

SERVICE & OPERATING MANUAL

BRUIN PUMPS

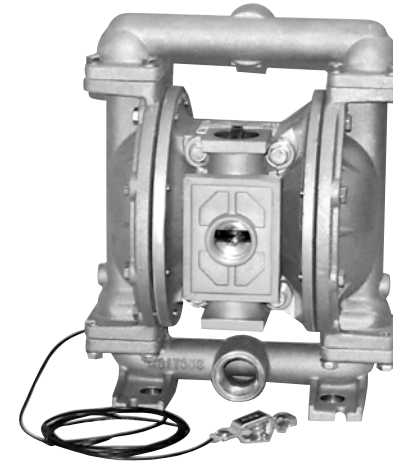
Model GIF Metallic Design Level I

**Designed to meet CSA Requirement
2.01 U.S. for sweet natural gas operated
diaphragm pumps.**

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U.S. Patent #
5,996,627; 6,241,487
Other U.S. Patents
Applied for



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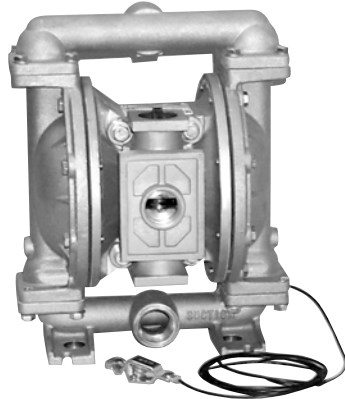
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BRUIN PUMPS

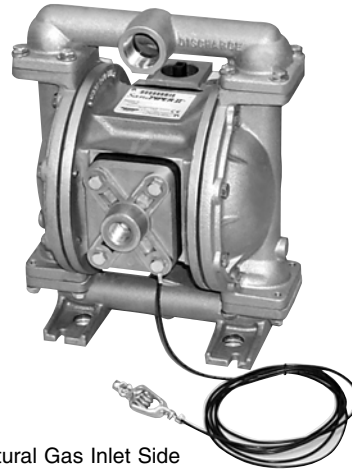
G1F Metallic

Designed to meet CSA Requirement 2.01 U.S. for sweet natural gas operated diaphragm pumps.

ENGINEERING, PERFORMANCE
& CONSTRUCTION DATA



Natural Gas Exhaust Side



Natural Gas Inlet Side

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INTAKE/DISCHARGE PIPE SIZE 1" NPT (internal) 1" BSPT Tapered (internal)	CAPACITY 0 to 45 gallons per minute (0 to 170 liters per minute)	GAS VALVE No-lube, no-stall design	SOLIDS-HANDLING Up to .25 in. (6mm)	HEADS UP TO 125 psi or 289 ft. of water (8.6 Kg/cm ² or 86 meters)	DISPLACEMENT/STROKE .11 Gallon / .42 liter
⚠ CAUTION! Operating temperature limitations are as follows:					
Materials					
			Maximum*	Operating Temperatures	
				Minimum*	Optimum**
Buna General purpose, oil-resistant. Shows good solvent, oil, water and hydraulic fluid resistance. Should not be used with highly polar solvents like acetone and MEK, ozone, chlorinated hydrocarbons and nitro hydrocarbons.			190°F 88°C	-10°F -23°C	50° to 140°F 10°C to 60°C
Virgin PTFE Chemically inert, virtually impervious. Very few chemicals are known to react chemically with PTFE: molten alkali metals, turbulent liquid or gaseous fluorine and a few fluoro-chemicals such as chlorine trifluoride or oxygen difluoride which readily liberate free fluorine at elevated temperatures.			212°F 100°C	-35°F -37°C	50°F to 212°F 10°C to 100°C

For specific applications, always consult "Chemical Resistance Chart" Technical Bulletin

*Definite reduction in service life.

**Minimal reduction in service life at ends of range.

These G1F models are designed to be powered only by sweet natural gas.

Explanation of Pump Nomenclature

G1F Metallic · Design Level 1· Ball Valve

MODEL	Pump Brand	Pump Size	Check Valve Type	Design Level	Wetted Material	Diaphragm/ Check Valve Materials	Check Valve Seat	Non-Wetted Material Options	Porting Options	Pump Style	Pump Options	Kit Options	Shipping Weight lbs. (kg)
G1FB1ABAXNSX00.	G	1F	B	1	A	B	A	X	N	S	X	00.	28 (13)
G1FB1ATAXNSX00.	G	1F	B	1	A	T	A	X	N	S	X	00.	28 (13)
G1FB1SBSXNSX00.	G	1F	B	1	S	B	S	X	N	S	X	00.	43 (20)
G1FB1STXNSX00.	G	1F	B	1	S	T	S	X	N	S	X	00.	43 (20)
G1FB1ABAXBXSX00.	G	1F	B	1	A	B	A	X	B	S	X	00.	28 (13)
G1FB1ATAXBXSX00.	G	1F	B	1	A	T	A	X	B	S	X	00.	28 (13)
G1FB1SBSXBXSX00.	G	1F	B	1	S	B	S	X	B	S	X	00.	43 (20)
G1FB1STXBXSX00.	G	1F	B	1	S	T	S	X	B	S	X	00.	43 (20)

Pump Brand

G= Sweet Gas Operated

Pump Size

1F=1"

Check Valve Type

B=Ball

Design Level

1= Design Level

Wetted Material

S= Stainless Steel

A= Aluminum

Diaphragm Check Ball Materials

B= Buna/Buna

T=PTFE -Buna/PTFE

Check Valve Seat

S= Stainless Steel

A= Aluminum

Non-Wetted Material Options

X= Unpainted Aluminum

Porting Options

N=NPT Threads

B= BSPT (Tapered) Threads

Pump Style

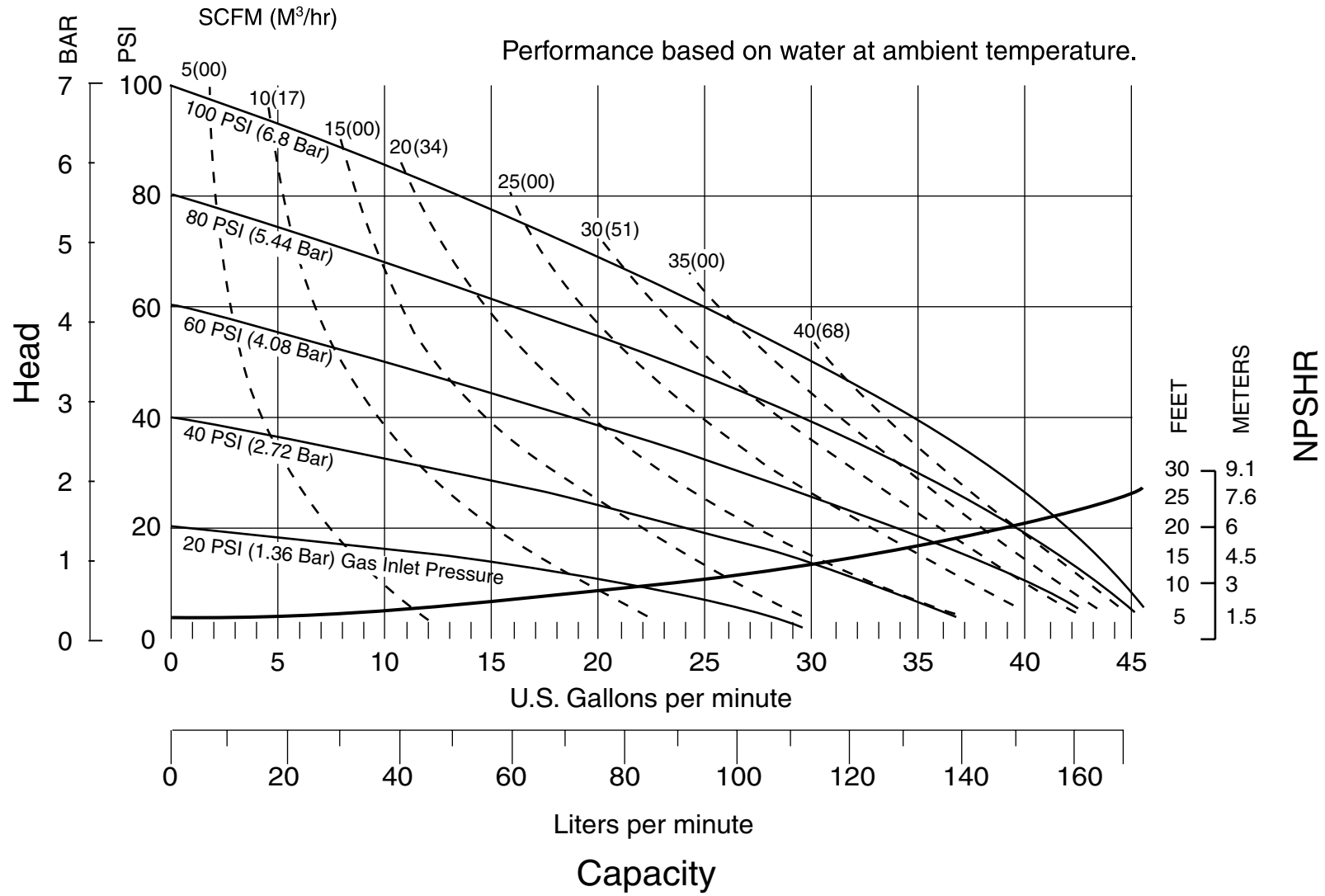
S= Standard

Pump Options

X= No Muffler

These pump models are designed to pump the following fluids:
Crude Oil, Salt Water, Drilling Mud, Condensate, Lubrication Oils,
Glycol, Caustic liquids, and Acids.

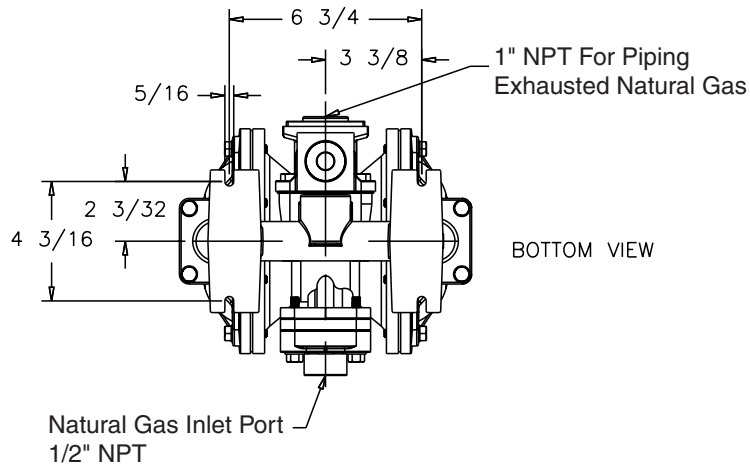
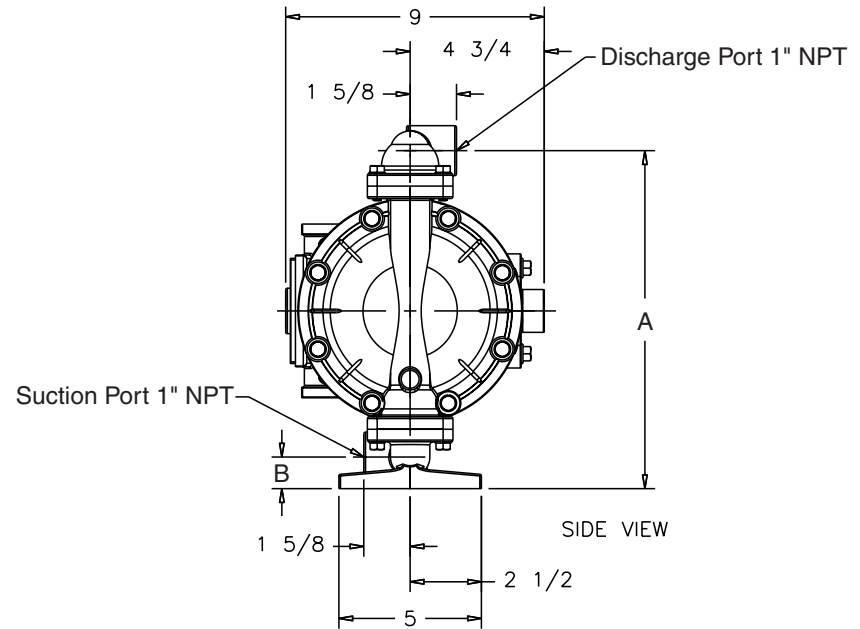
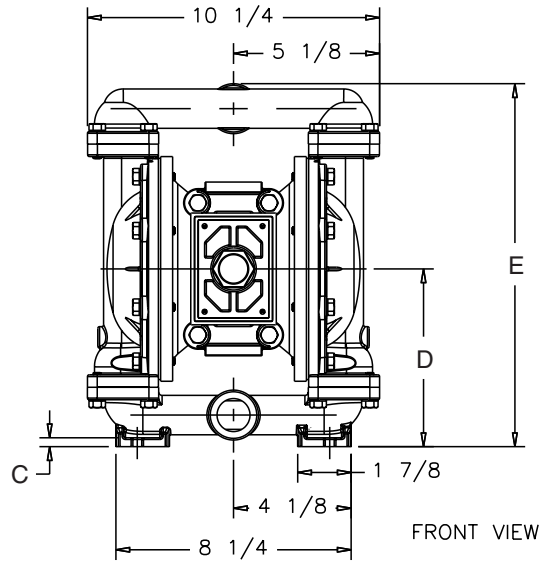
Performance Curve, G1F Model Metallic Design Level 1



Dimensions: G1F Model Metallic

Dimensions in Inches

Dimensional Tolerance: $\pm 1/8"$

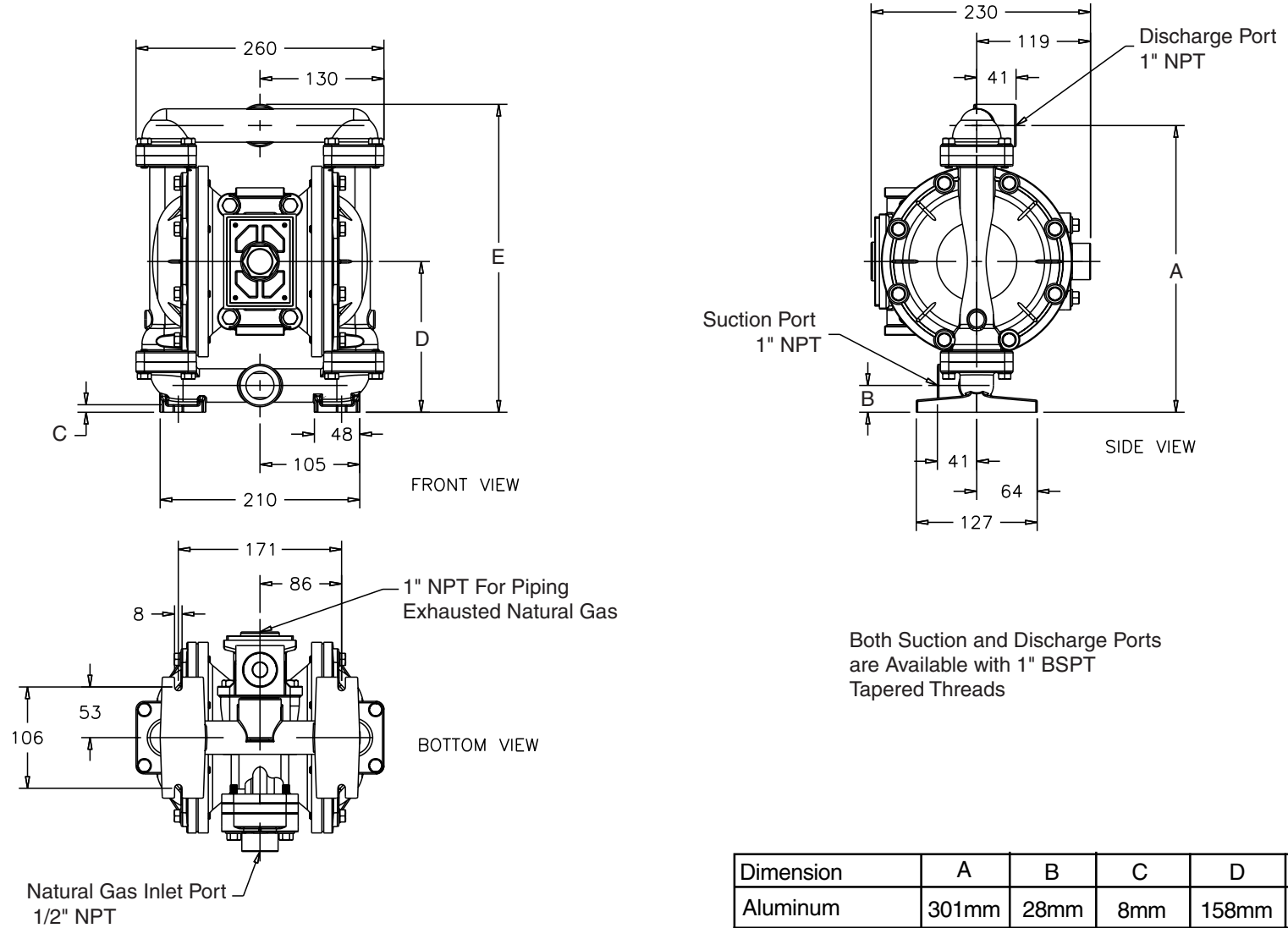


Both Suction and Discharge Ports Are With Available With 1" BSPT Tapered Threads.

Dimension	A	B	C	D	E
Aluminum	11 27/32	1 3/32	5/16	6 7/32	12 23/32
Stainless Steel	11 31/32	1 7/32	7/16	6 11/32	12 27/32

Metric Dimensions: G1F Model Metallic

Dimensions in Millimeters
Dimensional Tolerance: ± 3mm



Dimension	A	B	C	D	E
Aluminum	301mm	28mm	8mm	158mm	323mm
Stainless Steel	304mm	31mm	11mm	161mm	326mm

PRINCIPLE OF PUMP OPERATION

This ball type check valve pump is powered by sweet natural gas and is a 1:1 ratio design. The inner side of one diaphragm chamber is alternately pressurized while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod secured by plates to the centers of the diaphragms, to move in a reciprocating action. (As one diaphragm performs the discharge stroke the other diaphragm is pulled to perform the suction stroke in the opposite chamber.) Gas pressure is applied over the entire inner surface of the diaphragm while liquid is discharged from the opposite side of the diaphragm. The diaphragm operates in a balanced condition during the discharge stroke which allows the pump to be operated at discharge heads over 200 feet (61 meters) of water.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) may require a back pressure regulating device to maximize diaphragm life.

Alternate pressurizing and exhausting of the diaphragm chamber is performed by an externally mounted, pilot operated, four way spool type gas distribution valve. When the spool shifts to one end of the valve body, inlet pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool shifts to the opposite end of the valve

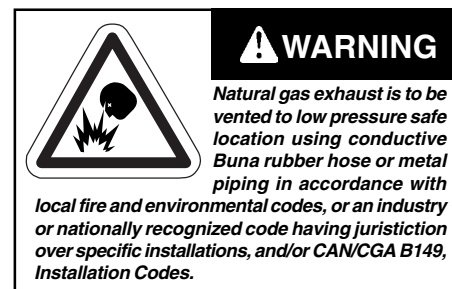
body, the pressure to the chambers is reversed. The gas distribution valve spool is moved by an internal pilot valve which alternately pressurizes one end of the valve while exhausting the other end. The pilot valve is shifted at each end of the diaphragm stroke when an actuator plunger is contacted by the diaphragm plate. This actuator plunger then pushes the end of the pilot valve spool into position to activate the gas distribution valve.

The chambers are connected with manifolds with a suction and discharge check valve for each chamber, maintaining flow in one direction through the pump.

INSTALLATION AND START-UP

Locate the pump as close to the product being pumped as possible. Keep the suction line length and number of fittings to a minimum. Do not reduce the suction line diameter.

For installations of rigid piping, short sections of flexible conductive hose should be installed between the pump and the piping. The flexible conductive hose reduces vibration and strain to the pumping system. A surge suppressor is recommended to further reduce pulsation in flow.



NATURAL GAS SUPPLY

Natural gas inlet pressure must be regulated to 100 (7 bar) psi with a pressure regulator. Connect the pump gas inlet to an gas supply of sufficient capacity and pressure required for desired performance. When the gas supply line is solid piping, use a short length of flexible conductive hose not less than ¾" (19mm) in diameter between the pump and the piping to reduce strain to the piping. The weight of the gas supply line, regulators and filters must be supported by some means other than the gas inlet cap. Failure to provide support for the piping may result in damage to the pump. A pressure regulating valve should be installed to insure gas supply pressure does not exceed recommended limits.

VALVE LUBRICATION

The natural gas distribution valve and the pilot valve are designed to operate WITHOUT lubrication. This is the preferred mode of operation. There may be instances of personal preference or poor quality gas supplies when lubrication of the supply is required. The pump system will operate with properly lubricated supply. Proper lubrication requires the use of an gas line lubricator set to deliver one drop of SAE 10 non-detergent oil for every 20 SCFM (9.4 liters/sec.) of gas the pump consumes at the point of operation. Consult the pump's published Performance Curve to determine this.

GAS INLET AND PRIMING

To start the pump, open the gas valve approximately ½ to ¾ turn. After the pump primes, the valve can be opened to increase gas flow as desired. If opening the valve increases cycling rate, but does not increase the rate of flow, cavitation has occurred. The valve should be closed slightly to obtain the most efficient gas flow to pump flow ratio.

BETWEEN USES

When the pump is used for materials that tend to settle out or solidify when not in motion, the pump should be flushed after each use to prevent damage. (Product remaining in the pump between uses could dry out or settle out. This could cause problems with the diaphragms and check valves at restart.) In freezing temperatures the pump must be completely drained between uses in all cases.

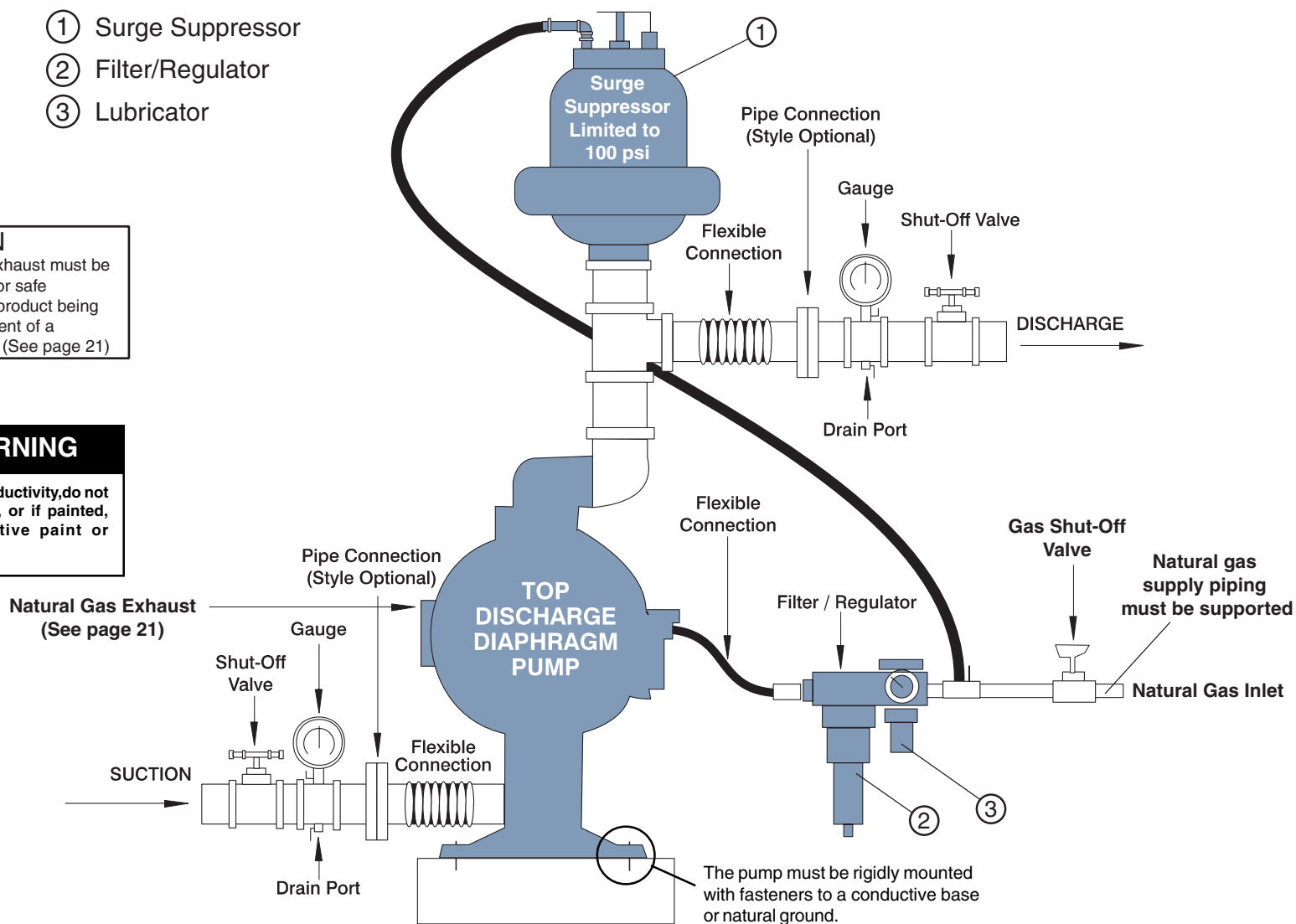
BRUIN PUMPS INSTALLATION GUIDE

Top Discharge Ball Valve Pump

- ① Surge Suppressor
- ② Filter/Regulator
- ③ Lubricator

CAUTION
 The natural gas exhaust must be piped to an area for safe disposition of the product being pumped, in the event of a diaphragm failure. (See page 21)

WARNING
 To maintain conductivity, do not paint the pump, or if painted, use a conductive paint or coating.



TROUBLESHOOTING

Possible Symptoms:

- Pump will not cycle.
- Pump cycles, but produces no flow.
- Pump cycles, but flow rate is unsatisfactory.
- Pump cycle seems unbalanced.
- Pump cycle seems to produce excessive vibration.

What to Check: Excessive suction lift in system.

Corrective Action: For lifts exceeding 20 feet (6 meters), filling the pumping chambers with liquid will prime the pump in most cases.

What to Check: Excessive flooded suction in system.

Corrective Action: For flooded conditions exceeding 10 feet (3 meters) of liquid, install a back pressure device.

What to Check: System head exceeds natural gas supply pressure.

Corrective Action: Increase the inlet gas pressure to the pump. Most diaphragm pumps are designed for 1:1 pressure ratio at zero flow.

What to Check: Natural gas supply pressure or volume exceeds system head.

Corrective Action: Decrease inlet gas pressure and volume to the pump as calculated on the published PERFORMANCE CURVE. Pump is cavitating the fluid by fast cycling.

What to Check: Undersized suction line.

Corrective Action: Meet or exceed pump connection recommendations shown on the DIMENSIONAL DRAWING.

What to Check: Restricted or undersized gas line.

Corrective Action: Install a larger gas line and connection. Refer to gas inlet recommendations shown in your pump's SERVICE MANUAL.

What to Check: Check the externally serviceable gas distribution system of the pump.

Corrective Action: Disassemble and inspect the natural gas distribution valve, pilot valve and pilot valve actuators. Refer to the parts drawing and valve section of the SERVICE MANUAL. Check for clogged discharge or closed valve before reassembly.

What to Check: Pumped fluid in gas exhaust line.

Corrective Action: Disassemble pump chambers. Inspect for diaphragm rupture or loose diaphragm plate assembly. Refer to the Diaphragm Replacement section of your pump SERVICE MANUAL.

What to Check: Fluid suction side air leakage or air in product.

Corrective Action: Visually inspect all suction side gaskets and pipe connections.

What to Check: Obstructed check valve.

Corrective Action: Disassemble the wet end of the pump and manually dislodge

obstruction in the check valve pocket. Refer to the Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

What to Check: Worn or misaligned check valve or check valve seat.

Corrective Action: Inspect check valves and seats for wear and proper seating. Replace if necessary. Refer to Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

What to Check: Blocked suction line.

Corrective Action: Remove or flush obstruction. Check and clear all suction screens and strainers.

What to Check: Blocked discharge line.

Corrective Action: Check for obstruction or closed discharge line valves.

What to Check: Blocked pumping chamber.

Corrective Action: Disassemble and inspect the wetted chambers of the pump. Remove or flush any obstructions. Refer to the pump SERVICE MANUAL for disassembly instructions.

What to Check: Entrained air or vapor lock in one or both fluid pumping chambers.

Corrective Action: Purge chambers through tapped chamber vent plugs. PURGING THE CHAMBERS OF AIR CAN BE DANGEROUS! Contact the Bruin Pump Technical Services Department before performing this procedure. Any model with top-ported

discharge will reduce or eliminate problems with entrained air.

If your pump continues to perform below your expectations, contact your local Bruin Pump Distributor or factory Technical Services Group for a service evaluation.

WARRANTY

Refer to the enclosed Bruin Pump Warranty Certificate.

RECYCLING

Many components of Natural Gas Operated BRUIN Metallic pumps are made of recyclable materials (see chart on page 10 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.

CE Pump complies with EN809 Pumping Directive and Directive 98/37/EC Safety of Machinery




WARNING
Do not smoke near the pump or use the pump near an open flame. Fire or explosion could result.



WARNING
This pump must not be used for fluid transfer into aircraft.


IMPORTANT SAFETY INFORMATION



IMPORTANT
Read these safety warnings and instructions in this manual completely, before installation and start-up of the pump. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.



CAUTION
Before pump operation, inspect all gasketed fasteners for looseness caused by gasket creep. Re-torque loose fasteners to prevent leakage. Follow recommended torques stated in this manual.




WARNING
Before maintenance or repair, shut off the compressed natural gas line, bleed the pressure, and disconnect the gas line from the pump. The discharge line may be pressurized and must be bled of its pressure.



WARNING
In the event of diaphragm rupture, pumped material may enter the natural gas end of the pump, and be discharged into the atmosphere. The gas exhaust must be piped to an appropriate area for safe disposition.




WARNING
Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.



WARNING
This pump is pressurized internally with natural gas pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.



WARNING
When used for toxic or aggressive fluids, the pump should always be flushed clean prior to disassembly.



WARNING
Before doing any maintenance on the pump, be certain all pressure is completely vented from the pump, suction, discharge, piping, and all other openings and connections. Be certain the natural gas supply is locked out or made non-operational, so that it cannot be started while work is being done on the pump. Be certain that approved eye protection and protective clothing are worn all times in the vicinity of the pump. Failure to follow these recommendations may result in serious injury or death.



WARNING
Airborne particles and loud noise hazards. Wear ear and eye protection.

MATERIAL CODES

The Last 3 Digits of Part Number

000 Assembly, sub-assembly; and some purchased items	175 Die Cast Zinc	374 Carboxylated Nitrile	607 Envelon
010 Cast Iron	180 Copper Alloy	375 Fluorinated Nitrile	606 PTFE
012 Powered Metal	305 Carbon Steel, Black Epoxy Coated	378 High Density Polypropylene	610 PTFE Encapsulated Silicon
015 Ductile Iron	306 Carbon Steel, Black PTFE Coated	379 Conductive Nitrile	611 PTFE Encapsulated Viton
020 Ferritic Malleable Iron	307 Aluminum, Black Epoxy Coated	405 Cellulose Fibre	632 Neoprene/Hytrel
025 Music Wire	308 Stainless Steel, Black PTFE Coated	408 Cork and Neoprene	633 Viton/PTFE
080 Carbon Steel, AISI B-1112	309 Aluminum, Black PTFE Coated	425 Compressed Fibre	634 EPDM/PTFE
100 Alloy 20	310 Kynar Coated	426 Blue Gard	635 Neoprene/PTFE
110 Alloy Type 316 Stainless Steel	330 Zinc Plated Steel	440 Vegetable Fibre	637 PTFE , Viton/PTFE
111 Alloy Type 316 Stainless Steel (Electro Polished)	331 Chrome Plated Steel	465 Fibre	638 PTFE , Hytrel/PTFE
112 Alloy "C" (Hastelloy equivalent)	332 Aluminum, Electroless Nickel Plated	500 Delrin 500	639 Buna-N/TFE
113 Alloy Type 316 Stainless Steel (Hand Polished)	333 Carbon Steel, Electroless Nickel Plated	501 Delrin 570	643 Santoprene®/EPDM
114 303 Stainless Steel	334 Cast Iron, Electroless Nickel Plated	502 Conductive Acetal, ESD-800	644 Santoprene®/PTFE
115 302/304 Stainless Steel	335 Galvanized Steel	503 Conductive Acetal, Glass-Filled	649 PTFE Buna-N/PTFE
117 440-C Stainless Steel (Martensitic)	336 Zinc Plated Yellow Brass	505 Acrylic Resin Plastic	656 Santoprene Diaphragm and Check Balls/EPDM Seats
120 416 Stainless Steel (Wrought Martensitic)	337 Silver Plated Steel	506 Delrin 150	
123 410 Stainless Steel (Wrought Martensitic)	340 Nickel Plated	520 Injection Molded PVDF Natural color	
148 Hardcoat Anodized Aluminum	342 Filled Nylon	540 Nylon	
149 2024-T4 Aluminum	353 Geolast; Color: Black	541 Nylon	
150 6061-T6 Aluminum	354 Injection Molded #203-40 Santoprene- Duro 40D +/-5; Color: RED	542 Nylon	
151 6063-T6 Aluminum	355 Thermal Plastic	544 Nylon Injection Molded	
152 2024-T4 Aluminum (2023-T351)	356 Hytrel	550 Polyethylene	
154 Almag 35 Aluminum	357 Injection Molded Polyurethane	551 Glass Filled Polypropylene	
155 356-T6 Aluminum	358 Urethane Rubber (Some Applications) (Compression Mold)	552 Unfilled Polypropylene	
156 356-T6 Aluminum	359 Urethane Rubber	553 Unfilled Polypropylene	
157 Die Cast Aluminum Alloy #380	360 Buna-N Rubber. Color coded: RED	555 Polyvinyl Chloride	
158 Aluminum Alloy SR-319	361 Buna-N	556 Black Vinyl	
159 Anodized Aluminum	363 Viton (Fluorel). Color coded: YELLOW	570 Rulon II	
162 Brass, Yellow, Screw Machine Stock	364 E.P.D.M. Rubber. Color coded: BLUE	580 Ryton	
165 Cast Bronze, 85-5-5-5	365 Neoprene Rubber. Color coded: GREEN	590 Valox	
166 Bronze, SAE 660	366 Food Grade Nitrile	591 Nylatron G-S	
170 Bronze, Bearing Type, Oil Impregnated	368 Food Grade EPDM	592 Nylatron NSB	
	370 Butyl Rubber. Color coded: BROWN	600 PTFE (virgin material) Tetrafluorocarbon (TFE)	
	371 Philthane (Tuftane)	601 PTFE (Bronze and moly filled)	
		602 Filled PTFE	
		603 Blue Gylon	
		604 PTFE	

Delrin, Viton and Hytrel are registered tradenames of E.I. DuPont.
Gylon is a registered tradename of Garlock, Inc.
Nylatron is a registered tradename of Polymer Corp.
Santoprene is a registered tradename of Monsanto Corp.
Rulon II is a registered tradename of Dixon Industries Corp.
Hastelloy-C is a registered tradename of Cabot Corp.
Ryton is a registered tradename of Phillips Chemical Co.
Valox is a registered tradename of General Electric Co.

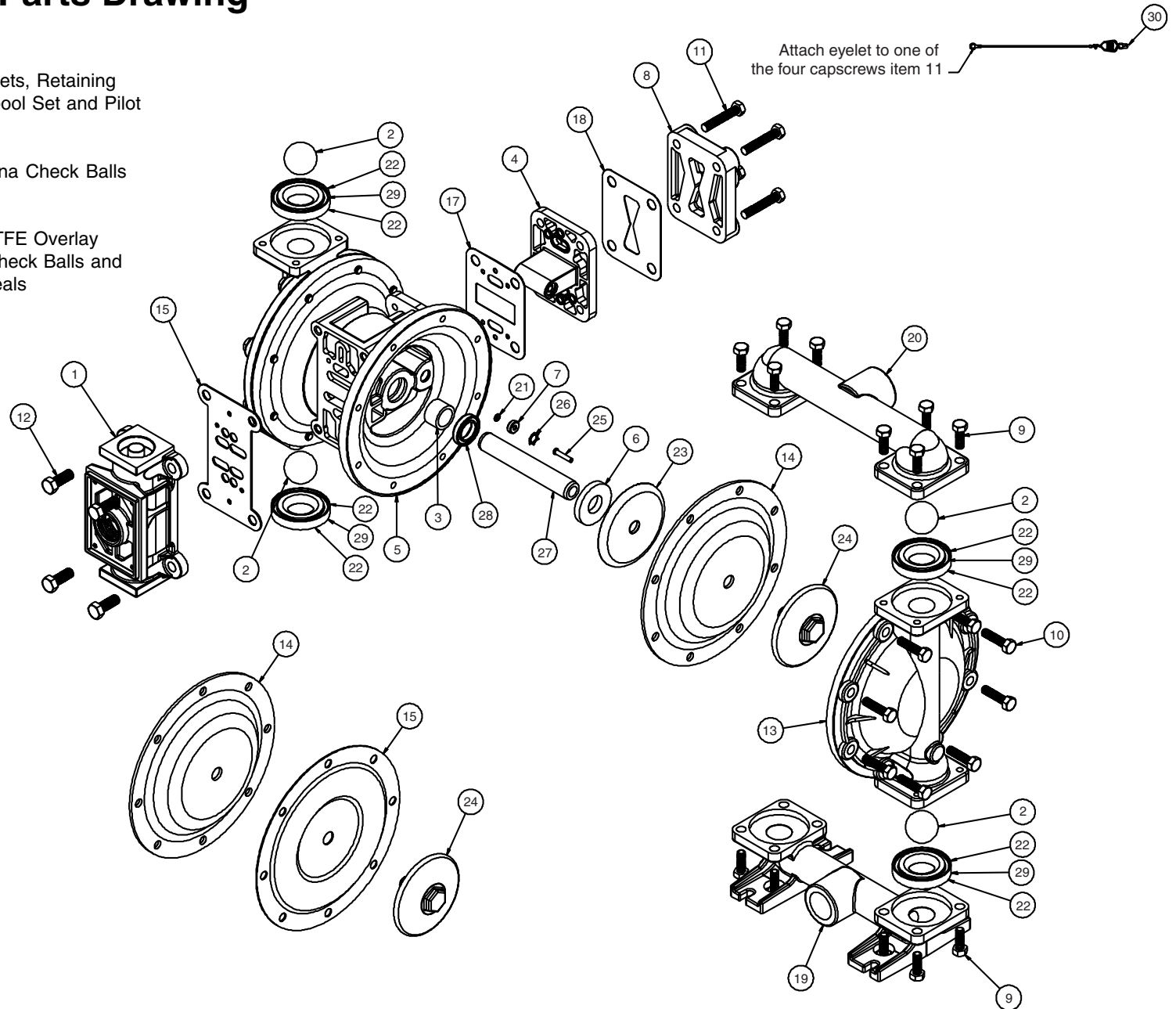
Composite Repair Parts Drawing

Available Service Kits:

476-212-000 Air End Kit
 Seals, O-Rings, Gaskets, Retaining Rings, Sleeve and Spool Set and Pilot Valve Assembly

476-204-360 Wetted End Kit
 Buna Diaphragms, Buna Check Balls and Buna O-Rings

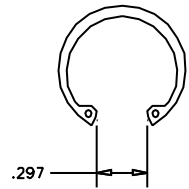
476-204-649 Wetted End Kit
 Buna Diaphragms, PTFE Overlay Diaphragms, PTFE Check Balls and PTFE Check Valve Seals



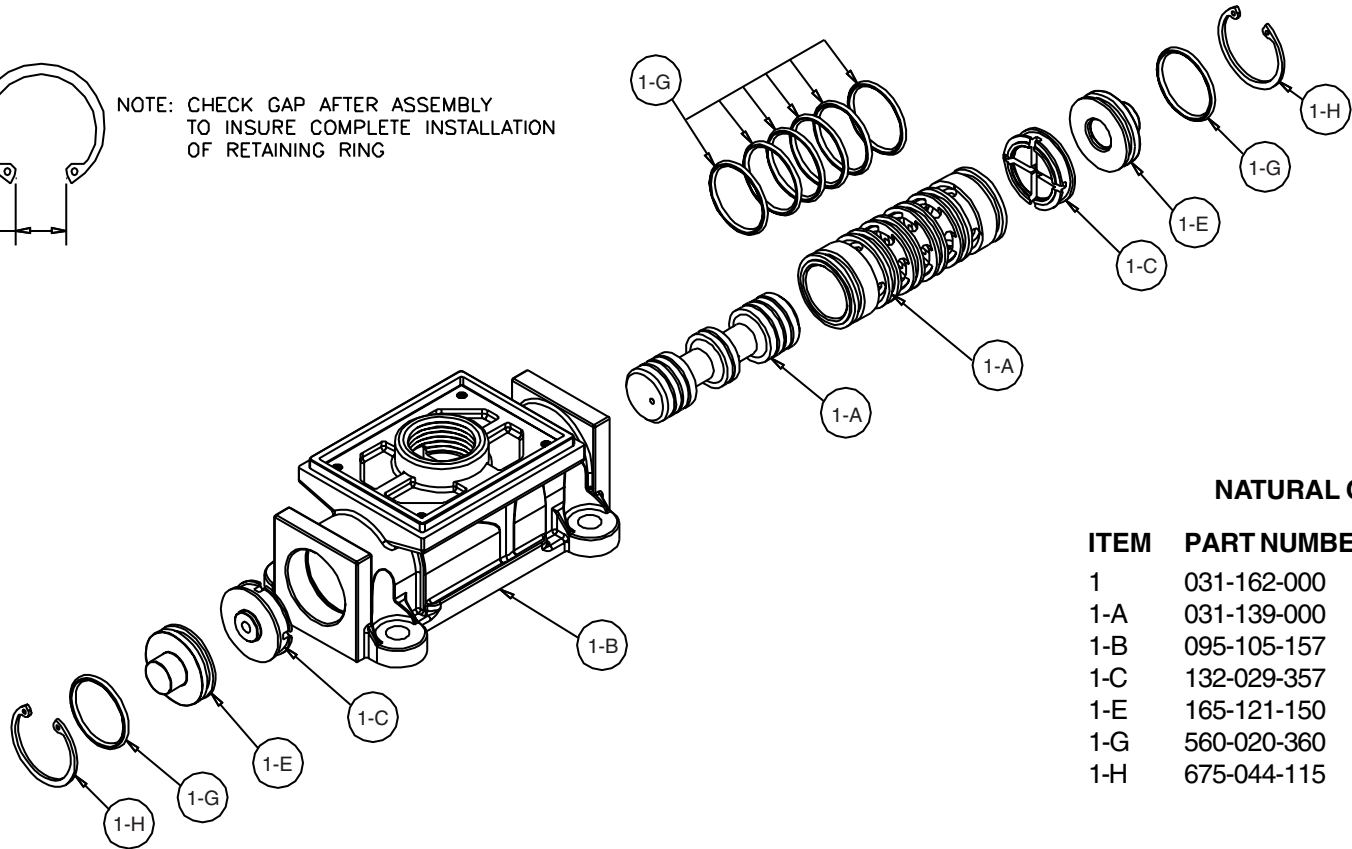
Composite Repair Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-162-000	Gas Valve Assembly	1	19	518-175-156	Manifold, Suction	1
2	050-005-360	Ball, Check	4		518-175-156E	Manifold, Suction 1-1/2" BSPT (Tapered)	1
	050-010-600	Ball, Check	4		518-175-110	Manifold, Suction	1
3	070-012-170	Bushing	2		518-175-110E	Manifold, Suction 1-1/2" BSPT (Tapered)	1
4	095-096-157	Pilot Valve Assembly	1	20	518-176-156	Manifold, Discharge	1
5	114-025-157	Intermediate Bracket	1		518-176-156E	Manifold, Discharge 1-1/2" BSPT (Tapered)	1
6	132-019-360	Bumper, Diaphragm	2		518-176-110	Manifold, Discharge	1
7	135-036-506	Bushing, Plunger	2		518-176-110E	Manifold, Discharge 1-1/2" BSPT	1
8	165-120-000	Cap, Gas Inlet Assembly	1	21	560-001-360	O-Ring	2
9	170-005-330	Capscrew, Hex Hd 5/16-18 X .88	16	22	560-091-360	Seal (Check Valve) (See item 29)	8
10	170-045-330	Capscrew, Hex Hd 5/16-18 X 1.25	16		720-062-600	Seal (Check Valve) (See item 29)	8
11	170-069-330	Capscrew, Hex Hd 5/16-18 X 1.75	4	23	612-022-330	Plate, Inner Diaphragm	2
12	170-006-330	Capscrew, Hex 3/8-16 X 1.00	4	24	612-108-157	Plate, Outer Diaphragm Assembly	2
13	196-173-157	Chamber, Outer	2		612-101-110	Plate, Outer Diaphragm Assembly	2
	196-173-110	Chamber, Outer	2	25	620-022-115	Pin, Actuator	2
14	286-008-360	Diaphragm	2	26	675-042-115	Ring, Retaining	2
15	286-015-604	Diaphragm, Overlay	2	27	685-060-120	Rod, Diaphragm	1
16	360-093-379	Gasket, Natural Gas Valve	1	28	720-010-375	Seal, U-Cup	2
17	360-103-379	Gasket, Pilot Valve	1	29	722-098-110	Seat, Check Ball (seals required see item 22)	4
18	360-104-379	Gasket, Gas Inlet	1	30	722-098-150	Seat, Check Ball (seals required see item 22)	4
					920-025-000	Ground Strap	1

Natural Gas Valve Assembly Drawing, Parts List



NOTE: CHECK GAP AFTER ASSEMBLY
TO INSURE COMPLETE INSTALLATION
OF RETAINING RING



NATURAL GAS ASSEMBLY PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-162-000	Gas Valve Assembly	1
1-A	031-139-000	Sleeve and Spool Set	1
1-B	095-105-157	Body, Gas Valve	1
1-C	132-029-357	Bumper	2
1-E	165-121-150	Cap, End	2
1-G	560-020-360	O-Ring	8
1-H	675-044-115	Ring, Retaining	2

NATURAL GAS DISTRIBUTION VALVE SERVICING

To service the valve first shut off the natural gas supply, bleed pressure from the pump, and disconnect the natural gas supply line from the pump.

STEP #1: See COMPOSITE REPAIR PARTS DRAWING.

Using a $\frac{9}{16}$ " wrench or socket, remove the four hex capscrews (item 12). Remove the gas valve assembly from the pump.

Remove and inspect gasket (item 15) for cracks or damage. Replace gasket if needed.

STEP #2: Disassembly of the gas valve.

To access the internal gas valve components first remove the two retaining rings (item 1-H) from each end of the gas valve assembly using clip ring pliers.

Next remove the two end caps (item 1-E) and bumper (item 1-C). Inspect the o-ring (item 1-G) for cuts or wear. Replace the o-rings if necessary.

Remove the spool (part of item 1-A) from the sleeve. Be careful not to scratch or damage the outer diameter of the spool. Wipe spool with a soft cloth and inspect for scratches or wear.

Inspect the inner diameter of the

sleeve (part of item 1-A) for dirt, scratches, or other contaminants. Remove the sleeve if needed and replace with a new sleeve and spool set (item 1-A).

STEP #3: Reassembly of the natural gas valve.

Install one end cap (item 1-E) with an o-ring (item 1-G) into one end of the gas valve body (item 1-B). Install one retaining ring (item 1-H) into the groove on the same end.

Remove the new sleeve and spool set (item 1-A) from the plastic bag. Carefully remove the spool from the sleeve. Install the six o-rings (item 1-G) into the six grooves on the sleeve. Apply a light coating of grease to the o-rings before installing the sleeve into the valve body (item 1-B), align the slots in the sleeve with the slots in the valve body. Insert the spool into the sleeve. Be careful not to scratch or damage the spool during installation. Push the spool in until it touches the bumper on the opposite end.

Install the remaining end cap with o-ring, bumper and retaining ring.

Fasten the natural gas valve assembly (item 1) and gasket (item 15) to the pump.

Connect the natural gas line to the pump. The pump is now ready for operation.



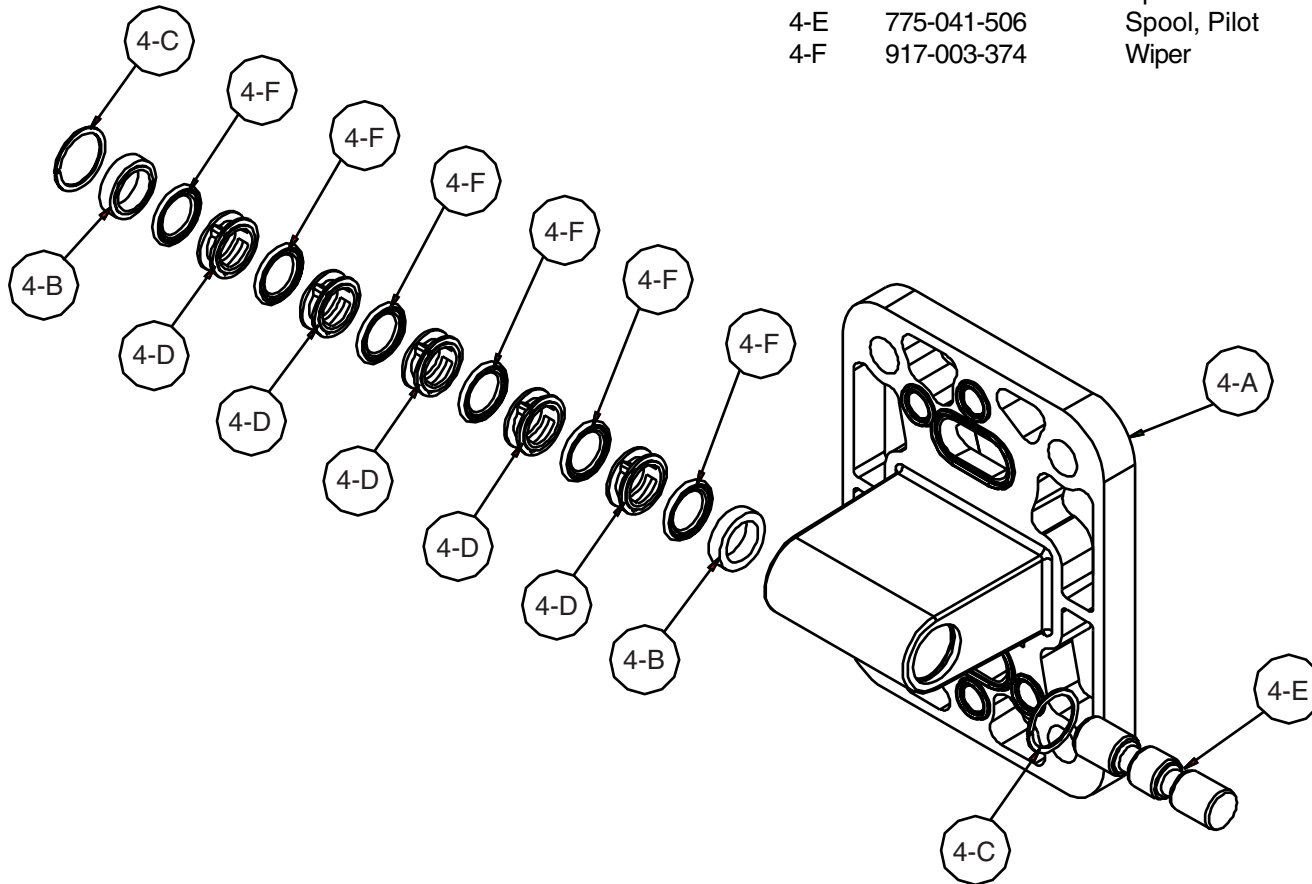
! IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Pilot Valve Assembly Drawing, Parts List

PILOT VALVE ASSEMBLY PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QTY
4	095-096-157	Pilot Valve Assembly	1
4-A	095-095-157	Body, Pilot Valve	1
4-B	135-037-506	Bushing	2
4-C	675-057-115	Ring, Retaining	2
4-D	770-065-175	Spacer	5
4-E	775-041-506	Spool, Pilot	1
4-F	917-003-374	Wiper	6



PILOT VALVE SERVICING

To service the pilot valve first shut off the compressed natural gas supply, bleed the pressure from the pump, and disconnect the natural gas supply line from the pump.

Step #1: See PUMP ASSEMBLY DRAWING.

Using a ½" wrench or socket, remove the four capscrews (items 11). Remove the gas inlet cap (item 8) and gas inlet gasket (item 18). The pilot valve assembly (item 4) can now be removed for inspection or service.

Step #2: Disassembly of the pilot valve.

Remove the pilot valve spool (item 4-E). Wipe clean, and inspect for dirt, scratches or wear. Replace the spool if necessary.

Remove the two retaining rings (items 4-C) from each end of the pilot valve body.

Remove the two pilot valve bushings (items 4-B), five spacers (items 4-D), and six spool wipers (items 4-F) by pushing gently from other end of the pilot valve body. Inspect the wipers for cuts and/or wear. Replace any wipers as necessary.

Step #3: Re-assembly of the pilot valve.

First install a retaining ring to one end of the pilot valve. Install one bushing making sure the step side faces toward the wiper. Apply a light coating of grease

to the outside diameter of each wiper. Next, gently push in the wipers and spacers until they are against the installed retaining ring and bushing in the opposite end of the pilot valve body. Install the remaining bushing making sure the step side faces the wiper. Install the remaining retaining ring.

Apply a light coating of grease to the inner diameter of each wiper. Also apply a light coating of grease to the outer diameter of the pilot valve spool and gently push the spool through each wiper.

Step #4: Inspect the actuator plungers.

See ILLUSTRATION AT RIGHT.

The actuator plungers (items 25) can be reached through the pilot valve cavity in the intermediate assembly (item 5).

Remove the plungers (item 25) from the bushings (item 7) in each end of the cavity. Inspect the installed o-ring (items 21) for cuts and/or wear. Replace the o-rings if necessary. Apply a light coating of grease to each o-ring and re-install the plungers in to the bushings. Push the plungers in as far as they will go.

To remove the bushings (item 7), first remove the retaining rings (item 26) by using a flat screwdriver. **NOTE:** It is recommended that new retaining rings be installed.


Step #5: Re-install the pilot valve assembly into the intermediate assembly.

Be careful to align the ends of the stem between the plungers when inserting the stem of the pilot valve into

the cavity of the intermediate.

Re-install the gasket (item 18), natural gas inlet cap (item 8) and capscrews (item 11).

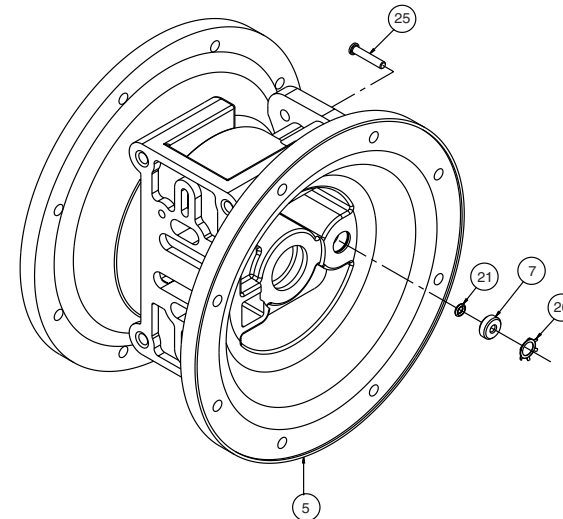
Connect the natural gas supply to the pump. The pump is now ready for operation.



! IMPORTANT

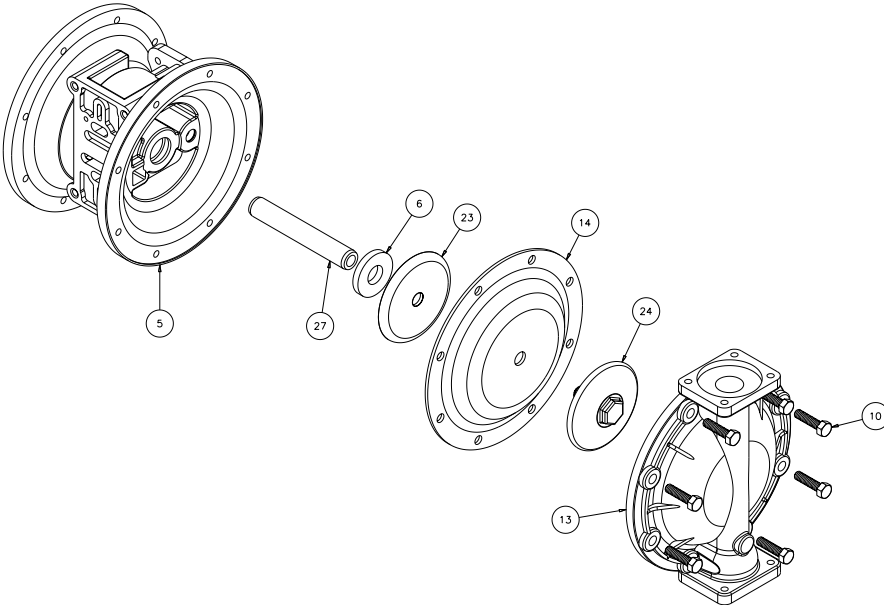
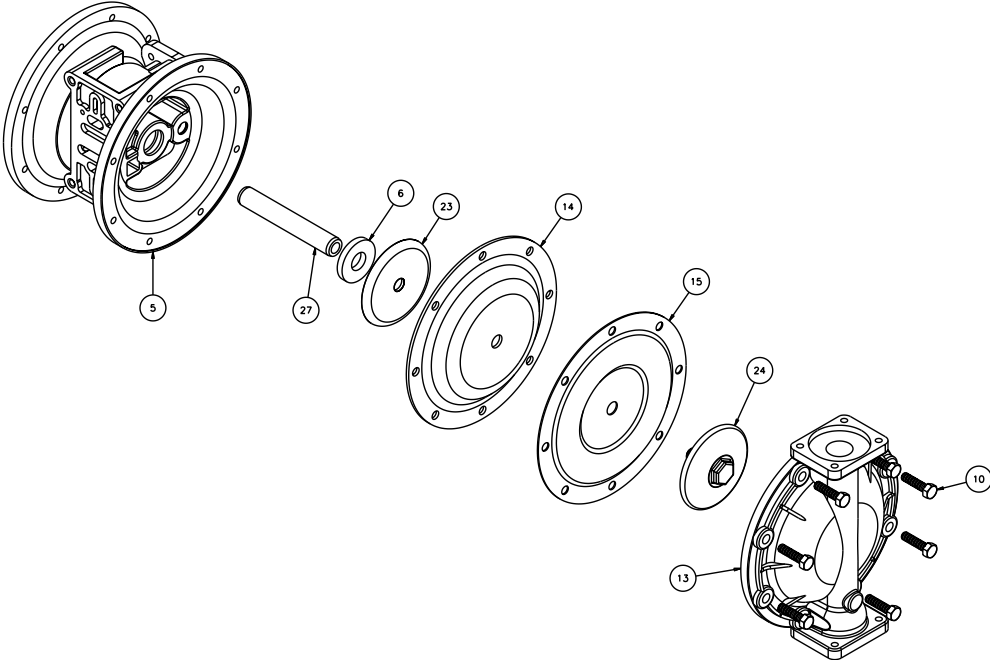
Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

ACTUATOR PLUNGER SERVICING



Diaphragm Service Drawing, with Overlay

Diaphragm Service Drawing, Non-Overlay



DIAPHRAGM SERVICING

To service the diaphragms first shut off the suction, then shut off the discharge lines to the pump. Shut off the natural gas supply, bleed the pressure from the pump and disconnect the natural gas supply line from the pump. Drain any remaining liquid from the pump.

Step #1: See the pump assembly drawing and the diaphragm servicing illustration.

Using a 1/2" wrench or socket, remove the 16 capscrews (item 9) that fasten the manifolds (items 19 & 20) to the outer chambers (item 13).

Step #2: Removing outer chambers.

Using a 1/2" wrench or socket, remove the 16 capscrews (item 10), that fasten the outer chambers (item 13), diaphragms (item 14) and intermediate (item 5) together.

Step #3: Removing the diaphragms and diaphragm plates.

Use a 7/8" wrench or six point socket to remove the outer diaphragm plate assemblies (item 24), diaphragms (item 14) and inner diaphragm plates (item 23) from the diaphragm rod (item 27) by turning counterclockwise. Inspect the diaphragm for cuts, punctures, abrasive wear or chemical attack. Replace the diaphragms if necessary. **DO NOT USE A WRENCH ON THE DIAPHRAGM ROD. FLAWS ON THE SURFACE MAY DAMAGE BEARINGS AND SEALS.**

Step #4: Assembling the diaphragm and diaphragm plates to the diaphragm rod.

Push the threaded stud of one outer diaphragm plate assembly through the center of one diaphragm and through one inner diaphragm plate. Install the diaphragm with the natural bulge facing away from the diaphragm rod and make sure the radius on the inner diaphragm plate is towards the diaphragm, as indicated on the diaphragm servicing illustration. Thread the assembly onto the diaphragm rod, leaving loose.

Step #5: Installing the diaphragm and rod assembly to the pump.

Make sure the bumper (item 6) is installed over the diaphragm rod. Insert rod into pump.

On the opposite side of the pump, pull the diaphragm rod out as far as possible. Make sure the second bumper is installed over the diaphragm rod.

Push the threaded stud of the other outer diaphragm plate assembly through the center of the other diaphragm and through the other inner diaphragm plate. Make sure the radius on the inner diaphragm plate is towards the diaphragm. Thread the assembly onto the diaphragm rod. Use a 7/8" wrench or socket to hold one outer diaphragm plate. Then, use a torque wrench to tighten the other outer diaphragm plate to the diaphragm rod to 500 in. lbs. (56.5 Newton meters).

Align one diaphragm with the intermediate and install the outer chamber to the pump using the 8

capscrews. Tighten the opposite diaphragm plate until the holes in the diaphragm align with the holes in the intermediate. Then, install the other outer chamber using the 8 capscrews.

Step #6: Reinstall the manifolds to the pump using the 16 capscrews.

The pump is now ready to be reinstalled, connected and returned to operation.

OVERLAY DIAPHRAGM SERVICING

The overlay diaphragm (item 15) is designed to fit over the exterior of the standard diaphragm (item 14).

Follow the same procedures described for the standard diaphragm for removal and installation, except tighten the outer diaphragm plate assembly, diaphragms and inner diaphragm plate to the diaphragm rod to 500 in. lbs. (56.5 Newton meters).



! IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

CHECK VALVE SERVICING

Before servicing the check valve components, first shut off the suction line and then the discharge line to the pump. Next, shut off the compressed natural gas supply, bleed natural gas pressure from the pump, and disconnect the natural gas supply line from the pump. Drain any remaining fluid from the pump. The pump can now be removed for service.

To access the check valve components, remove the manifolds (item 22 not shown). Use a $\frac{9}{16}$ " wrench or socket to remove the fasteners. Once the manifold is removed, the check valve components can be seen.

Inspect the check balls (items 2) for wear, abrasion, or cuts on the spherical surface. The check valve seats (item 29) should be inspected for cuts, abrasive wear, or embedded material on the surfaces of both the external and internal chambers. The spherical surface of the check balls must seat flush to the surface of the check valve seats for the pump to operate to peak efficiency. Replace any worn or damaged parts as necessary.

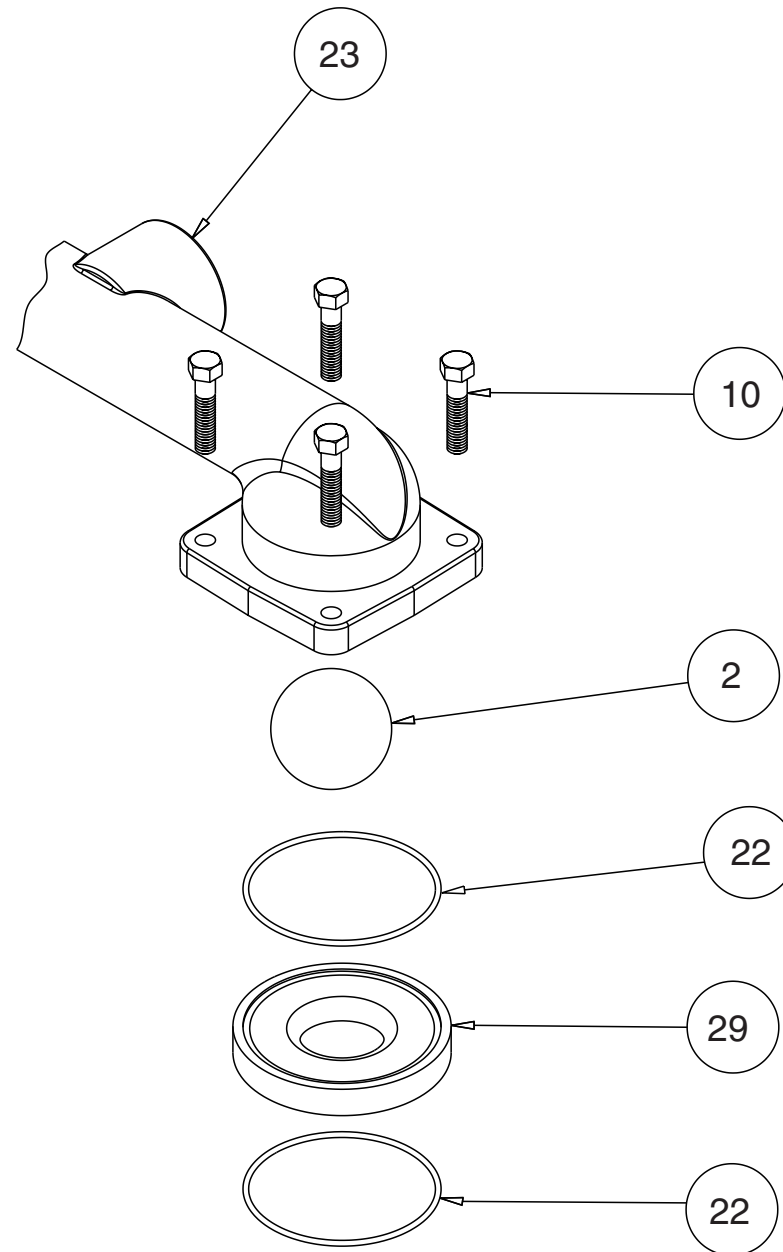
Re-assemble the check valve components. The seat should fit into the counter bore of the outer chamber.

The pump can now be reassembled, reconnected and returned to operation.

METALLIC SEATS

Two o-rings (or seals) (item 22) are required for metallic seats.

Check Valve Drawing



PUMPING HAZARDOUS LIQUIDS

When a diaphragm fails, the pumped liquid or fumes enter the natural gas end of the pump. Fumes are exhausted into the surrounding environment. When pumping hazardous or toxic materials, the exhaust gas must be piped to an appropriate area for safe disposal. See illustration #1 at right.

This pump can be submerged if the pump materials of construction are compatible with the liquid being pumped. The natural gas exhaust must be piped above the liquid level. See illustration #2 at right. Piping used for the gas exhaust must not be smaller than 1" (2.54 cm) diameter. Reducing the pipe size will restrict natural gas flow and reduce pump performance. When the pumped product source is at a higher level than the pump (flooded suction condition), pipe the exhaust gas higher than the product source to prevent siphoning spills. See illustration #3 at right.

PIPING THE NATURAL GAS EXHAUST

The following steps are necessary to pipe the exhaust gas away from the pump.

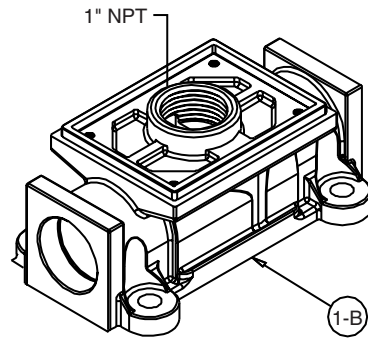
The gas distribution valve body (item 1-B) has 1" NPT threads for piped exhaust.

IMPORTANT INSTALLATION

NOTE: The manufacturer recommends installing a flexible conductive hose or connection between the pump and any rigid plumbing. This reduces stresses on the molded threads of the natural gas exhaust port. Failure to do so may result in damage to the natural gas distribution valve body.

Any piping or hose connected to the pump's natural gas exhaust port must be conductive and physically supported. Failure to support these connections could also result in damage to the valve body.

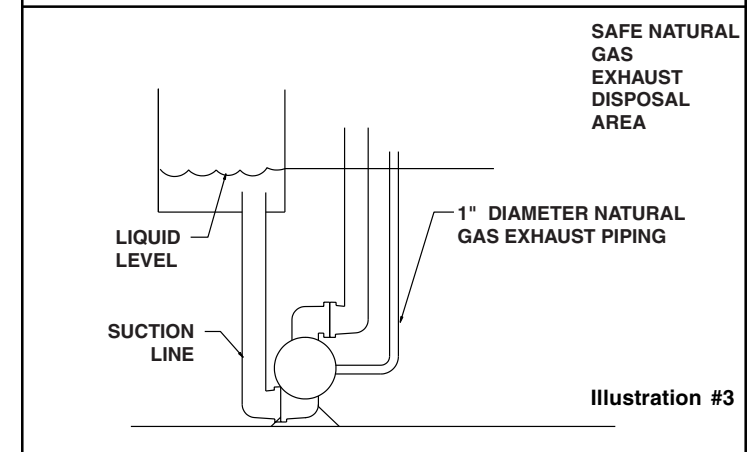
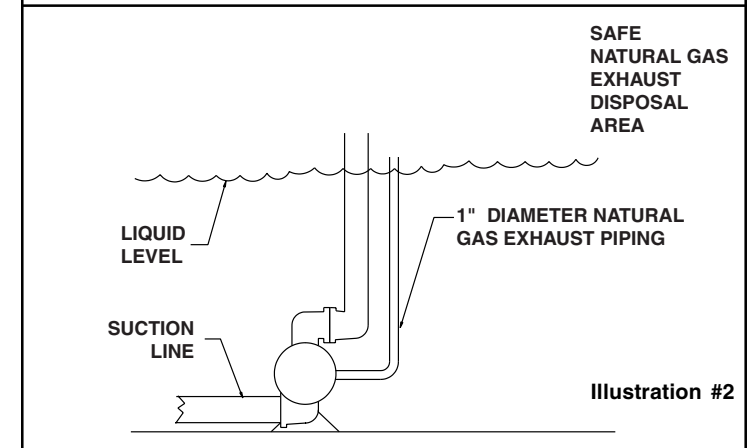
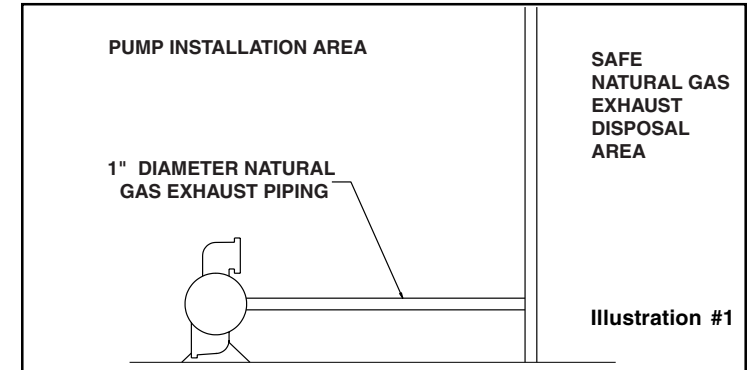
If a high pressure gas spike is possible through the exhaust line, a pressure regulator is required in the exhaust piping.



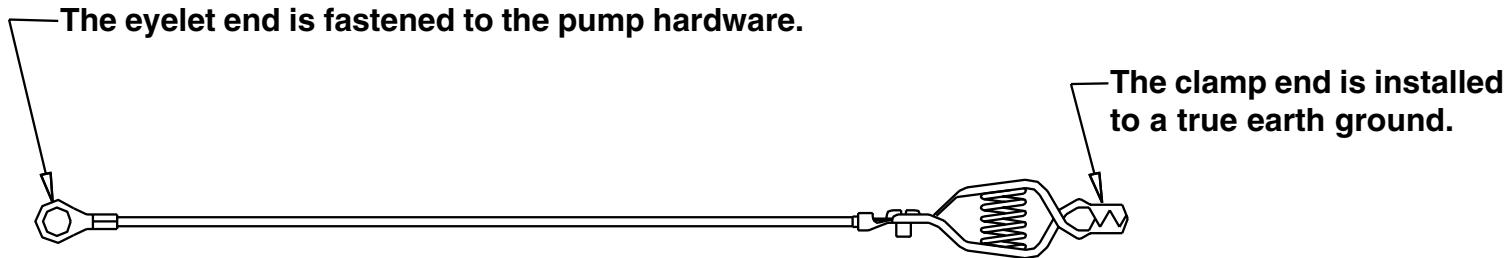
WARNING

Natural gas exhaust is to be vented to low pressure safe location using conductive Buna rubber hose or metal piping in accordance with local fire and environmental codes, or an industry or nationally recognized code having jurisdiction over specific installations, and/or CAN/CGA B149, Installation Codes.

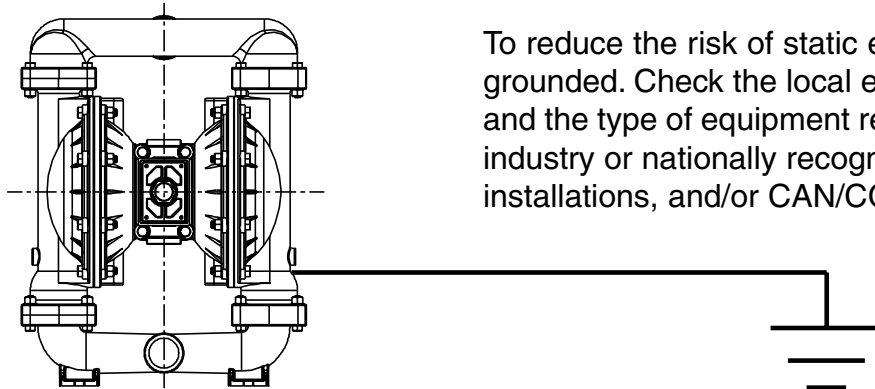
NATURAL GAS EXHAUST ILLUSTRATION



Grounding The Pump



This 8 foot long (244 centimeters) Ground Strap (Item 30) is shipped with the eyelet end fastened to the pump hardware.



To reduce the risk of static electrical sparking, this pump must be grounded. Check the local electrical code for detailed grounding instruction and the type of equipment required, or in the absence of local codes, an industry or nationally recognized code having jurisdiction over specific installations, and/or CAN/CGA B149, installation codes.

	! WARNING
	<i>Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.</i>