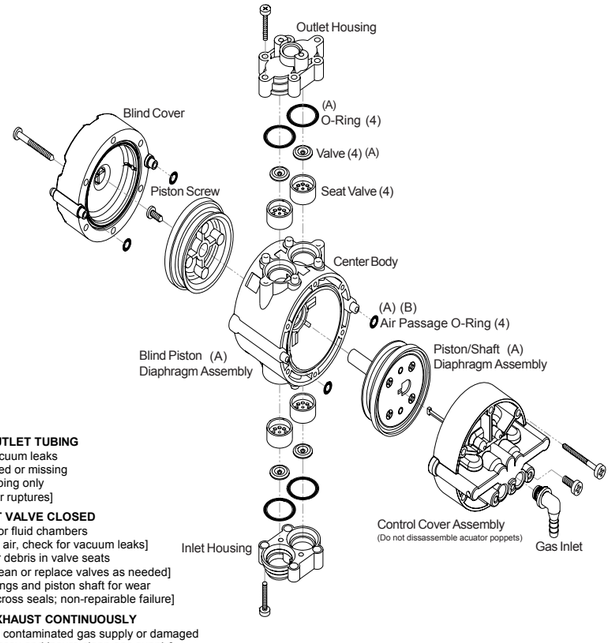
START-UP PROCEDURE

1. Confirm that all tubing connections are properly clamped, fittings are tight, and tubing is not kinked.
2. Insert the inlet tube into fluid container. Open outlet/valve to permit trapped air to purge. Adjust gas regulator to about 15 psi.[1 bar] allowing the pump to stroke slowly until primed. Operate the pump until all air is purged.
3. Adjust the gas regulator to achieve sufficient backpressure for the desired flow rate. Restrict fluid delivery and/or increase gas pressure to achieve a differential across the pump of not more than 5 psi., while maintaining the stroke rate at not more than two strokes per second.
4. The most efficient gas usage occurs at 40 psi.[2.8 bar]. ***Maximum*** static gas pressure to the pump is 60 psi. [4.1 bar], minimum 20 psi. [1.4 bar].

CAUTION: Flow rates or a dry running condition which results in a stroke rate of more than two per second may decrease pump life. Damage to internal components due to "over running" may occur and is not covered by the SHURflo Limited warranty.



TROUBLESHOOTING

DOES NOT OPERATE / GAS APPLIED / OUTLET (VALVE) OPEN
- ✓ Gas pressure too high
- ✓ Outlet tube kinked or restricted
- ✓ Operated without fluid for excess period (Dry run)
  [piston shaft seized on center body seals non-repairable failure]
- ✓ Control cover subjected contaminated gas supply or damaged
  [replace control cover assy and insure clean gas supply]

OPERATES WILL NOT PRIME / OUTLET VALVE OPEN
- ✓ Warped/swollen valves or debris in valve seats
  [check compatibility, clean or replace valves as needed]

FLUID FROM EXHAUST OR IN GAS INLET TUBING
- ✓ Insure clean gas supply
- ✓ Inspect diaphragm/piston assemblies for ruptures
  [replace diaph/pis assy and control cover; check compatibility]

AIR IN INLET AND/OR OUTLET TUBING
- ✓ Inlet tubing/fitting for vacuum leaks
- ✓ Inlet fitting o-ring; pinched or missing
- ✓ Air bubbles in output tubing only
  [inspect diaphragms for ruptures]

STROKES WITH OUTLET VALVE CLOSED
- ✓ Air trap in outlet tubing or fluid chambers
  [open outlet and purge air, check for vacuum leaks]
- ✓ Warped outlet valves or debris in valve seats
  [check compatibility, clean or replace valves as needed]
- ✓ Inspect center body o-rings and piston shaft for wear
  [piston shaft leaking across seals; non-repairable failure]

GAS BLOWING FROM EXHAUST CONTINUOUSLY
- ✓ Control cover subjected contaminated gas supply or damaged
  [replace control cover assy and insure clean gas supply]

REPLACEMENT PARTS KITS

(A) Elastomer Kit
(includes piston/diaphragm assemblies, valves, and valve seat o-rings)
To insure the correct Elastomer kit order by pump model number.

(B) Control Cover Assembly
Control cover is necessary if comtaminated air or pump fluid has entered actuator and is incompatible with buna o-rings within the control cover.

Complete inspection of pump components is crucial to insure repairs will correct failed condition. Kits include air passage o-rings and detailed illustrated instructions. Contact a SHURflo distributor or SHURflo directly for information regarding kits.

RETURN POLICY

All Industrial pumps/products ***must*** be flushed of ***any*** chemical (ref. OSHA Section 1910.1200 (d)(e)(f)(g)(h)) and hazardous chemicals ***must*** be labeled / tagged before being shipped* to SHURflo for service or warranty consideration. SHURflo reserves the right to request a Material Safety Data Sheet from the returnee for any pump/ product it deems necessary. SHURflo reserves the right to "disposition as scrap" pumps/products returned which contain unknown fluids. SHURflo reserves the right to charge the returnee for any and all costs incurred for chemical testing, and proper disposal of components containing unknown fluids. SHURflo request this in order to protect the environment and personnel from the hazards of handling unknown fluids.

* Carriers, including U.S.P.S., airlines, UPS, ground freight, etc., require specific identification of any hazardous materials to be shipped. Failure to do so may result in a substantial fine and/or prison term. Check with your shipping company for specific instructions.

INDUSTRIAL PRODUCT LIMITED WARRANTY

SHURflo Industrial series pumps and products are warranted to be free of defects in material and workmanship under normal use, for a period of one (1) year from the date of manufacture, or one (1) year of use, with proof of purchase. This limited warranty will not exceed two (2) years, in any event.

The limited warranty will not apply to pumps/products that were improperly installed, misapplied, damaged, altered, incompatible with fluids or components not manufactured by SHURflo.

All Industrial pumps/products ***must*** be flush of ***any*** chemicals before shipping*. All warranty considerations are governed by SHURflo's written Return Policy.

Returns are to be shipped postage prepaid to either service center; SHURflo Cypress, CA or Elkhart, IN. SHURflo shall not be liable for freight damage incurred during shipping. Package returns carefully.

SHURflo's obligation under this warranty policy is limited to the repair or replacement of the pump/ product. All returns will be tested per SHURflo factory criteria. Products found not defective (under the terms of this limited warranty) are subject to charges paid by the returnee for the testing and packaging of "tested good" non-warranty returns.

No credit or labor allowances will be given for pumps or products returned as defective. Warranty replacements will be shipped on a freight allowed basis. SHURflo reserves the right to choose the method of transportation.

This limited warranty is in lieu of all other warranties, expressed or implied, and no other person is authorized to give any other warranty or assume obligation or liability on SHURflo's behalf. SHURflo shall not be liable for any labor, damage or other expense, nor shall SHURflo be liable for any indirect, incidental or consequential damages of any kind incurred by the reason of the use or sale of any defective product or part. This limited warranty covers industrial products distributed within the United States of America. Other world market areas should consult with the actual distributor for any deviation from this document.

Variables within individual systems can affect total pumping distance. The SHURflo gas pump will deliver a fluid depending on the physical demand of the system. Prior to installing the pump SHURflo recommends estimating ***OUTLET*** losses in the system by considering various factors:
- Fluid viscosity and temperature.
- Inside diameter of the outlet tubing, fittings, etc.
- Total flow rate of valve(s) connected to a pump.
- Horizontal distance from the pump to the valve.
- Vertical lift will adversely affect total tubing run length. Depending on the fluid, assume an extra 4~8 psi.[.3~.6 bar] gas pressure loss for every 10 ft.[3 M] of vertical lift.

The following tables are to be used as ***general*** pumping distances within **HORIZONTAL OUTLET TUBING** for different viscosity's. The distances listed are achieved at 60 psi.[4.1 bar] with a minimum of 20 psi.[1.4 bar] remaining at that distance, for the flow rate indicated. Test conducted at 70°F [21°C].

FLUID VISCOSITY OF 3.0 cps.

G.P.M.	[L.P.M.]	3/8"[10mm] I.D. tubing feet	3/8"[10mm] I.D. tubing meter	1/4"[6mm] I.D. tubing feet	1/4"[6mm] I.D. tubing meter
.2	.87	500+	200	500+	183
.35	1.3	500+	175	500	160
.46	1.7	500	152	475	154
.58	2.1	475	145	435	132

FLUID VISCOSITY OF 50 cps.

G.P.M.	[L.P.M.]	3/8"[10mm] I.D. tubing feet	3/8"[10mm] I.D. tubing meter	1/4"[6mm] I.D. tubing feet	1/4"[6mm] I.D. tubing meter
.1	.38	300	91	180	54
.23	.87	250	76	90	46
.35	1.3	150	46	60	18
.46	1.7	70	21	30	9
.58	2.1	40	12	15	5

FLUID VISCOSITY OF 2500 cps.

G.P.M.	[L.P.M.]	3/8"[10mm] I.D. tubing feet	3/8"[10mm] I.D. tubing meter	1/4"[6mm] I.D. tubing feet	1/4"[6mm] I.D. tubing meter
.1	.38	225	68	120	37
.23	.87	140	43	65	20
.35	1.3	60	18	25	8
.46	1.7	18	6	15	5

INSTALLATION GUIDELINES

- As indicated on the pump, the liquid outlet is to be mounted up (vertical). The pump should be mounted at the same level or higher than the fluid container.
- The inlet side of the pump ***must not*** have positive pressure. Longer total run lengths than indicated are obtainable by installing pumps in series. The use of a SHURflo Vacuum Regulator Valve at the inlet of the secondary pump drops liquid pressure to zero. Contact SHURflo for determination of fluid compatibility with a V.R.V.
- Inlet tubing should be rated for vacuum, either 3/8" or 1/2" [10 or 13mm] I.D. Liquids with low viscosity (<50 cPs.) can have a maximum of 5 ft. [1.5 M] vertical rise within an overall tubing length of 10 ft. [3 M].

NOTE: Restrictions on the inlet may cause vacuum levels to reach the fluids vapor pressure, causing cavitation, degassing, vapor lock, and a loss in performance.

Fluids that are highly viscous (5000 cPs.) require inlet tubing that is 1/2" [13mm] I.D. with maximum length of 1 ft. [0.3 M]. The pump must be placed level with fluid container, with only minimal vertical rise.

- Use chemically compatible high pressure tubing, 3/8" or 1/4" [10 or 6 mm] I.D. for pressurized outlet lines. Secure all tubing connections with the appropriate clamps.
- Pressurized gas supply lines must be plumbed with clean 1/4" [6mm] high pressure braided tubing. A secondary low pressure adjustable regulator should be installed as a back-up in case of primary regulator failures, which may over pressurize the pump. An air compressor may ***only*** be used when equipped with adequate particulate filter and moisture separator. The air storage tank should be drained on a regular basis.

CAUTION: The gas supply to the pump ***must*** be clean and contain no contaminates (oil, rust, water, etc.). Pump damage due to "contaminated air" is not covered under warranty.

- Tie-wrap all tubing securely to prevent any kinks or sags that inhibit performance or cause damage to the pump or the fittings.
- ***ALL*** tubing should be visibly marked at the pump and along the tubing to prevent accidental contact or confusion with other fluids.

TECHNICAL SPECIFICATION:

DESIGN:	Twin Chamber Double Diaphragm
MODEL NUMBER/ FLUID CHAMBER MATERIALS:	166–200 –36 Viton™ –47 Buna –56 EDPM –57 Santoprene/ EPDM
MATERIALS OF CONSTRUCTION:	Polypropylene, Nylon, 316 Stainless Steel, Buna within air passages
POWER SOURCE:	CO_2, Nitrogen, or Compressed Filtered Air
OPERATING PRESSURE: (static)	60 psi. [4.1 bar] MAX. / 20 psi. [1 bar] MIN.
DISPLACEMENT:	.0195 gal. per cycle [74cc]
FLOW RATE: (CONTINUOUS)	.6 gal. per min. maximum [2.2 L]
GAS CONSUMPTION RATE: (FLUID VISCOSITY 22 CENTIPOISE)	.48 CFM @ 60 psi consumed when pumping at .46 GPM [13.5 LPM @ 4.1 bar consumed when pumping at 1.7 LPM]
TEMPERATURE LIMITS:	34° – 120°F [1.1°–49°C]
SUCTION LIFT: (WET)	25 in/Hg. [85 kPa] (not intended for dry operation)
VALVE PASSAGE:	.025 [.6mm] soft, round particulates max.
DIMENSIONS	6.3"H x 5.9"W x 3.8"D [160 x 150 x 97 mm]
WEIGHT:	2 lbs. [.9 kgs]
STANDARD FITTINGS:	3/8" [10mm] Barb, stainless steel, 90° configuration
AVAILABLE FITTINGS:	1/4" [6mm], 3/8" [10mm], and 1/2" [13mm] barb, Plastic or Stainless Steel; Straight or 90° configurations

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911-334 Rev. H 9/05

SHURflo

INDUSTRIAL GAS PUMP 166-200-XX

Installation and Operation Instructions

The SHURflo Industrial Gas Pump employs a dual diaphragm design which yields consistent flow and pressure. The compressed gas (CO_2, nitrogen, or clean filtered air) used to operate the pump never comes in contact with the pumped fluid, eliminating contamination and degassing. The pump operates whenever there is a differential in pressure between the outlet line and the regulated gas. When the outlet valve is opened the pump responds by stroking to re-pressurize the line. When the valve is closed the output liquid line pressure equalizes that of the regulated gas and the pump stops.

CHEMICAL COMPATIBILITY

The industrial gas pump is offered in various configurations. Each utilizes specialized elastomers within the fluid passages, allowing compatibility with most caustic or acidic fluids. If unsure of the chemical compatibility of the pumps elastomers SHURflo can help recommend the correct model for the chemical in question.

CAUTION: ***Do Not*** assume compatibility of the pump with the fluid being used. If the fluid is incorrectly matched to the pump's elastomers, leaks may occur. Pumps used with harmful chemicals, or driven with CO_2/air must be in a vented area to guard against the possibility of injury due to harmful or explosive liquid/vapors. If located in a confined area (basement, closet, cooler box, etc.) an exhaust fan capable of changing the room air on a continuous basis should be installed.

PUMPING CAPABILITY

Flow rates or a dry running condition which results in a stroke rate of more than two strokes per second ***may*** be detrimental to pump life. ***Do not*** control stroke rate by regulating gas pressure; restrict fluid outlet flow rate to maintain sufficient backpressure to insure componet longevity. When operated continuously at 60 psi [4.1 bar] static, with no more than .6 gpm [2.2 Lpm] flow rate (1 stroke/ sec.) pump life is approximatly 7500 gals. If higher flow rates are necessary, additional pumps should be installed to achieve the flow required. Installation of pumps using separate inlet/outlet tubing and individual valves is recommended.

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