa metric
ranges are available.

TO ORDER THIS 1279 DURAGAUGE:

Select:

1. Dial size—4½" 45
2. Case type—1279 1279
Ring-threaded reinforced polypropylene
3. Bourdon system selection ordering code SS*
4. Connection—1/4 NPT (02), 1/2 NPT (04), Lower (L), Back (B) 04L
5. Optional features—see page 239 -
6. Standard pressure range 60 PSI
7. Accessories—see pages 233-238

(*) "S" denotes solid front case design

Consult factory for guidance in product selection
Phone (203) 385-0217, Fax (203) 385-0602 or
visit our web site at www.ashcroft.com

MADE IN U.S.A.

DRESSER
Instruments

SELECTION

Pressure Ranges – Select a gauge with a full scale pressure range of approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Failure to select a gauge range within this criteria may ultimately result in fatigue failure of the Bourdon tube component.

INSTALLATION

Always use a wrench on the flats of the gauge socket to screw the gauge in place. When a fitting is being screwed to the gauge, hold a wrench on the socket flats instead of twisting against the gauge socket screws which are intended to hold the gauge mechanism in the case.

When gauges are mounted on the wall or panel, make sure they are connected free from piping strains. Also see that the mounting surface is flat, or insert washers under the flange of the gauge case to obtain three-point suspension. Preferably, the last length of piping leading up to the gauge should be flexible tubing. This will ensure that the gauge is free from strain.

Install gauges where they will be free from the effects of mechanical vibrations as this will wear out any gauge quickly. Try to mount the gauge on a wall nearby and connect the gauge to the machine which vibrates badly by means of flexible line assembly.

Protect gauges from frequent pressure pulsations by using liquid-filled or Duragauge Plus® with a throttle screw in the socket of the gauge, needle valves, pulsation dampeners or pressure snubbers.

When any gauge is used for steam pressures, a siphon filled with water must be installed between the gauge and the line. When the system is subject to occasional vacuum, provide a leg of piping which cannot be emptied by the vacuum effect. A drain cock or plug should be installed at the bottom of this leg to enable occasional cleaning out of the sediment. The head effect of this piping leg should be compensated for by resetting the pointer of the gauge.

OPERATING CONDITIONS

The operating conditions to which a gauge will be subjected must be considered. If the gauge will be subjected to severe vibration or pressure pulsations, liquid filling the gauge may be necessary to obtain normal product life. Other than discoloration of the dial and hardening of the gasketing that will occur as ambient temperatures exceed 150°F, metal case Duragauges (that are not liquid filled) can withstand continuous ambient temperatures as high as 250°F. Liquid filled gauges can withstand 200°F but glycerin fill and acrylic window will tend to yellow. Accuracy will be affected by approximately 1.5% per 100°F. Gauges with welded joints will withstand 750°F (450°F with silver brazed joints) for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost. For temperature limits on other gauges see the appropriate bulletin.

PROPER USE

Apply pressure slowly. do not open gauge cock or valve too quickly – this imparts a severe strain on the Bourdon tube which may rupture it, or result in shortened life. When the service itself is subject to sudden pressure applications, use a needle valve or the Ashcroft Gauge Saver.

Avoid overpressure. See that the apparatus is provided with a relief valve and that the range of the gauge is higher than the set pressure of the relief valve.

Sudden pressure release has the same detrimental effect and should be compensated for in the same manner as for the pressure applications mentioned above. On hydraulic presses, Catalog Number 1056 or 1009DH Gauges with slotted link should be specified. See Special Service Bulletin SG-1.

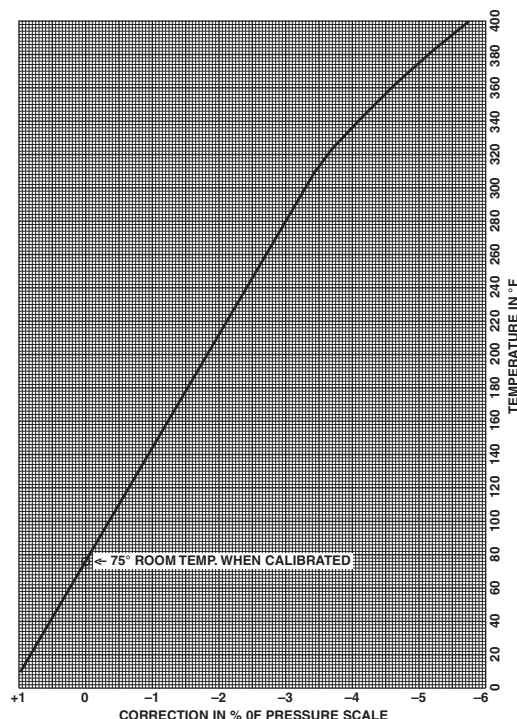
MAINTENANCE

Replace broken glasses and thus keep dirt out of the working bearings and teeth of the movement mechanism.

Never oil gauge movements or linkages except with high grade instrument oil. Regular oil attracts dirt and becomes gummy, thus causing the gauge to act sluggish and inaccurate.

HEAT AFFECTS GAUGE ACCURACY

Approximate error or change in calibration of a Bourdon tube type pressure gauge caused by changes in temperature.



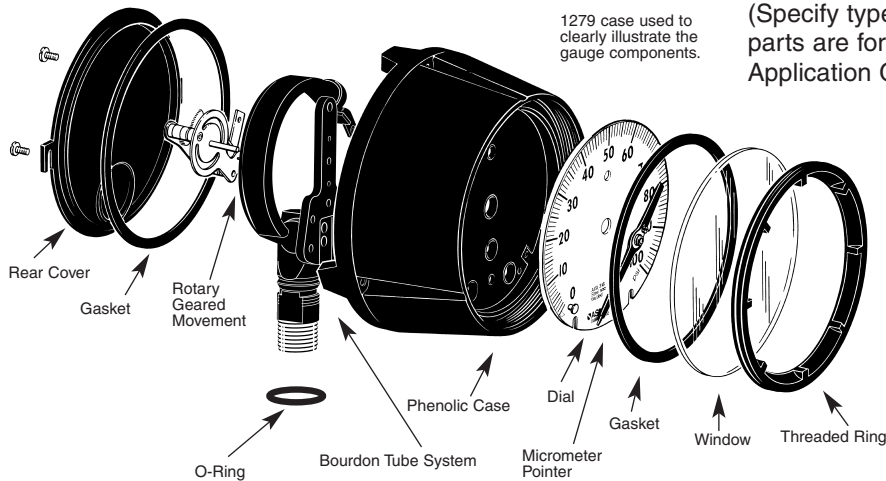
Example: Gauge working at 500 psi pressure at 280°F. temperature would have a -3% correction and would read 3% or 15 psi fast.

Installation and Maintenance Instructions for ASHCROFT® Pressure Gauges, Gauge Parts and Ring Designs, Engineering Data



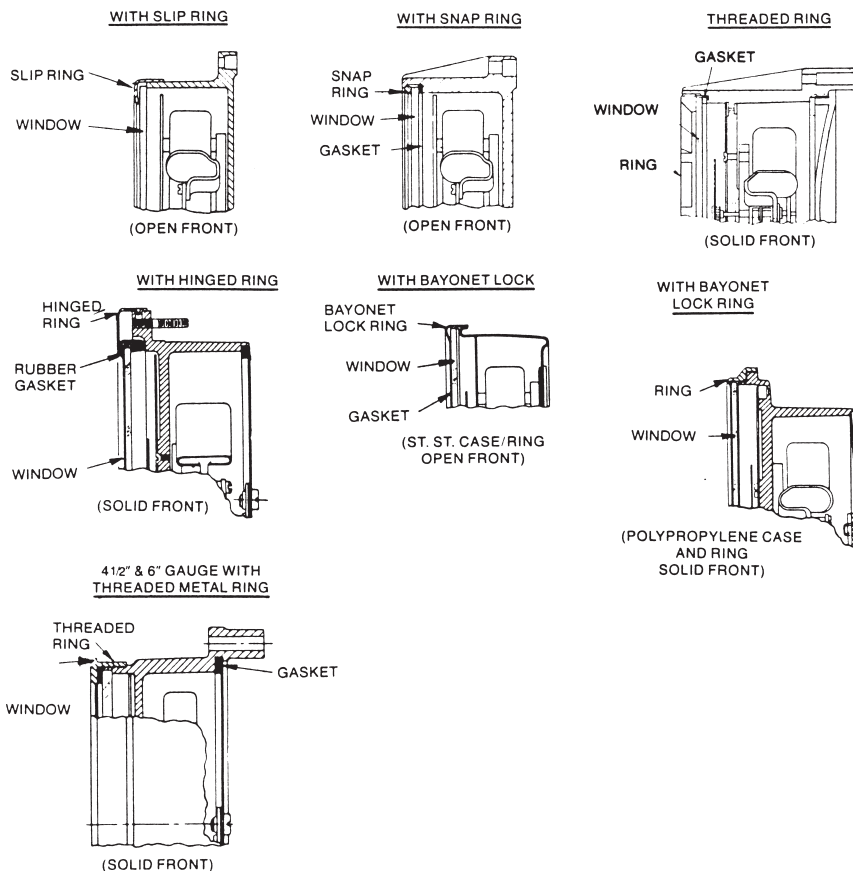
The drawing below shows a typical solid front, lower connection Duragauge with all of the parts designated by their standard names. The use of these names will facilitate the ordering of parts and eliminate any misunderstanding in describing gauge construction.

When ordering parts – specify as much of the following data as possible: *Size* (Dial Diameter); *Case Material* (Stainless Steel, Polypropylene, Aluminum or Phenol); *Case Type* (Open Front or Solid Front); *Ring Design* (Slip, Internal Threaded, External Threaded, Bayonet, Snap or Hinged); *Connection Location* (Lower or Back); *Connection Size* ($\frac{1}{4}$ " or $\frac{1}{2}$ ""); *Bourdon Tube/Socket* (Material Indicated on Dial); *Dial Range* (Specify type number if possible; otherwise, mention whether parts are for Duragauge, General Service Gauge, Special Application Gauge, Receiver Gauge or Test Gauge.)



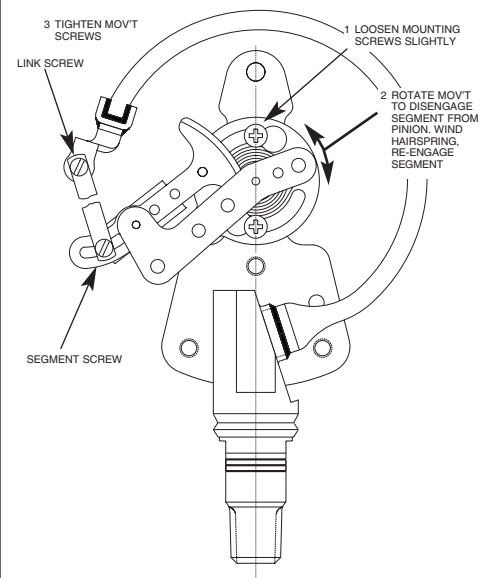
Note: The socket, tube and tip assembly is furnished as one integral unit. The movement is supplied complete.

TYPICAL CONSTRUCTION DETAILS



CALIBRATION PROCEDURE

1. Preliminary Gauge Calibration Setting – (SOLID FRONT GAUGE SHOWN)



2. Calibration –

- At zero pressure (or at full vacuum for compound or vacuum gauges), assemble pointer to pinion shaft in the horizontal position.
- Apply pressure equal to full range and adjust the slide in the segment slot until the pointer has rotated 270° (vertical position).
- Reduce pressure to zero and reset pointer, if necessary, to horizontal position. If pointer adjustment was required, repeat step (b) above.
- Apply pressure equal to mid-scale and drive pointer firmly onto pinion.
- Recheck calibration at the lower and upper ends of the scale.

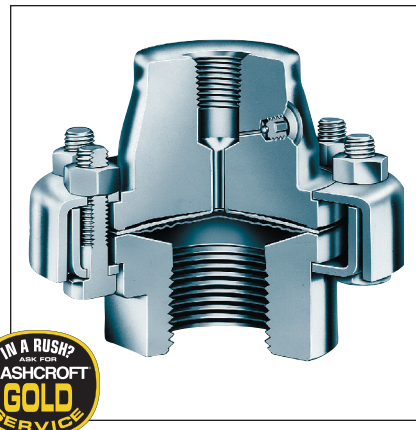
3. Linearity Adjustment –Although the procedure outlined above should produce a correctly calibrated gauge, linearity adjustment may be required. If the pointer reads correctly at the bottom of the scale and low at the top of the scale, rotate the movement to increase the angle between the link and the segment. If the pointer reads high, rotate the movement in the opposite direction.

Type 200 Welded

- Teflon gasketed, continuous-duty diaphragm capsule is welded to the top housing, which is then clamped to a bottom housing.
- Fill/bleed connection is standard.
- Top housing and pressure instrument are removable.
- Available in same process connections, materials, types and sizes as the Type 100 capsule design.
- Top housing is interchangeable with all standard Ashcroft® bottom housings.

Type 200 Bonded Viton, Kalrez and Teflon

Similar in construction, materials, and product features to the Type 300 clamped diaphragm seal on page 142, the diaphragm in the Type 200 seal is bonded permanently to the top housing – and is the removable type.


SELECTION TABLES
Table A – Process Connection/Type Number

	Process Connection Size/Code—Inches											Type Number
	Size	1/4	1/2	3/4	1	1 1/2	2	3	4	6	8	
Process Connection	Code	25	50	75	10	15	20	30	40	60	80	Welded & Bonded ⁽³⁾
Threaded—female NPT		*	*	*	*	*						200
Threaded—female NPT (with flushing connection)		*	*	*	*	*						201
Flanged ⁽¹⁾			*	*	*	*	*	*				202
Flanged (with flushing connection)			*	*	*	*	*	*				203
In-line—threaded NPT		*	*	*	*							204
Saddle									AND LARGER			205
In-line—butt weld		*	*	*	*	*	*	*				208
In-line—flanged ⁽²⁾			*	*	*	*	*	*	*	*	*	206
In-line—socket weld		*	*	*	*	*	*	*				207

Pressure Ratings—All 2500 psi except flanged seals are per ASME B 16.5, temperature limit determined by diaphragm, bottom housing and/or filling fluid.

**Table B
Diaphragm Material**

Material	Code
316L stainless steel	S
304 stainless steel	C
K-Monel ⁽⁸⁾	P
Nickel	N
Carpenter 20	D
Tantalum	U
Hastelloy B	G
Hastelloy C 22 ⁽⁷⁾	J
Hastelloy C 276 ⁽⁷⁾	H
Teflon ⁽⁹⁾	T
Viton ⁽⁶⁾	Y
Kalrez ⁽¹²⁾	K
Titanium	TI

**Table C
Bottom Housing Materials**

Material	Code
Steel	B
304L stainless steel	C
316L stainless steel	S
Hastelloy B	G
Hastelloy C 22 ⁽⁷⁾	J
Hastelloy C 276 ⁽⁷⁾	H
Carpenter 20	D
Monel “400” ⁽⁷⁾	M
Inconel “600”	W
Nickel	N
PVC ⁽⁸⁾	V
Tantalum clad stainless steel ⁽⁹⁾	SU
Halar coated stainless steel ⁽¹⁰⁾	BH
Teflon flanged steel ⁽¹¹⁾	T
Kynar ⁽¹³⁾⁽¹⁴⁾	KY
Titanium ⁽¹³⁾	TI

**Table D
Instrument Connection**

Size – NPT	Code
1/4	02T
1/2	04T

NOTES:

- (1) 150, 300, 600, 900, 1500 & 2500 class flanges.
- (2) 1” 150 thru 8” 300 class flanges only.
- (3) Metal diaphragms welded; Teflon, Kalrez & Viton diaphragms bonded.
- (5) Temp. Limits: –40/400°F.
- (6) Max. Pressure: 500 psi. Temp. Limits: –40/350°F.
- (7) Use on applications where NACE standard MR-01-75 2003 is specified.
- (8) Maximum Press./Temp.
Threaded: 200 psi/74°F, 125 psi/125°F, 80 psi/150°F.
Flanged: 75 psi/100°F.
- (9) Type 202 only.
- (10) Temp. Limits: –40/300°F.
- (11) Only available in 1”, 1 1/2”, & 2” 150 class, Type 202.
Max. Press./Temp. – 270 psi and 150°F.
Consult factory for conditions beyond these limits.
- (12) Max. Pressure: 500 psi
Temp. Limits: 30/212°F.
- (13) On application.
- (14) Maximum Pressure/Temp.: 200 psi and 180°F.

Table E – Filling Fluid

Filling	Service	Connection to Instrument	Temperature Range °F	Code
Glycerin	Pressure	Direct Only	0/400	CG
Silicone	Pressure/Vacuum	Direct or Flexible Line	–40/600	CK
Halocarbon	Pressure/Vacuum in presence of strong oxidizing agent	Direct or Flexible Line	–70/300	CF
Syltherm	Pressure/Vacuum	Direct or Flexible Line	–40/750	HA

TO ORDER THIS TYPE 200 DIAPHRAGM SEAL:

1. From Table A...select TYPE NUMBER based on process connection, process connection size and diaphragm type/construction. (e.g., Threaded/1”/welded—code-10-200)
2. From Table B...select DIAPHRAGM MATERIAL. (e.g., 316L stainless steel—code S)
3. From Table C...select BOTTOM HOUSING MATERIAL. (e.g., 316 stainless steel—code S)
4. From Table D...select INSTRUMENT CONNECTION size. (e.g., 1/4 NPT—code 02T)
5. From Table E...select FILLING FLUID. if diaphragm seal will be attached to instrument. (e.g., Glycerin—code CG)

Coded order: 50-200SS-04T-XCG

Consult factory for guidance in product selection
 Phone (203) 385-0217, Fax (203) 385-0602 or
 visit our web site at www.ashcroft.com

Pump & Systems Accessories

Backpressure Valves

Pressure Relief Valves

Backpressure, antisiphon and pressure relief valves



In-line pressure relief valve (3 port)



Backpressure valve (2 port)



Backpressure valve on tee for pressure relief

Backpressure (2-port) valves may be used in-line to provide a constant discharge pressure for protection from siphoning, or they may be teed off of the discharge line for pressure relief, discharging back to the source tank or to the pump suction line to create a bypass.

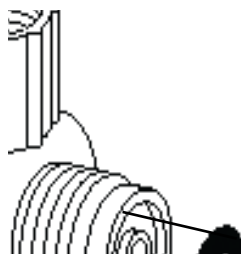
Pressure relief (3-port) valves are mounted in the discharge line, featuring a separate relief port which discharges back to the source tank or to the pump suction line to create a bypass.

Backpressure valves provide several functions: they improve repeatability by providing a constant discharge pressure; they provide antisiphon protection for discharge into pressurized water lines or vacuums, or where suction head exceeds discharge head; and they minimize pulsation when used in conjunction with a pulsation dampener.

In-line backpressure/antisiphon and pressure relief valves

These adjustable backpressure (2-port) and pressure relief (3-port) valves have FNPT ports and require tubing adapters for use with flexible tubing.

Can be adjusted with screwdriver.



DIMENSIONS: 1/4" to 1/2" valves

D	A (in)	B (in)	C (in)
1/4"	4.90	2.6	1.2
*1/4"	*3.5	*2.375	*0.75
1/2"	4.9	2.6	1.2
*1/2"	*5.5	*3.5	*1.125
3/4"	5.4	3.5	1.1
1"	5.7	3.9	1.4
1-1/2"	8.5	4.6	2.2
2"	8.5	4.6	2.2v

*Note: Dimensions apply to SS and PTFE valves only.

DIMENSIONS (for replacement valves only): 1/4" to 1/2" valves - SEE PG. 8

D	A (in)	B (in)	C (in)
1/4"	3.9	2.375	0.75
*1/4"	*3.5	*2.375	*0.75
1/2"	4.6	2.375	1.125
*1/2"	*5.5	*3.5	*1.125
3/4"	5.5	3.5	1.125
1"	5.8	3.5	1.25
1-1/2"	9.0	4.5	2.1
2"	9.0	5.0	2.1

*Note: Dimensions apply to SS, PVDF and PTFE valves only.

Technical data

Size:

1/2"

Diaphragm

Materials:

PTFE-faced EPDM

Liquid Handling

Materials:

PP, PVC, PTFE, PVDF

316 Stainless Steel

Pressure Adjustment:

0-150 psig (0-10.3 bar)

Flow rates @ 45 psig (3.1 bar):

1/4" - 132 U.S. gph (500 L/h)

1/2" - 132 U.S. gph (500 L/h)

Flow rates @ 150 psig:

1/2" (PP, PVC) - 200 U.S. gph (757 L/h)

1/2" (PVDF, TT, SS) - 300 U.S. gph

(1135 L/h)

3/4" - 300 U.S. gph (1135 L/h)

1" - 500 U.S. gph (1893 L/h)

1-1/2" - 900 U.S. gph (3407 L/h)

2" - 1200 U.S. gph (4542 L/h)

Max. Temperature:

PP - 195°F (90°C)

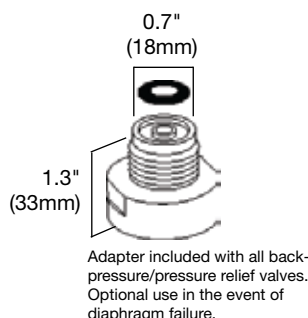
PVC - 140°F (60°C)

PTFE - 250°F (121°C)

PVDF - 250°F (121°C)

316 Stainless - 250°F (121°C)

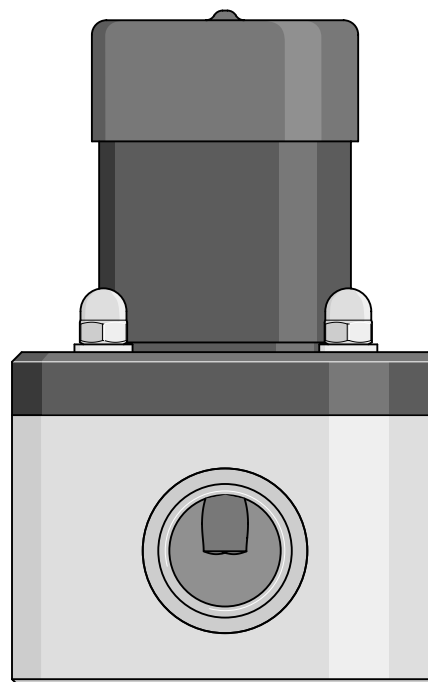
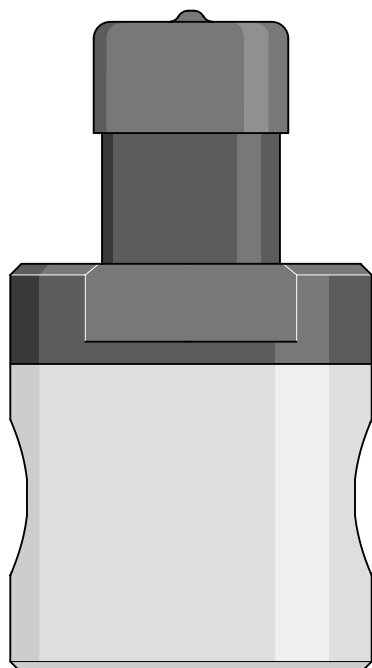
Max. Pressure Rating 170 psig @ 120°F



Adapter included with all backpressure/pressure relief valves. Optional use in the event of diaphragm failure.

Operating Instructions

ProMinent® Backpressure and Pressure Relief Valves



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Description of Controls & Operation	5	Repair Service	7
Helpful Tips	5	Troubleshooting	7
Specifications	5	Dimensions	11

Read the operating instructions before installation and use. The warranty does not cover damages due to faulty operation. Keep for reference and replacement information.

BA B/PRVI 01 1/04 NA

Order no.7750089

ProMinent Fluid Controls, Inc.

136 Industry Drive, Pittsburgh, PA 15275-1014

ProMinent Fluid Controls Ltd.

490 Southgate Drive, Guelph, Ontario N1G 4P5

e-mail: sales@prominent.cc

Phone: 412/787-2484 Telefax: 412/787-0704

e-mail: sales@prominent.ca

Phone: 519/836-5692 Telefax: 519/836-5226

Operating Instructions for ProMinent® Backpressure and Pressure Relief Valves

General Safety Considerations

Safety Operating Procedures

SAFETY INSTRUCTIONS

- Wear protective clothing and glasses when working with or near chemicals.
- Refer to the MSDS for all chemicals being used.
- Use only ProMinent® parts. Use of other parts may result in damage to equipment or injury.
- Flush all components that are in contact with chemicals prior to servicing.
- Secure all chemicals and equipment making them inaccessible to children and pets.
- Dispose of all chemicals and waste according to all local, state and federal regulations.
- Stop the flow of sample through the system prior to working on the pump.
- Do not exceed the maximum operating pressure.

UNPACKING

CHECK ALL EQUIPMENT FOR DAMAGE AND FOR COMPLETENESS AGAINST THE ORDER. REPORT INCORRECT ORDERS OR DAMAGES TO THE SELLER IMMEDIATELY.

The carton should contain:

1 Backpressure or Pressure Relief Valve as ordered
Accessories as ordered

INTRODUCTION

ProMinent® diaphragm pressure relief valves are designed to protect chemical feed systems from overpressure caused by defective equipment or by blockage in the chemical line. Chemical flows through the valve via an internal chamber. When the pressure in the chemical line exceeds the preset pressure of the valve, the diaphragm lifts off the seat and the chemical then flows out the bottom port back into the chemical tank. The relief pressure is adjustable from 0-150 psig by the adjuster in the top of the valve.

ProMinent® diaphragm backpressure valves are used to enhance the performance of the chemical feed pumps by providing a constant head pressure. These valves can also be used as an antisiphon valve. The diaphragm is held against the seat by an internal spring. The backpressure is adjustable from 0-150 psig. When the inlet pressure exceeds the preset pressure, the diaphragm lifts off the seat and the chemical flows to the injection point.



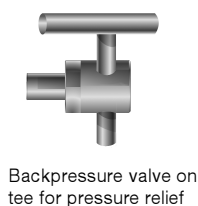
FUNCTION AND DESCRIPTION

The ProMinent® backpressure and pressure relief valves have been modified to include an optional diaphragm safety port to route the chemical in the event of a diaphragm failure. The optional diaphragm safety port fitting must be removed to adjust the backpressure screw. **NOTE: If the optional diaphragm safety port tubing adapter is not installed, upon diaphragm failure, chemical will come out thru the screwdriver adjustment slot.**

INSTALLATION

Pressure Relief Valve

Install as close to the chemical pump discharge valve as possible, without any other equipment, especially shut-off valves, between the pressure relief valve and the pump.



The relief port in the bottom of the valve should be vented back to the chemical tank or directly to the drain. No backpressure can be applied to the outlet of the valve. This will impair the valve's ability to relieve at the preset pressure. The valve should not be installed across the pump. That is, the valve should not be connected from the discharge of the pump to the suction side of the pump if there is a check valve in the suction line that could prevent pressure relief.

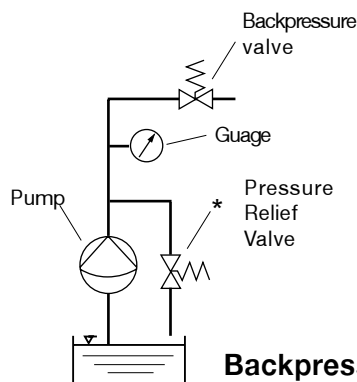
Back Pressure Valve

The backpressure valve can be installed anywhere in the discharge line, provided there is some downstream pressure at the dosage point via an injection valve or line pressure. If there is no downstream pressure, the backpressure valve should be installed at the dosage point to prevent drainage of the chemical line. The chemical must flow across the valve, in the direction of the arrow.

The performance of the backpressure valve will be enhanced with the installation of a pulsation dampener to smooth out the discharge/ suction cycles of the pump.

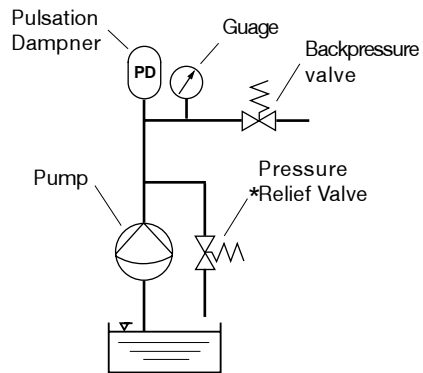
The pulsation dampener should be sized for the dosage volume of the pump head. For most applications, dampeners without diaphragms are acceptable. However some applications require dampeners with diaphragms.

Typical Installation

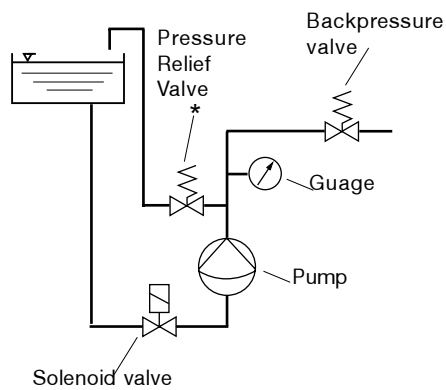


Backpressure valve to produce a constant pressure to pump against.

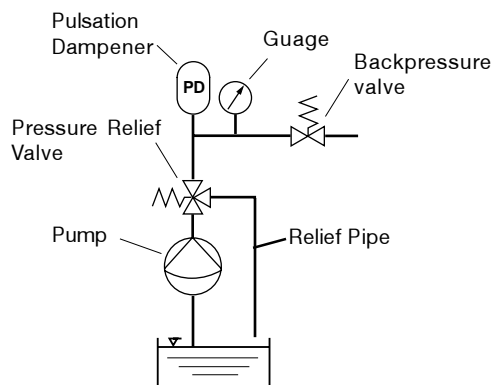
Backpressure valve in conjunction with a pulsation dampener.



Backpressure valve used when the suction pressure is high.



Pressure relief valve to protect pump from overpressure





DESCRIPTION OF CONTROLS AND OPERATION

Adjust the backpressure and the pressure relief valves by turning the pressure adjuster on the valves to the desired pressure. The valves have a screwdriver slot to adjust the pressure. Turning clockwise increases the pressure and counterclockwise decreases the pressure.

OR:

ADJUSTING THE PRESSURE ON THE VALVES

Remove the optional diaphragm safety port from the top of the valve by unscrewing it from the backpressure/pressure relief valve. The valves have a screwdriver slot to adjust the pressure. Turning clockwise increases the pressure and counterclockwise decreases the pressure. Replace the relief assembly by screwing it onto the backpressure/pressure relief valve.

HELPFUL TIPS

1L = 0.264 gallon

1000 mL = 1 L

1 bar = 14.5 psig

SPECIFICATIONS

Size:	1/4", 1/2", 3/4", 1", 1 1/2", 2" NPT or Socket
Diaphragm material:	PTFE-faced EPDM
Liquid handling materials:	PP, PVC, PTFE, PVDF, 316 Stainless Steel
Pressure adjustments:	0-150 psig
Flow rates at 45 psig:	1/4" - 132 gph 1/2" - 132 gph 3/4" - 235 gph 1" - 345 gph 1-1/2" - 740 gph 2" - 740 gph
Max. Temperature:	PP - 122°F PVC - 100°F PTFE - 250°F PVDF - 250°F 316 Stainless - 250°F

ATTACHING TUBING TO THE OPTIONAL DIAPHRAGM SAFETY PORT

Connector sets connect flexible tubing of different sizes to optional diaphragm safety port fitting. A connector set consists of hose nozzle, grip ring, union nut and gasket. All connector sets fit on optional diaphragm safety port with M20 X 1.5 threads. Part number includes two connector sets. One of the following connector sets are required to attach the tubing to the relief port:

PART NUMBERS

PP/VITON® for tubing size 1/4" x 3/16"	790872
PP/VITON® for tubing size 1/2" x 3/8"	740133
PP/EPDM for tubing size 1/4" x 3/16"	790885
PP/EPDM for tubing size 1/2" x 3/8"	740132
PP/EPDM for tubing size 1/4" x 1/2"	817163
PVC/VITON® for tubing size 1/4" x 3/16"	817050
PVC/VITON® for tubing size 1/2" x 3/8"	817055
PVC/VITON® for tubing size 1/4" x 1/2"	817068
PVC/EPDM for tubing size 1/4" x 3/16"	790871
PVC/EPDM for tubing size 1/2" x 3/8"	740160
PTFE for tubing size 1/4" x 3/16"	817201
PTFE for tubing size 1/2" x 3/8"	791199

Cut hose ends straight across

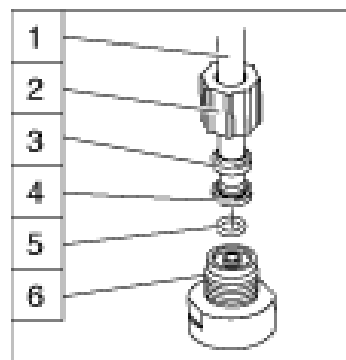
Push Union Nut (2) and clamping ring (3) onto tubing (1)

Push the tubing end (1) over the nozzle (4) to the stop.
Widen if necessary

Place the hose (1) with the nozzle (4) onto the optional diaphragm safety port fitting (6)

Tighten the union nut (2) while pressing in the tubing (1)

Pull the tubing connected to the optional diaphragm safety port fitting (6); then retighten the union nut



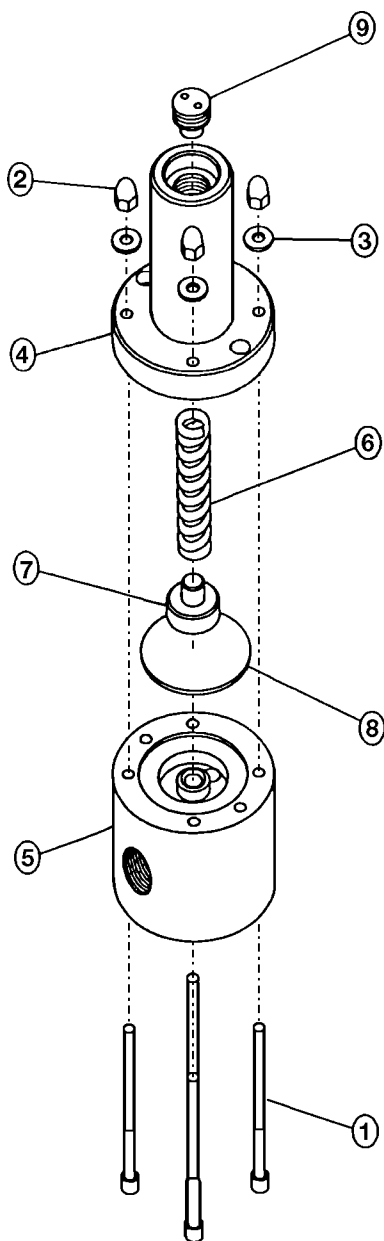
- 1 **Tubing**
- 2 **Union Nut**
- 3 **Clamping Ring**
- 4 **Nozzle**
- 5 **O-ring**
- 6 **Optional diaphragm safety port fitting**

MAINTENANCE

Routinely look for leaks that could indicate a diaphragm rupture. Replacement of the diaphragm can be done without taking the valve out of the chemical line.

Replacing the diaphragm

- Relieve the pressure from the system.
- Flush the chemical lines prior to disassembling the valve.
- Unscrew the pressure adjuster to relieve the pressure from the diaphragm.
- Unscrew the valve top from the valve bottom **or** Remove the 4 bolts from the top of the valve.
- Lift off the top of the valve.
- Inspect the diaphragm and replace as necessary.
- Inspect the adjustment spring for rust or corrosion and replace if necessary.
- Replace the spring and the spring bumper into the top of the valve.
- Slide the top of the valve back over the bolts and Tighten the screws **or** Screw the valve top to the valve bottom and tighten.
- Screw in the pressure adjuster to approximately the same position it was prior to disassembly.
- Use a pressure gauge to adjust the valve to the desired pressure setting.



Example of a backpressure valve

SPARE PARTS

1. Bolts
2. Hex Nut
3. 1/4" Flat Washer
4. Valve Lid
5. Valve Body
6. Pressure Spring
7. Spring Plate
8. Diaphragm
9. Pressure Adjustment Screw

REPAIR SERVICE

Repairs must be done by ProMinent® Fluid Controls. Call your distributor or ProMinent® at (412) 787-2484 for a return goods authorization. DO NOT return any goods without authorization. All items must be free of hazardous chemicals and clean when returned.

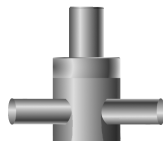
TROUBLESHOOTING

Leaking: Check for clogs, diaphragm ruptures or corrosion of the spring.

Part Numbers and Accessories

1/4" FNPT Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PP	1009444	1009452
PVC	1009445	1009453
PVDF	1009446	1009454
316 SS	1009447	1009455

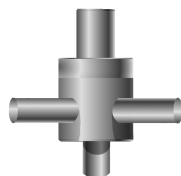
Backpressure
Valve (2 port)Tubing Adapters

(1 required per valve port): 1/4" x 3/16" tubing x 1/4" MNPT

PP/EPDM (PP1)	7358222
PP/Viton (PP2)	7358226
PVC/Viton (NP6)	7358223
PTFE (TT1)	7358224

1/2" FNPT Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PP	1006846	1006858
PVC	1006850	1006862
PVDF	1006854	1006866
316 SS	1008796	1008800

Pressure Relief
Valve (3 port)Tubing Adapters

(1 required per valve port): 1/2" x 3/8" tubing x 1/2" MNPT

PP/EPDM (PP1)	7358220
PP/Viton (PP2)	7358227
PVC/Viton (NP6)	7358221
PTFE (TT1)	7358225

3/4" FNPT Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PP	1006847	1006959
PVC	1006851	1006863
PVDF	1006855	1006867
316 SS	1008797	1008801

Part Numbers and Accessories (CONT.)**1" FNPT Valves**

Material	Backpressure Valve (2-port)	Pressure Relief Valve (3-port)
PP	1006848	1006860
PVC	1006852	1006864
PVDF	1006856	1006868
316 SS	1008798	1008802

1-1/2" FNPT Valves

Material	Backpressure Valve (2-port)	Pressure Relief Valve (2-port)
PP	1006849	1006865
PVC	1006853	1006865
PVDF	1006857	1006869
316 SS	1008799	1008803

2" FNPT Valves

Material	Backpressure Valve (2-port)	Pressure Relief Valve (2-port)
PP	1009448	1009456
PVC	1009449	1009457
PVDF	1009450	1009458
316 SS	1009451	1009459

Spare Diaphragms

1/4" - 1/2" valve PTFE/EPDM	1006813	1006813
3/4" - 1" valve PTFE/EPDM	1006814	1006814
1-1/2"-2" valve PTFE/EPDM	1006815	1006815

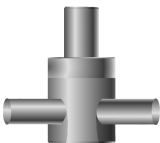
Part Numbers and Accessories

1/4" Socket Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PVC	1019891	1019892
PVDF	1019893	1019894

1/2" Socket Valves

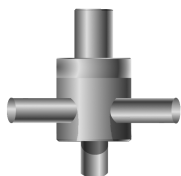
<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PVC	1019883	1019884
PVDF	1019895	1019896



Backpressure
Valve (2 port)

3/4" Socket Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PVC	1019885	1019886
PVDF	1019897	1019898



Pressure Relief
Valve (3 port)

1" Socket Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (3-port)</u>
PVC	1019887	1019888
PVDF	1019899	1019900

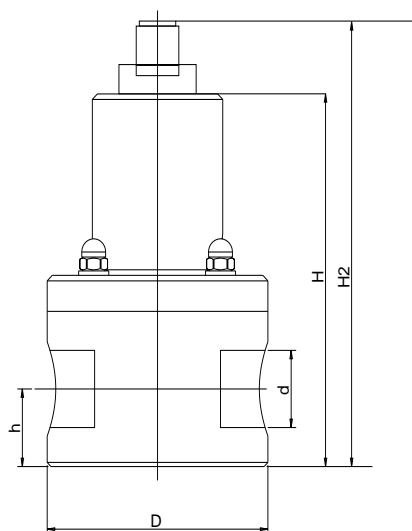
1-1/2" Socket Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (2-port)</u>
PVC	1019889	1019889
PVDF	1019901	1019901

2" Socket Valves

<u>Material</u>	<u>Backpressure Valve (2-port)</u>	<u>Pressure Relief Valve (2-port)</u>
PVC	1019891	1019891
PVDF	1019905	1019905

Dimensions



Valve size d [inches]	Thread type	h [mm]	h (in.)	D [mm]	D (in.)	H [mm]	H (in.)	H2 (mm)	H2 (in.)
1/4	NPT	31	1.2	65	2.6	125	4.9	158	6.2
1/2	NPT	31	1.2	65	2.6	125	4.9	158	6.2
3/4	NPT	28	1.1	88	3.5	136	5.4	169	6.7
1	NPT	36	1.4	98	3.9	145	5.7	178	7.0
1-1/2	NPT	56	2.2	118	4.6	229.5	9.0	260.5	10.3
2	NPT	56	2.2	118	4.6	229.5	9.0	260.5	10.3

Pump & Systems Accessories

Pulsation Dampeners

Pulsation dampeners operate on the principle that gas is compressible and fluid is not. The pulsation dampener consists of an air chamber containing compressed air, a fluid chamber connected to the pump's suction or discharge line, and a bladder or bellows which separates the air and fluid.

Some models are flow-through design, with two ports so they can be mounted directly on the pump suction or discharge line. Other models are single port design, to be teed off of the pump suction or discharge line. Flow-through models may also be used in a tee if one port is capped.

All models feature a Schrader (bicycle) valve and pressure gauge for charging the air chamber on-site.

PVDF/Nordel pulsation dampeners are recommended for sodium hydroxide (caustic) applications. Viton® pulsation dampeners are recommended for sodium hypochlorite applications.

Sizing Pulsation Dampeners

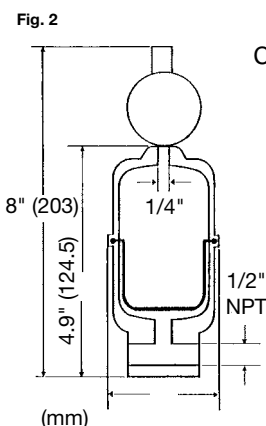
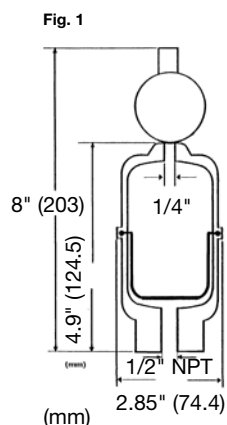
Multiply the pump's displacement per stroke (mL) times 26 to get minimum pulsation dampener volume (mL) to achieve 90% reduction in pulsation.

Safety Note: We recommend using pressure relief valves with the pulsation dampeners.

General Specifications

Maximum pressure:	150 psig (polypro, PVDF and PTFE), 300 psig (SS)
Temperature range:	
Nordel bladder:	-60°F to 280°F (-51°C to 138°C)
Viton® bladder:	30°F to 350°F (-1°C to 177°C)
HYPALON® bladder:	-20°F to 275°F (-29°C to 135°C)
PTFE bellows:	40°F to 220°F (4°C to 104°C)
Polypro housing :	32°F to 175°F (0°C to 79°C)
PVC housing:	32°F to 140°F (0°C to 60°C)
PVDF housing:	10°F to 250°F (-12°C to 121°C)
PTFE housing:	-20°F to 125°F (-29°C to 52°C)
SS housing:	32°F to 200°F (0°C to 93°C)

*Teflon bellows are smaller in volume



	Shipping Weight lbs (kg)	Model	Size	Part No.
131 mL (8 cu. in.) Models				
SS housing: 3/8" FNPT, 1 port (not illustrated)				
PTFE bellows	3 (1.4)	CTS1020 T	III	7253205
PVDF housing: 1/2" FNPT, 1 port (Fig. 1)				
PTFE bellows	1 (0.9)	CTK1005 T 5	III	7744101
164 mL (10 cu. in.) Models				
CPVC housing: 1/2" FNPT, 1 port (Fig. 1)				
Nordel bladder (EPDM)	1 (0.9)	RC-10X-E50	III	7744096
Viton® bladder	1 (0.9)	RC-10X-V50	III	7744097
HYPALON® bladder	1 (0.9)	RC-10X-H50	III	7744098
Polypro housing: 1/2" FNPT, 1 port (Fig. 1)				
Nordel bladder (EPDM)	1 (0.9)	CTP1005 ND 5	III	7744102
PVDF housing: 1/2" FNPT, 1 port (Fig. 1)				
Nordel bladder (EPDM)	1 (0.9)	CTK1005 ND 5	III	7744100
Viton® bladder	1 (0.9)	CTK1005 V 5	III	7744099

SENTRY PULSATION DAMPENERS



**DON'T
PUMP
WITHOUT
US**

BLACOH
FLUID CONTROL

601 Columbia Ave, Bldg. D, Riverside, CA 92507 • USA
Tel: (800) 603-7867 or (951) 342-3100 • Fax: (951) 342-3101
E-mail: sales@blacoh.com • Website: www.blacoh.com

SENTRY PULSATION DAMPENERS

BENEFITS & FEATURES

Positive Displacement (PD) pumps create pulsation and hydraulic shock due to the reciprocating nature of their stroking action, potentially damaging the entire pumping system. Blacoh's SENTRY® Pulsation Dampeners remove virtually all hydraulic shock, enhancing all-around performance and reliability of fluid handling equipment in industrial and chemical transfer applications.

SENTRY BENEFITS:

- Produces a near steady fluid flow up to 99%* pulsation and vibration free.
- Protects pipes, valves, fittings, meters, and in-line instrumentation from destructive pulsations, vibrations, surges, cavitation, thermal expansion, & water hammer
- Creates steady and continuous flow when dosing, blending or proportioning additives
- Insures accuracy, longevity, and repeatability of in-line meters
- Enables uniform application of material in spraying and coating systems
- Reduces product agitation, foaming, splashing and degradation of product
- Provides liquid energy storage for emergency valve closure and equipment shutdown
- Reduces overall energy cost with continuous linear flow, rather than start/ stop turbulent flow
- Operates as a reservoir for make-up fluid

SENTRY FEATURES:

- Sizes available for all positive displacement pumps with discharge sizes from 1/8" (3.18mm) to 6" (152.4mm)
- Simple, reliable design and quick installation
- Easy in-line maintenance
- Pressure ranges up to 4000 PSI (276 BAR) available from stock
- Temperature ranges from -60°F to +400°F (-51°C to +205°C) available from stock
- Custom models available up to 100 gallons (378L) and 25,000 PSI (1724 BAR)
- Bodies available in a full range of chemically resistant materials
- Bladders available for even the most corrosive application

***Let SENTRY Stand Guard Over Your System.
Increase productivity, safety, reliability and efficiency.
Decrease maintenance and operating costs.***

PROCESSES

- | | | | | |
|-------------------|--------------------|-------------------|--------------------|------------------|
| • TRANSFER | • FILTERING | • PRINTING | • DOSING | • FILLING |
| • METERING | • SPRAYING | • COATING | • INJECTING | • MIXING |

INDUSTRIES SERVED



Chemical Process



Water Treatment



Food & Beverage



Pulp, Paper & Textile



Paint & Coating



**Biotech/
Pharmaceutical**



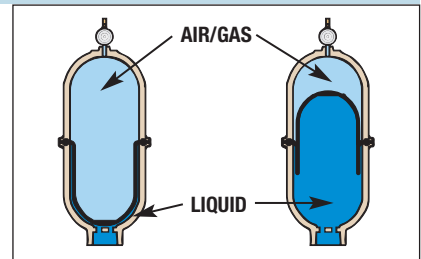
Gas, Oil, & Petrochemical



Consumer Products

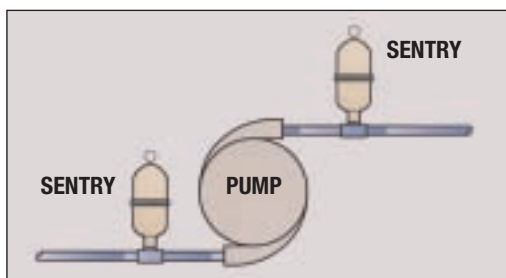
PRINCIPLES OF OPERATION

SENTRY operates on the principle that volume is inversely proportional to pressure. Compressed air or gas is introduced into the air chamber of the SENTRY Pulsation Dampener to a specified pressure. The gas is entrapped by the elastomeric bladder, which prevents contact between the process fluid and compressed gas. (Without the bladder, the gas would dissolve into the fluid and cause product contamination). During pump discharge, fluid enters the wetted chamber of the SENTRY Pulsation Dampener, displacing the bladder, compressing the gas and absorbing the shock. During pump shift, liquid pressure decreases, the dampener gas expands, pushing fluid back into the process line, eliminating up to 99% of system shock and pulsation.

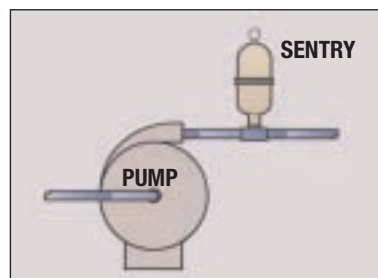


TYPICAL INSTALLATIONS

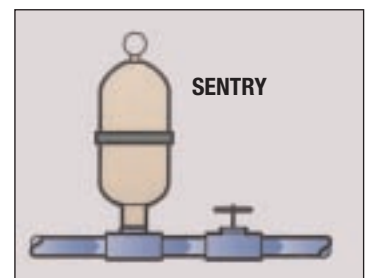
ADD, METERING, PERISTALTIC, & PISTON PUMPS



PUMP STARTUP & SHUTDOWN



QUICK CLOSING VALVES



*Requires proper sizing.

SENTRY TECHNICAL SPECIFICATIONS



SENTRY PLASTIC

Pressure Rating*:	Up to 150 PSI (10 BAR)	Temperature Range**:	-20°F to +250°F (-29°C to +121°C)
Capacities:	4 cubic inches to 5 gallons (.066 – 18L)	Inlet Ports:	Threaded: FNPT and BSP Flanged: ANSI and DIN
Shell Materials:	Polypropylene Conductive Polypropylene PVC and CPVC PVDF Conductive Acetal		



SENTRY METAL

Pressure Rating*:	Up to 4000 PSI (276 BAR)	Temperature Range**:	-60°F to + 400° F (-51°C to +204°C)
Capacities:	4 cubic inches to 100 gallons (.066 - 378L)	Inlet Ports:	Threaded: FNPT and BSP Flanged: ANSI and DIN
Shell Materials:	Aluminum Carbon Steel 316L Stainless Steel Alloy 20 Hastelloy C Epoxy, PVDF and PTFE coated steel		



SENTRY SANITARY

Pressure Rating*:	Up to 1000 PSI (69 BAR)	Temperature Range**:	-20° F to +350° F (-28°C to +176° C)
Capacities:	4 cubic inches to 10 gallons (.066 - 37L)	Inlet Ports:	Tri-clamp type sanitary fitting
Shell Materials:	30 RA Polished 316L Stainless Steel Bead Blasted 316L Stainless Steel		



SENTRY PTFE

Pressure Rating*:	Up to 100 PSI (6 BAR)	Temperature Range**:	+40°F to + 220°F (+4°C to +104°C)
Capacities:	4 to 370 cubic inches (.066 - 6L)	Inlet Ports:	Threaded: FNPT and BSP Flanged: ANSI and DIN Metric Flare Type
Shell Materials:	Machined PTFE		



SENTRY XP HIGH PRESSURE

Pressure Rating*:	Up to 4000 PSI (276 BAR)	Temperature Range**:	-60°F to +225°F (-51°C to +107°C)
Capacities:	8 to 24 cubic inches (.13 - .39L)	Inlet Ports:	Threaded: FNPT Flanged: ANSI
Shell Materials:	316L Stainless Steel		



SENTRY TEF-GUARD HP II

Pressure Rating*:	Up to 2000 PSI (137 BAR)	Temperature Range**:	+40°F to + 220°F (+4°C to +104°C)
Capacities:	12 cubic inches (.20L)	Inlet Ports:	Threaded: FNPT Flanged: ANSI
Shell Materials:	316L Stainless Steel Carbon Steel Alloy 20 Hastelloy C		

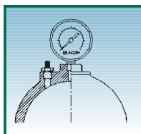
BLADDER OPTIONS

COMPOUND	TEMPERATURE LIMITS	APPLICATIONS
Neoprene	0°F to +200°F (-18°C to +93°C)	Good abrasion resistance and flex; use with moderate chemicals.
Buna	+10°F to +180°F (+12°C to +82°C)	Good flex life; use with petroleum, solvents and oil-based fluids.
EPDM	-60°F to +280°F (-51°C to +137°C)	Use in extreme cold; good chemical resistance with ketones, caustics.
Hypalon	-20°F to +275°F (-29°C to +135°C)	Excellent abrasion resistance; good in aggressive acid applications.
Viton	-10°F to +350°F (-23°C to +176°C)	Use in hot & aggressive fluids; good with aromatics, solvents, acids & oils.
Aflas	0°F to +400°F (-18°C to +204°C)	High temperature, petroleum based chemicals, strong acids and bases.
FDA Silicone	-20°F to +300°F (-29°C to +149°C)	FDA-approved food grade material; for use in food and pharmaceutical processing.
FDA Buna	+10°F to +180°F (-12°C to +82°C)	FDA-approved food grade. Similar characteristics of Silicone.
FDA Fluorel	-10°F to +350°F (-23°C to +176°C)	Fluorel is a fluorelastomer comparable to Viton
PTFE	+40°F to +220°F (+4°C to +104°C)	Bellows design; excellent flex life; use with highly aggressive fluids.

* Maximum PSI rated for ambient temperatures.

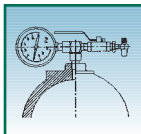
** Reflects entire temperature range for all available materials. Consult Blacoh on specific materials.

AIR CONTROL OPTIONS



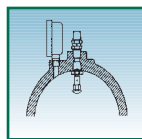
CHARGEABLE

The chargeable model has a Schrader type charging valve that allows for a predetermined pressure charge to be applied and held in the dampener. No permanent source of compressed gas is required to be attached to the unit. The chargeable models are used primarily with metering, piston and peristaltic pumps for pulsation dampening. Chargeable models are also used for surge suppression to prevent water hammer from quick closing valves, for make-up fluid to prevent pump cycling and for suppression of pump start up or shut down pressure spikes.



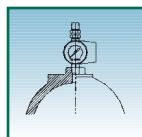
INLET STABILIZER

The patented inlet stabilizer air control (U.S. Patent No. 6,089,837) consists of a compound pressure gauge, a pressure/vacuum tight ball valve and a venturi valve. When compressed air is passed through the venturi valve at high speed, a low pressure area is created which is used to evacuate the air from the stabilizer, creating a vacuum internally. Conversely, when the flow of air through the venturi valve is diverted into the stabilizer, a pressure charge is obtained. When pump inlet conditions are optimized, pump efficiency is maximized.



AUTOMATIC

An automatic poppet type valve located in the non-wetted section of the dampener allows for an increase in compressed air pressure to balance an increase in system liquid pressure. As liquid system pressure increases, the bladder is pushed further up into the dampener until it contacts the internal automatic valve. This contact opens the valve and allows an increase of compressed air to enter the dampener. When the air pressure inside the dampener equals the system liquid pressure, the dampener is in balance and pulsations are minimized. If a change in pressure occurs this process is repeated. Automatic units are designed for use on air operated diaphragm pumps in systems with a varying discharge pressure.



ADJUSTABLE

The adjustable model uses a self-relieving regulator to set dampener pressure. A compressed air line must be permanently attached to the regulator. The regulator allows for an easy, convenient method for readjusting the dampener pressure if the system fluid pressure changes. Adjustable units are designed for use on air operated diaphragm pumps in systems with a constant discharge pressure.

APPLICATION STORIES

APPLICATION: PULSATION DAMPENING

PROBLEM: A major pulp & paper mill in the Northwest used AODD unloading pumps. The reciprocating action of these air-operated pumps created violent pulsations that caused both pipe stress and mounting fatigue. In fact, these pulsations often caused the pumps to be pulled from their cement foundations. This created significant downtime, costly foundation repair, environmental hazards, and a dangerous working environment.



SOLUTION: A Blacoh SENTRY IV Pulsation Dampener was installed in the common discharge of the pumps to dampen these pulsations.

RESULT: Pipe stress and mounting fatigue have been eliminated. Not only have the pumps not been ripped from their cement foundations, but the mill has experienced longer life from pump components such as diaphragms and ball valves.

APPLICATION: WATER HAMMER

PROBLEM: A major producer of water treatment chemicals accessed their local water supply through a 3" PVC pipe with quick-closing valves. When the desired quantity had been measured and the valve shut, a water hammer effect with pressure spikes that exceeded the PVC pipe's burst strength was created. The PVC repeatedly broke, causing the entire plant to be shut down for repair. In addition, since pipe failure occurred under a nearby highway, it also had to be closed.



SOLUTION: A Blacoh SENTRY 10 gallon Surge Suppressor was installed on the pressure side of each quick closing valve to reduce water hammer pressure spikes.

RESULT: The damaging water hammer pressure spikes are now absorbed, no pipes have ruptured, and the plant (and nearby highway) have had no downtime due to water hammer.

APPLICATION: METERING

PROBLEM: A 300 megawatt power plant required a chemical feed system to supply hydrazine to a boiler. The hydrazine acts as an oxygen scavenger, and must be delivered in a precise and consistent quantity. While metering pumps can deliver chemicals in precise amounts, their reciprocating action will not allow delivery in a smooth and consistent flow.



SOLUTION: A Blacoh SENTRY III Pulsation Dampener was installed in the common discharge of two metering pumps to create smooth and consistent flow.

RESULT: Hydrazine is now delivered to the boiler in a precise and consistent quantity. In addition, pipe vibration has been eliminated, gauge accuracy has been maximized, and pump component stress has been reduced.

APPLICATION: SPRAYING/ COATING

PROBLEM: A decontamination facility pumped acids and water through a series of 15° spray nozzles to rinse radiation from contaminated metals. However, the pulsating action of their reciprocating pumps caused uneven spray into the rinse tanks, and the metals were not rinsed completely.



SOLUTION: A Blacoh SENTRY 1 Pulsation Dampener was installed at each pump discharge manifold to eliminate the surging flow of the pumps and ensure complete coverage and thorough cleaning.

RESULT: The even flow ensures that the metal product is completely rinsed of radiation. Furthermore, both process time and the amount of acid required have been reduced, which increased productivity and profit.

UNDERSTANDING PULSATION AND WATER HAMMER CONTROL

PULSATION DAMPENING

Positive displacement pumps create pulsation and hydraulic shock purely by the reciprocating nature of the pump's stroking action. During the discharge stroke of a pump, fluid pressure takes the line of least resistance, displacing the bladder in the dampener, and compressing the trapped gas. As the pump begins its next cycle, fluid flow stops momentarily allowing the compressed gas to expand, forcing the bladder to push the accumulated

fluid back into the discharge line. This fills the void created in the pipeline by the pump's cycle shift. Whether a piston, plunger, air diaphragm, peristaltic, gear, or diaphragm metering pump, a SENTRY Pulsation Dampener placed at the pump's discharge will produce a steady fluid flow up to 99% pulsation free; protecting the entire pumping system from the damaging effects of shock.

SURGE SUPPRESSION & WATER HAMMER

When fluid in motion is abruptly stopped, a hydraulic surge is created in the system. Hydraulic surge is often referred to as "water hammer". The kinetic energy, released as pressure, can spike up to six times the system's operating pressure, destroying system instrumentation, pumps, pipes, fittings, and valves. Without a suppression device, the shock wave travels the length of the pipe back to the pump, then reverses again, oscillating back and forth until friction dissipates the pressure spike or a system component fails.

There are several major culprits that produce water hammer; quick closing valves, back surge, pump start up and pump shut down. Quick closing valves can be defined as valves that close within one and one-half seconds. Quick closing valves have the potential of stopping large volumes of energized fluid, producing violent water hammer. The pump start up also stops fluid in motion. During pump start up, fluid in a pipe is static and must be accelerated. The pumped fluid is abruptly stopped when it contacts the static fluid in the pipe, again creating a shock wave. A SENTRY Surge

Suppressor installed at the pump's discharge will provide the accumulation capacity to absorb the rapid fluid acceleration and prevent a pressure spike from occurring. As the surge enters the Suppressor, the gas inside is compressed, the fluid is accumulated and the shock wave is absorbed. When steady system flow rate is achieved, pressure and fluid are slowly released back into the system by the compressed gas.

At pump shut-down, either planned or failure, fluid flow will momentarily continue away from the pump due to momentum. As the flow continues, a void, called column separation can occur at the pump's discharge. When fluid momentum is stopped due to pipe friction, the liquid will usually reverse toward the void area of the pump discharge. The reversing fluid will slam into the check valve usually located at the pump discharge and a water hammer pressure spike will occur. Depending upon the design of the piping system and the fluid involved, the voided area can actually become sub-atmospheric which can significantly increase the pressure spike.

INLET (SUCTION) STABILIZATION

Without a sufficient supply of fluid a pump will not perform efficiently. Fluid "starvation" is caused by unbalanced hydraulics from friction, acceleration, and head. A reciprocating pump further complicates the issue by emitting high-frequency pressure waves created by the inlet valves opening and closing. In high inlet pressure situations, a pump's inlet valves create water hammer by their opening and closing action; increasing pipe and pump damage, and draining system efficiency.

In suction lift and horizontal suction applications, the pumps' inlet valve action actually decreases inlet fluid pressure. A "starved" or cavitating

pump will be unable to produce specified flow rates due to the incomplete filling of cylinders and liquid chambers. In addition, cavitation will result in the premature failure of pump parts. A SENTRY Suction Stabilizer at the pump's inlet will act as an accumulator, reducing pressure fluctuations and aid in filling the pump head with fluid during each inlet stroke. In high suction lift applications it is also important not to lose the acceleration of the fluid created with each suction stroke of the pump. A Suction Stabilizer will momentarily maintain the flow of the accelerated fluid. The fluid flows into the stabilizer as the pump shifts, and then out as the inlet valve re-opens, maintaining even pressure and steady flow, minimizing cavitation.

THERMAL EXPANSION

Many fluids change volume due to temperature changes. As the temperature of a fluid rises, the fluid expands. In a closed or loop system a volumetric increase in fluid can create a rise in pressure beyond the limits of safety. The increase in pressure can result in ruptured pipes and fittings,

destroyed in-line instrumentation, burst pressure relief valves and contaminated surroundings. A SENTRY Thermal Expansion Chamber installed in the pipeline will accumulate the expanded fluid, eliminating a dangerous rise in pressure.

ACCUMULATORS, AUXILIARY ENERGY, FLUID MAKE-UP & TRANSFER BARRIER

Fluids flowing in a system can be accumulated during one part of the process cycle, and then released when needed during another part of the cycle. The release can be based upon the pressure of the system or by the opening/closing of a valve. The SENTRY Accumulator can be used to maintain process line pressure and store fluid for other uses, such as to back flush filters or to draw off sample fluid.

Accumulators can be used as a Transfer Barrier where pressure on one side of a system needs to be transferred to another side without the mixing of the fluids. The accumulator is installed in-line with the two fluids entering at opposite ends, separated by the bladder. As the pressure of one fluid increases, it pushes the bladder against the other fluid, transferring the increase in pressure.

Please call your local distributor:

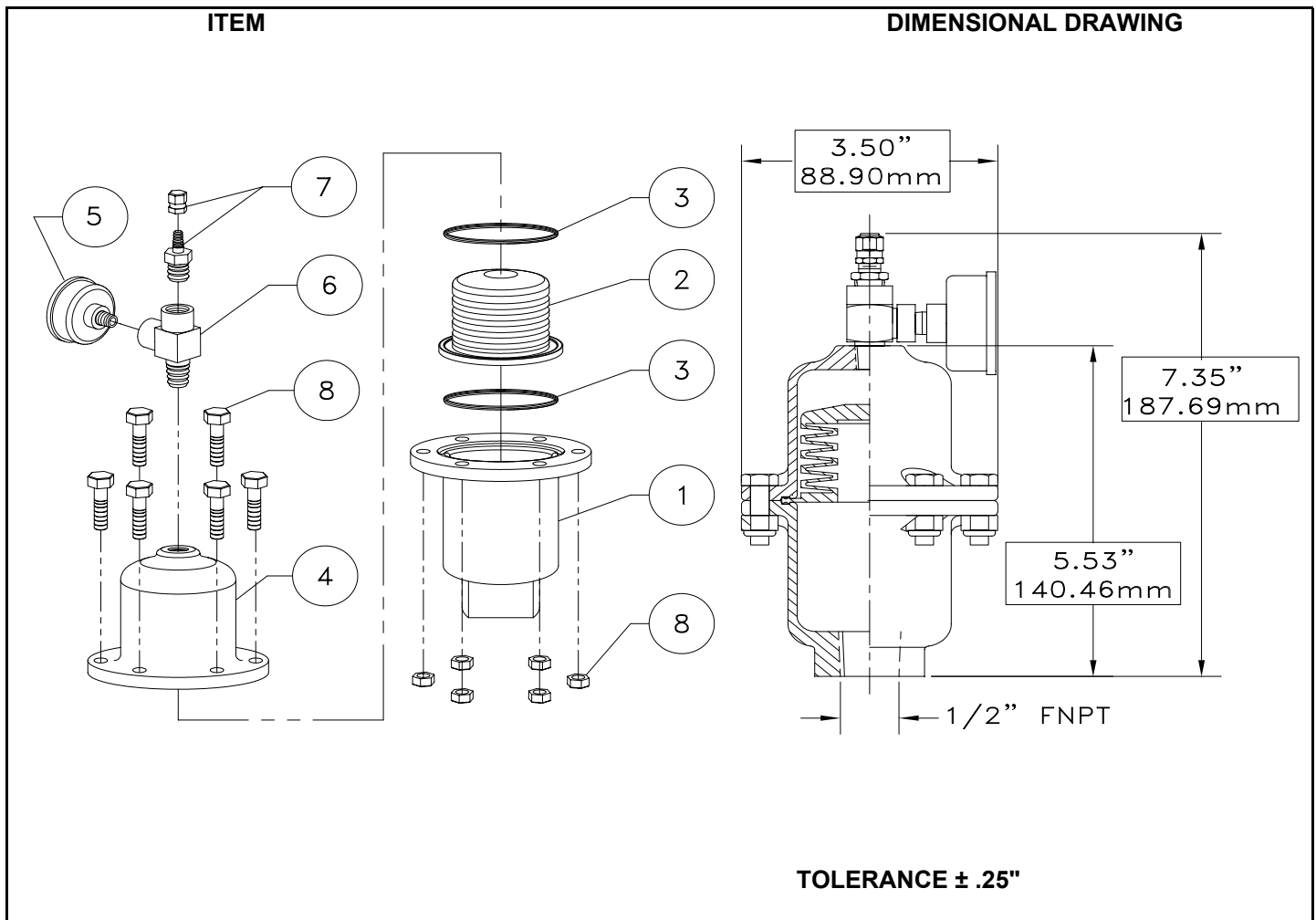


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SENTRY MODEL #:	CTS1020T-5
MAXIMUM PRESSURE:	150 PSI/10 BAR
CAPACITY:	10 CUBIC INCHES/0.163 LITERS
WETTED HOUSING:	316L STAINLESS STEEL
NONWETTED HOUSING:	316L STAINLESS STEEL
BELLOWS:	PTFE
INLET:	1/2" FNPT
AIR CONTROL:	CHARGEABLE

DESCRIPTION				
ITEM	PART #	QTY	Component	Material
1	1020-27-5	1	Wetted Housing	316L Stainless Steel
2	P1000-10	1	Bellows	PTFE (Includes O-Ring Assy)
3	P1000-G	1	O-Ring Assy	TFE Encapsulated Viton & Viton
4	1020-24	1	Nonwetted Housing	316L Stainless Steel
5	101-20	1	Gauge	Plastic
6	1000-46	1	Tee	Steel
7	101-53	1	Fill Valve	Stainless Steel
8	1020-43	1	Fastener Assy	Stainless Steel

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SENTRY INSTALLATION & OPERATION INSTRUCTIONS **CHARGEABLE (C, CT & RC MODELS)**

S/N:_____	MODEL #:_____	DATE OF PURCHASE_____
MATERIALS OF CONSTRUCTION: BODY_____BLADDER_____		
PUMP AREA & NUMBER_____		
SUPPLIER: COMPANY _____	CONTACT _____	
PHONE _____	FAX _____	E-MAIL _____

INSTALLATION NOTES

READ BEFORE INSTALLATION

- To prevent pre-charge loss through the fill valve, **always** replace the cap after charging unit.
- If a **system pressure test is to be performed**, SENTRY must be charged with 80% of the system test pressure prior to test. This will avoid possible bladder damage.
- Blacoh recommends installing a pressure relief valve in all pump systems to ensure compliance with pressure limits on system equipment.
- Mount SENTRY as close to pump discharge, inlet and/or quick closing valve as possible, but within 10 pipe diameters.
- Temperature and pressure affect the strength and chemical resistance of plastic and rubber. Please consult factory for additional information.
- Remove all pressure from SENTRY unit **AND** pumping system before attempting maintenance.
- Do not exceed 150 PSI with plastic models; up to 300 PSI with CT units (all metal models excluding units with plastic non-wetted parts). **Check pressure rating shown on serial tag.**
- Always wear safety glasses when installing, charging or repairing SENTRY units.
- Do not operate a SENTRY that is leaking, damaged, corroded or unable to hold internal fluid, air or gas pressure.
- Pre-charge SENTRY with compressed air or nitrogen only. **DO NOT USE OXYGEN**
- **DANGER OF STATIC SPARK: GROUNDING PRECAUTIONS MUST BE CONSIDERED WHEN USED IN FLAMMABLE OR EXPLOSIVE ENVIRONMENTS.**

INSTALLATION FOR PUMP DISCHARGE PULSATION

READ BEFORE INSTALLATION

Step 1 – Installation Position

Install the dampener in-line, as close to the pump discharge as possible to absorb the pulse at its source. Install ahead of any downstream equipment such as risers, valves, elbows, meters, or filters. Dampener installation should be no more than ten pipe diameters from pump discharge. If using a flexible connector from pump to system piping, dampener should be installed at the pump discharge manifold. The flexible connector should be attached to the dampener's tee and system piping (see Figure 1). Since pressure is equal in all directions, SENTRY can be installed in a vertical, horizontal, or upside-down position. Blacoh recommends a vertical installation for better draining of the unit. Limitations for horizontal and upside-down mounting include high specific gravity, high viscosity, settling of solid material, or possible air entrapment, which could result in shortened bladder life and/or poor dampening performance.

Step 2 – Air Line Connection

Chargeable models do not require an air line connection. Units must be pre-charged with compressed air or Nitrogen, using a hand pump, tank/bottle or compressor. **DO NOT USE OXYGEN.** Charging hose kits are available – part number 701-00.

Step 3 – Charging and Start Up – see *PRE-CHARGE NOTES* on next page.

Prior to starting the pump, pre-charge SENTRY with compressed air or Nitrogen to approximately 80% of expected system pressure and replace fill valve cap. **DO NOT USE OXYGEN.** The gas pre-charge must always be lower than pump discharge pressure. Generally, pulsation is most effectively minimized when the gas charge is 80% of system pressure. Start the pump to generate system pressure.

NOTE: Once system pressure is in contact with the bladder, the gas charge will be compressed to the system pressure and the dampener gauge will read the system pressure, not the initial charge pressure. Once working pressure is achieved, adjustment may be necessary. Gradually increase or decrease the gas charge in the dampener by bleeding or filling through the gas valve. Allow the system to respond to each adjustment (this may take a minute or two) before making further adjustments.



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INSTALLATION FOR PUMP INLET

READ BEFORE INSTALLATION

Step 1 – Installation Position

Install SENTRY as close to the pump inlet as possible. Install after any upstream equipment such as risers, valves, elbows, meters, or filters. If using a flexible connector from system piping to pump, SENTRY should be installed to the pump inlet manifold. The flexible connector should be attached to the SENTRY tee and system piping (see Figure 1).

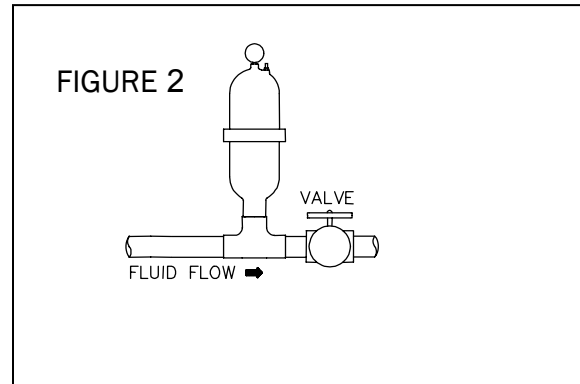
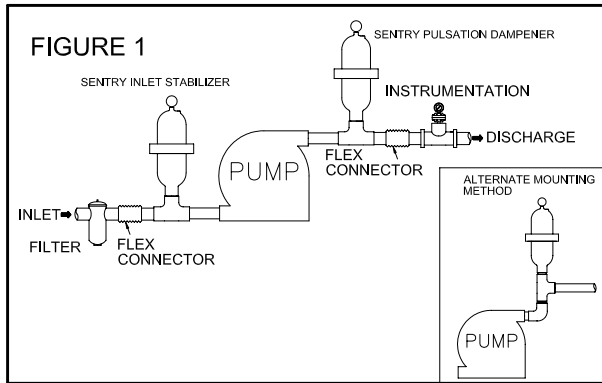
Step 2 – Air Line Connection

Chargeable models do not require an air line connection. Units must be pre-charged with compressed air or Nitrogen, using a hand pump, tank/bottle or compressor. **DO NOT USE OXYGEN.** Charging hose kits are available – part number 701-00.

Step 3 – Charging and Start Up – see PRE-CHARGE NOTES.

A. Suctions Lift/Accumulator: No pre-charge is required in a lift/accumulator installation. Start the pump to generate working pressure. As system pressure and vacuum is created, the acceleration head created with each suction stroke will compress the air trapped in the bladder. For better inlet stabilization, a SENTRY “J” Model is recommended.

B. Positive Inlet Pressure: Pre-charge SENTRY with 50% of the static pressure realized at the pump inlet. Start the pump to generate working pressure. Minor pressure adjustments may be required. Allow the system to respond to each adjustment (this may take a minute or two) before making further adjustments.



INSTALLATION FOR WATER HAMMER / SURGE

READ BEFORE INSTALLATION

Step 1 – Installation Position

Install SENTRY up stream from valve, as close as possible but no more than ten pipe diameters from the valve. (See Figure 2)

Step 2 – Air Line Connection

Chargeable models do not require an air line connection. Units must be pre-charged with compressed air or Nitrogen, using a hand pump, tank/bottle or compressor. **DO NOT USE OXYGEN.** Charging hose kits are available – part number 701-00.

Step 3 – Charging and Start Up – see PRE-CHARGE NOTES

Prior to operating system, pre-charge SENTRY to 90% of system pressure and replace fill valve cap. Start the system.

PRE-CHARGE NOTES

READ BEFORE INSTALLATION

Gas molecules will diffuse through elastomer membranes, the speed of which depends on elastomer material, temperature and pressure. As a rule of thumb, the pre-charge pressure should be checked every month. Checks must occur when no system pressure is present or inaccurate readings will be recorded. If temperature is above ambient and/or pressure is over 300 PSI, checks should be performed more frequently. **Also, to prevent pre-charge loss through the fill valve, always replace the cap after charging.** A proper gas charge is the key to dampener effectiveness and bladder life.

IMPORTANT: AFTER MAINTENANCE OR RE-ASSEMBLY, TORQUE FASTENERS ACCORDING TO SPECIFICATION ON THE UNIT TAG.

Standard Product Warranty: Blacoh Fluid Control warrants its products to be free of defective material and workmanship under normal use and service for two years from date of shipment. The remedy for any product defect covered under this warranty shall be limited to the replacement or repair of the defective part or parts and Blacoh will not be responsible for damages or injury caused to other products, machinery, buildings, property or person. This warranty shall be null and void if the product has been altered, misapplied, misused, or neglected of maintenance. Damage or loss resulting from over-pressurization of a product, whether from gas or fluid does not constitute a defect covered under this warranty nor will Blacoh be responsible in any way for any such damage or loss. Because Blacoh cannot anticipate or control the many different conditions under which its products may be used, Blacoh does not guarantee the applicability or suitability of its products for any particular use or purpose. Each user of Blacoh products should conduct its own tests to determine the suitability of each product for its intended uses or purposes. Blacoh products are sold with this limited warranty and each buyer assumes all responsibility for loss or damage, including consequential damage, arising from the handling and use of Blacoh products whether used in accordance with Blacoh's directions or otherwise. Statements concerning the possible use of Blacoh products are not intended as recommendations for any specific use of such products. This Standard Product Warranty shall be governed by and construed in accordance with the laws of the State of California.



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