Operation

SaniForce® High Sanitation Diaphragm Pumps

Models 1040, 1590, 2150, 3150, 4150

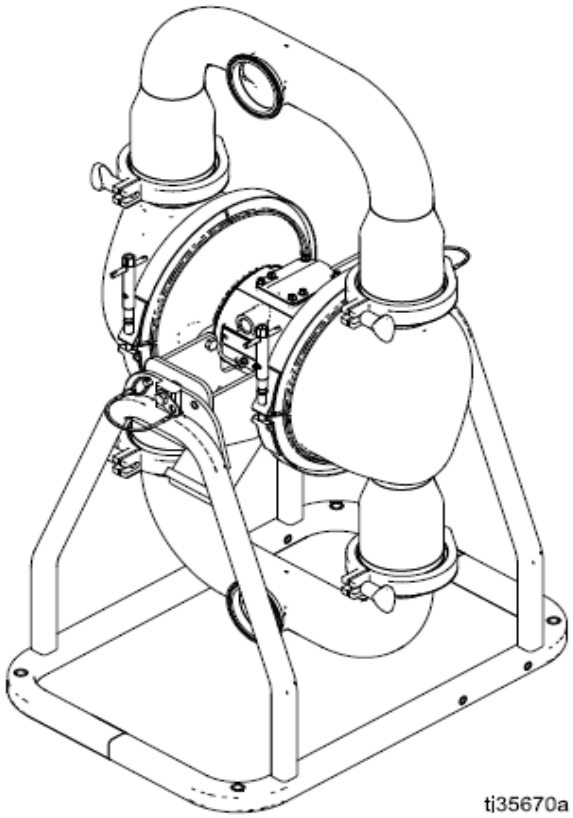
3A5999E

EN

For transfer of fluids in sanitary applications. Not approved for use in explosive atmospheres or hazardous (classified) locations unless otherwise stated. See Approvals page for more information. For professional use only.

120 psi (0.8 MPa, 8 bar) Maximum Fluid Working Pressure
120 psi (0.8 MPa, 8 bar) Maximum Air Input Pressure

Important Safety Instructions.
Read all warnings and instructions in this manual before using the equipment. Save these instructions.



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Contents

Related Manuals

English Manual Number	Title
3A6780	SaniForce High Sanitation Diaphragm Pump, Model 1040, Repair/Parts
3A6781	SaniForce High Sanitation Diaphragm Pump, Model 1590, Repair/Parts
3A6782	SaniForce High Sanitation Diaphragm Pump, Models 2150, 3150, 4150, Repair/Parts
3A6976	Leak Detection System

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbol refers to procedure-specific risk. When these symbols appear in the body of this manual, refer back to these warnings. Additional, product-specific warnings may be found throughout the body of this manual where applicable.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Flammable fumes, such as solvent, in **work area** can ignite or explode. Solvent flowing through the equipment can cause static sparking. To help prevent fire or explosion:

- Use equipment only in well ventilated area.
- Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static sparking).
- Ground all equipment in the work area. See **Grounding** instructions.
- Keep work area free of debris, including solvent, rags and gasoline.
- Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present.
- Use only grounded fluid lines.
- Hold gun firmly to side of grounded pail when triggering into pail. Do not use pail liners unless they are anti-static or conductive.
- **Stop operation immediately** if static sparking occurs or you feel a shock. Do not use equipment until you identify and correct the problem.
- Keep a working fire extinguisher in the work area.
- Route exhaust away from all ignition sources. If diaphragm ruptures, fluid may be exhausted with air.

PRESSURIZED EQUIPMENT HAZARD

Fluid from the equipment, leaks, or ruptured components can splash in the eyes or on skin and cause serious injury.

- Follow the **Pressure Relief Procedure** when you stop spraying/dispensing and before cleaning, checking, or servicing equipment.
- Tighten all fluid connections before operating the equipment.
- Check fluid lines, tubes, and couplings daily. Replace worn or damaged parts immediately.

⚠ WARNING

EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.

- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Specifications** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Specifications** in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheet (SDS) from distributor or retailer.
- Turn off all equipment and follow the **Pressure Relief Procedure** when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route fluid lines and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend fluid lines or use fluid lines to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.

TOXIC FLUID OR FUMES HAZARD

Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.

- Read Safety Data Sheet (SDS) to know the specific hazards of the fluids you are using.
- Route exhaust away from work area. If diaphragm ruptures, fluid may be exhausted into the air.
- Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.

BURN HAZARD

Equipment surfaces and fluid that is heated can become very hot during operation. To avoid severe burns:

- Do not touch hot fluid or equipment.

PERSONAL PROTECTIVE EQUIPMENT

Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. This equipment includes but is not limited to:

- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.

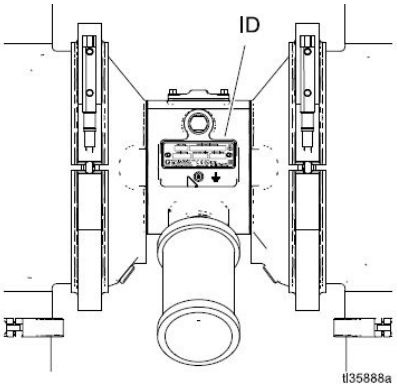
Configuration Number Matrix

Check the identification plate (ID) for the Configuration Number of your pump. Use the following matrix to define the components of your pump.

When you receive your pump, record the 9 character part number found on the shipping box (e.g., SP3F.0018): _____

Also record the configuration number on the pump ID plate to assist you when ordering replacement parts:

_____



Sample Configuration Number: 2150HS.PSP1ASSASSPTPSEP21

2150	HS	P	SP1A	SSA	SS	PT	PS	EP	21
Pump Model	Wetted Section Material	Drive	Center Section and Air Valve Material	Manifolds	Seats	Checks	Diaphragms	Seals	Certification

NOTE: Some combinations are not possible. Please check with your local supplier.

Pump	Wetted Section Material		Drive Type		Center Section and Air Valve Material		Manifolds	
1040	3A	3-A compliant	P	Pneumatic	S01A	Stainless Steel, for all but 2-piece PS diaphragms	SSA	Stainless steel, TriClamp, center ported
1590	HS	High Sanitation			S02A	Stainless Steel, leak detector, for all but 2-piece PS diaphragms	SSB	Stainless steel, DIN, center ported
2150	PH	Pharmaceutical			S03A	Stainless Steel, PH, for all but 2-piece PS diaphragms	SSC	Stainless steel, TriClamp, unloader
3150					SP1A	Stainless Steel, for 2-piece PS diaphragms only	SSD	Stainless steel, DIN, unloader
4150					SP2A	Stainless Steel, leak detector, PS diaphragms	SSE	Stainless steel, TriClamp, horizontal, WYE manifold
					SP3A	Stainless Steel, PH, for 2-piece PS diaphragms only	SSF	Stainless steel, DIN, horizontal, WYE manifold
							SSG	Horizontal, no manifolds

Seat Material		Checks		Diaphragm Material		Seals		Certification	
FL	316 stainless steel, flapper	—	Stainless Steel Flapper	BN	Buna-N	BN	Buna-N	21	EN 10204 type 2.1
SS	316 stainless steel, ball	BN	Buna-N	EO	EPDM Overmold	EP	EPDM	31	EN 10204 type 3.1
		CW	Polychloroprene Weighted Ball	FK	FKM Fluoroelastomer	FK	FKM		
		EP	EPDM	PO	PTFE/EPDM Overmold				
		FK	FKM Fluoroelastomer Ball	PS	PTFE/Santoprene				
		PT	PTFE Ball	SO	Santoprene Overmold				
		SP	Santoprene Ball	SP	Santoprene				

Approvals		
Except for 3-A pumps, all pumps are approved to:		II 2 GD Ex h IIA T6...T3 Gb Ex h IIIB T160°C Db
Diaphragm materials coded EO, PO, or PS combined with flapper or PT ball checks comply with:		EC 1935/2004
Diaphragm materials coded EO or PS combined with flapper or PT ball checks comply with:		Class VI
All models are approved to:		
All fluid contact materials are FDA compliant and meet the United States Code of Federal Regulations (CFR)		

ATEX T-code rating is dependent on the temperature of the fluid being pumped. Fluid temperature is limited by the materials of the pump interior wetted parts. See **Fluid Temperature Range** for the maximum fluid operating temperature for your specific pump model.

Fluid Temperature Range

NOTICE
Temperature limits are based on mechanical stress only. Certain chemicals will further limit the fluid temperature range. Stay within the temperature range of the most-restricted wetted component. Operating at a fluid temperature that is too high or too low for the components of your pump may cause equipment damage.

Diaphragm/Ball/Seat Material	Fluid Temperature Range	
	Fahrenheit	Celsius
Buna-N	10° to 180°F	-12° to 82°C
FKM Fluoroelastomer (FK)	-40° to 275°F	-40° to 135°C
EPDM overmolded diaphragm or check balls (EO)	-40° to 250°F	-40° to 121°C
Polychloroprene check balls (CW)	14° to 176°F	-10° to 80°C
PTFE overmolded diaphragm (PO)	-40° to 180°F	-40° to 82°C
PTFE check balls (PT)	-40° to 220°F	-40° to 104°C
2-piece PTFE/Santoprene diaphragm (PS)	-40° to 180°F	-40° to 82°C
Santoprene™ diaphragm or check balls (SP)	-40° to 180°F	-40° to 82°C

The maximum temperature listed is based on the ATEX standard for T4 temperature classification.

Ordering Information

To Find Your Nearest Distributor

1. Visit www.graco.com.
2. Click on Where to Buy and use the Distributor Locator.

To Specify the Configuration of a New Pump

Please call your distributor.

OR

Use the Online Diaphragm Pump Selector at www.graco.com. Search for Selector.

To Order Replacement Parts

Please call your distributor.

Installation

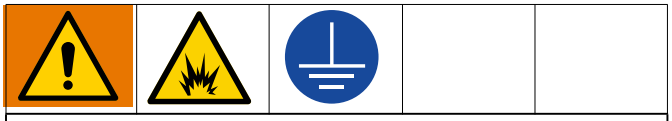
General Information

- A typical installation is shown in FIG. 2. It is only a guide for selecting and installing system components. Contact your Graco distributor for assistance in planning a system to suit your needs.
- Always use genuine Graco parts and accessories.
- Reference numbers and letters in parentheses refer to the callouts in the figures.

Tighten Clamps Before First Use

After you unpack the pump, and before you use it for the first time, check all clamps, and tighten as necessary.

Grounding



The equipment must be grounded to reduce the risk of static sparking. Static sparking can cause fumes to ignite or explode. Grounding provides an escape wire for the electric current.

- *Pump*: Connect a ground wire and clamp as shown in FIG. 1. Loosen the grounding screw (W). Insert one end of a 12 AWG (1.5 mm²) or thicker ground wire (X) behind the grounding screw and tighten the screw securely. Connect the clamp end of the ground wire to a true earth ground. To order a ground wire and clamp, order part number 222011.

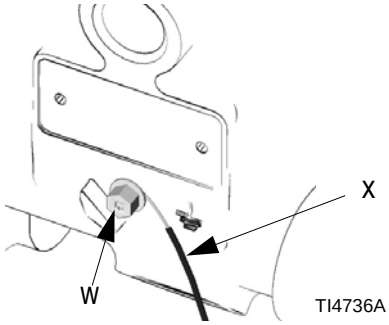


FIG. 1: Ground Wire Connection

- *Air and fluid lines*: Use only conductive lines with a maximum of 500 ft (150 m) combined line length to ensure grounding continuity. Check electrical resistance of lines. If total resistance to ground exceeds 29 megohms, replace line immediately.
- *Fluid supply container:* Follow the local codes and regulations.
- *Pails for solvents and sanitizing solution used when flushing:* Follow local codes and regulations. Use only conductive metal pails, placed on a grounded surface. Do not place the pail on a nonconductive surface, such as paper or cardboard, which interrupts rounding continuity.

Stand and Mounting

The pump may be very heavy (see **Technical Specifications** for specific weights). If the pump must be moved, follow the **Pressure Relief Procedure** on page 13 and have two people lift the pump by grasping the outlet manifold securely, or use appropriate lifting equipment. Never have one person move or lift the pump.

For pumps that are provided with a stand, the pump must be mounted to the stand before securing the pump to the mounting surface. Ensure that the pump is securely mounted to the stand.

Stand sizes:

Pump Type	Part No.	Base Dimensions
Vertical 4150 flapper	25P104	18.0 in x 23.0 in (45.72 cm x 58.42 cm)
Horizontal flapper	25N991	15.75 in x 14.0 in (40.00 cm x 35.56 cm)
Rotatable	24L978	17.3 in. x 23.8 in. (43.94 cm x 60.45 cm)
1040	25P103	10.5 in x 12.0in. (26.67 cm x 30.48 cm)

1. Ensure that the mounting surface is level and can support the weight of the pump, lines, and accessories, as well as the stress caused during operation.
2. Mount the pump and stand assembly on a level surface and secure the assembly to the mounting surface. See **Pump Dimensions**, pages 16–28, for dimensions of the mounting holes for your pump.

   NOTE: For ease of operation and service, mount the pump so the air valve cover, air inlet, and fluid inlet and outlet ports are easily accessible.

Air Line

A bleed-type master air valve (C) is required in the system to relieve air trapped between this valve and the pump. Trapped air can cause the pump to cycle unexpectedly, which could result in serious injury including splashing in the eyes or on the skin. See FIG. 2.

1. Install the air line accessories as shown in FIG. 2. Verify that the air line supplying the accessories is grounded.
   a. Install an air regulator (B) and air pressure gauge (T) to control the fluid pressure. Reducing the supplied air pressure will reduce the pump's fluid outlet pressure.
   b. Locate one bleed-type master air valve (C) close to the pump and use it to relieve trapped air. Locate the other master air valve (A) upstream from all air line accessories and use it to isolate them during cleaning and repair.
   c. The air line filter (R) removes harmful dirt and moisture from the compressed air supply.
2. Install a conductive, grounded, flexible air line (D) between the accessories and the 1/2 npt(f) pump air inlet (F). Use a minimum 3/8 in. (9.5 mm) ID air line. If necessary, install an air line coupler (E) between the air line (D) and the pump air inlet (F), and tighten until snug.

   3-A Pumps: If a leak sensor kit was supplied with your 3-A pump, see the provided kit manual for information on installing the sensors. See **Related Manuals**, page 2.

Fluid Suction and Outlet Lines

For best sealing results, use a standard tri-clamp or DIN style sanitary gasket of a flexible material such as EPDM, Buna-N, fluoroelastomer, or silicone.

NOTE: Compliance with 3-A sanitary standards requires DIN connections to use certain gaskets. See CCE Coordination Bulletin Number 2011-3.

1. Install flexible, conductive fluid lines (G and H).
2. Install a fluid drain valve (K) close to the pump fluid outlet. See FIG. 2.

A fluid drain valve (K) is required to relieve pressure in the fluid outlet line if it is plugged. The drain valve reduces the risk of serious injury, including splashing in the eyes or on the skin, when relieving pressure.

3. Install a fluid shutoff valve (J) in the fluid outlet line (G) downstream from the fluid drain valve (K).

NOTE: For best results, always install the pump as close as possible to the material source. See the **Technical Specifications** for maximum suction lift (wet and dry).

NOTICE

The pump can be damaged if flexible fluid lines are not used. If hard-plumbed fluid lines are used in the system, use a short length of flexible, conductive fluid line to connect to the pump.

Tips to Reduce Cavitation

Cavitation in a diaphragm pump is the formation and collapse of bubbles in the pumped liquid. Frequent or excessive cavitation can cause serious damage, including pitting and early wear of fluid chambers, balls, and seats. It may result in reduced efficiency of the pump. Cavitation damage and reduced efficiency both result in increased operating costs.

Cavitation depends on the vapor pressure of the pumped liquid, the system suction pressure, and the velocity pressure. It can be reduced by changing any of these factors.

1. Reduce vapor pressure: Decrease the temperature of the pumped liquid.
2. Increase suction pressure:
   a. Lower the installed position of the pump relative to the liquid level in the supply.
   b. Reduce the friction length of the suction lines. Remember that fittings add friction length to the lines. Reduce the number of fittings to reduce the friction length.
   c. Increase the diameter of the suction lines.
   d. Ensure the inlet fluid pressure does not exceed 25% of the outlet working pressure.
3. Reduce liquid velocity: Slow the cyclic rate of the pump.

Pumped liquid viscosity is also very important but normally is controlled by factors that are process dependent and cannot be changed to reduce cavitation. Viscous liquids are more difficult to pump and more prone to cavitation.

Graco recommends taking all of the above factors into account in system design. To maintain pump efficiency, supply only enough air to the pump to achieve the required flow.

Graco distributors can supply site-specific suggestions to improve pump performance and reduce operating costs.

Typical Installation

Key:

- A Master air valve (for accessories)
- B Air regulator (required, not supplied)
- C Bleed-type master air valve (for pump) (required, not supplied)
- D Air supply line
- E Air line coupler
- F 1/2 npt (f) pump air inlet
- G Flexible fluid outlet line
- H Flexible fluid suction line
- J Fluid shutoff valve (required, not supplied)
- K Fluid drain valve (required, not supplied)
- L Ground wire (required, not supplied; see page 8 for installation instructions)
- R Air line filter
- S Air pressure gauge (required, not supplied)

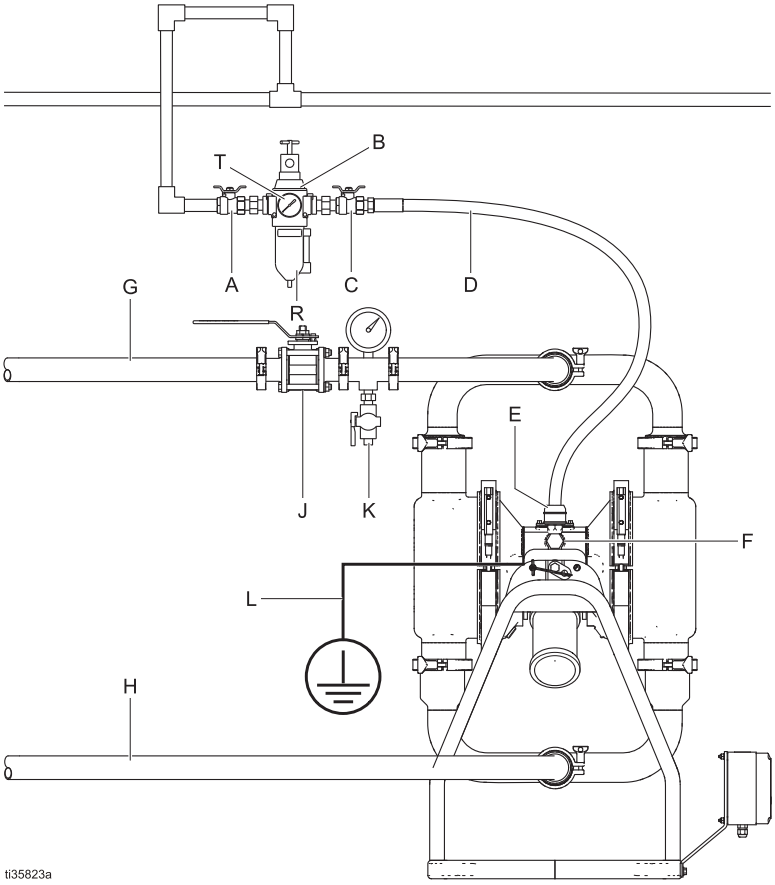


FIG. 2: Typical Floor-Mount Installation

Air Exhaust Ventilation

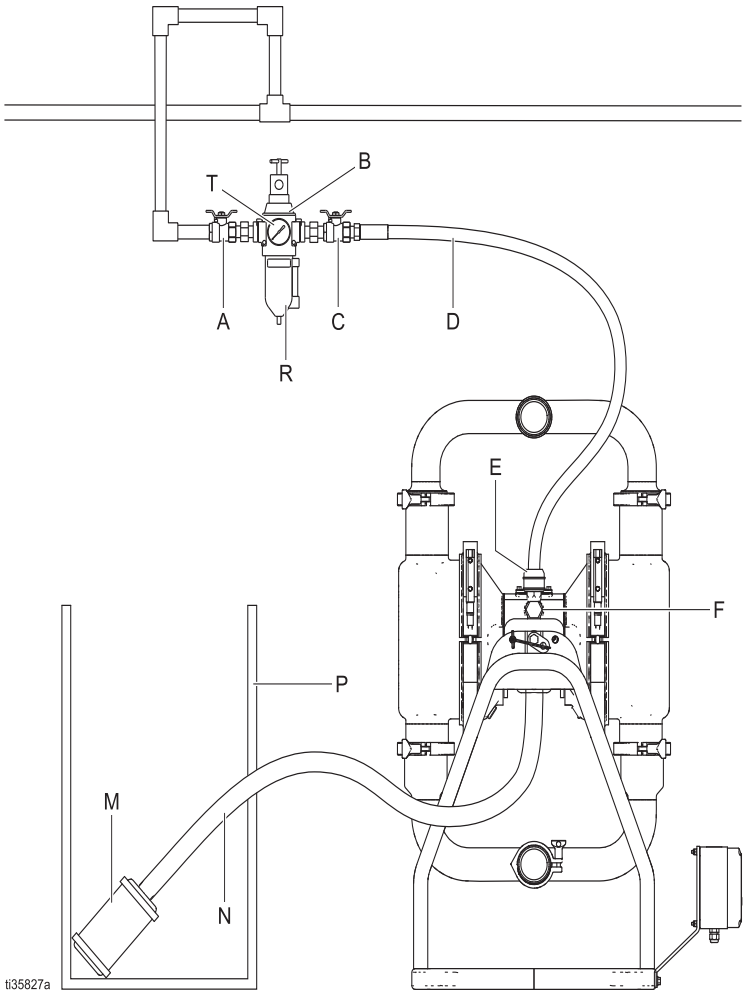
Be sure the system is properly ventilated for your type of installation. You must vent the exhaust to a safe place, away from people, animals, food handling areas, and all sources of ignition when pumping flammable or hazardous fluids. Diaphragm rupture can cause the fluid being pumped to exhaust with the air. Place a grounded container at the end of the air exhaust line to catch the fluid. See FIG. 3.

NOTE: The pump exhaust air may contain contaminants. Ventilate to a remote area if the exhaust could contaminate your fluid supply.

NOTE: The air exhaust port is 3/4 npt(f). Do not restrict the air exhaust port. Excessive exhaust restriction can reduce pump performance.

To provide a remote exhaust:

1. Remove the muffler (M) from the pump air exhaust port. See FIG. 3.
2. Install a conductive, grounded air exhaust line (N) and connect the muffler (M) to the other end of the line. The minimum size for the air exhaust hose is 3/4 in. (19 mm) ID. If a line longer than 15 ft (4.57 m) is required, use a larger diameter line. Avoid sharp bends or kinks in the line.
3. Place a conductive, grounded container (P) at the end of the air exhaust line to catch fluid in case of a diaphragm rupture. See FIG. 3.



Key:

A Master air valve (for accessories)
B Air regulator (required, not supplied)
C Bleed-type master air valve (for pump) (required, not supplied)
D Air supply line
E Air line coupler
F 1/2 npt (f) pump air inlet
M Muffler
N Grounded air exhaust line
P Grounded container for remote air exhaust
R Air line filter
P Air pressure gauge (required, not supplied)

FIG. 3: Venting Exhaust Air

Operation

Pressure Relief Procedure

Follow the Pressure Relief Procedure whenever you see this symbol.

This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as splashing fluid, follow the Pressure Relief Procedure when you stop dispensing and before cleaning, checking, or servicing the equipment.

1. Close the master air valve (A) to shut off the air to the pump.
2. Open outbound fluid valve to relieve fluid pressure from the pump.
   a. **For simple transfer applications,** open either the fluid shutoff valve (J) or the fluid drain valve (K).
   b. **For circulating applications,** ensure that the fluid shutoff valve (J) is closed and open the fluid drain valve (K).

Sanitize the Pump Before First Use

NOTE: The pump was built and tested using a food grade lubricant.

Properly sanitize the pump before first use. The user must determine whether to disassemble and clean individual parts or simply flush the pump with a sanitizing solution.

To simply flush the pump with a sanitizing solution, follow the steps under **Start and Adjust the Pump**, page 14, and **Flushing and Storage**, page 15. To disassemble and clean individual parts, refer to the appropriate Repair manual.

Start and Adjust the Pump

1. Confirm that the pump is properly grounded. See **Grounding**, page 8.
2. Check and tighten all pump clamps and fluid connections before operating the equipment. Replace worn or damaged parts as necessary.
3. Connect a flexible fluid suction line (H) from the fluid to be pumped to the pump fluid inlet port.
4. Connect the flexible fluid outlet line (G) to the pump fluid outlet port and route the line to the end container.
5. Close the fluid drain valve (K).
6. Turn the air regulator (B) knob to the lowest air pressure setting and open the bleed-type master air valve (C).
7. If the fluid outlet line (G) has a dispensing device, hold it open while continuing with the following step.
8. To prime the pump, slowly increase air pressure with the air regulator (B) until the pump starts to cycle. Do not exceed the maximum operating air pressure as listed in the **Technical Specifications**, pages 18, 22, and 31. Allow the pump to cycle slowly until all air is pushed out of the fluid lines and fluid exits the outlet line (G).

NOTE: If the fluid inlet pressure to the pump is more than 25% of the outlet working pressure, the ball check valves will not close fast enough, resulting in inefficient pump operation. Inlet fluid pressure higher than 25% of the outlet working pressure will also shorten diaphragm life. Approximately 3–5 psi (0.02–0.03 MPA, 0.21–0.34 bar) fluid inlet pressure should be adequate for most materials.

Pump Shutdown

At the end of each work shift, perform the **Pressure Relief Procedure**, page 13.

Flush the pump if necessary. See **Flushing and Storage**, page 15.

Maintenance

Lubrication

The pump is lubricated at the factory. It is designed to require no further lubrication for the life of the pump. There is no need to add an inline lubricator under normal operating conditions.

The air valve is designed to operate unlubricated. If lubrication is desired, every 500 hours of operation (or monthly) remove the hose from the pump air inlet and add two drops of machine oil to the air inlet.

NOTICE

Do not over-lubricate the pump. Lubricant is exhausted through the muffler and could contaminate your fluid supply or other equipment. Excessive lubrication can also cause the pump to malfunction.

Flushing and Storage

- Flush before fluid can dry or freeze in the equipment, at the end of the day, before storing, and before repairing equipment.
- Flush at the lowest pressure possible. Check connectors for leaks and tighten as necessary.
- Flush with a sanitizing solution that is compatible with the fluid being dispensed and the equipment wetted parts.
- Flushing schedule will vary based on particular uses.
- Always cycle the pump during the entire flushing process.

Always perform the **Pressure Relief Procedure,** page 13, and flush the pump before storing it for any length of time.

1. Insert the suction tube into sanitizing solution.
2. Open air regulator (B) to supply low pressure air to the pump.
3. Run the pump for enough time to thoroughly clean the pump and lines.
4. Close the air regulator.
5. Remove the suction line from the sanitizing solution and drain pump.

Routine Cleaning of Product Contact Section of Pump

NOTE: The pump and the system should be cleaned in accordance with applicable sanitary standard codes and local regulations.

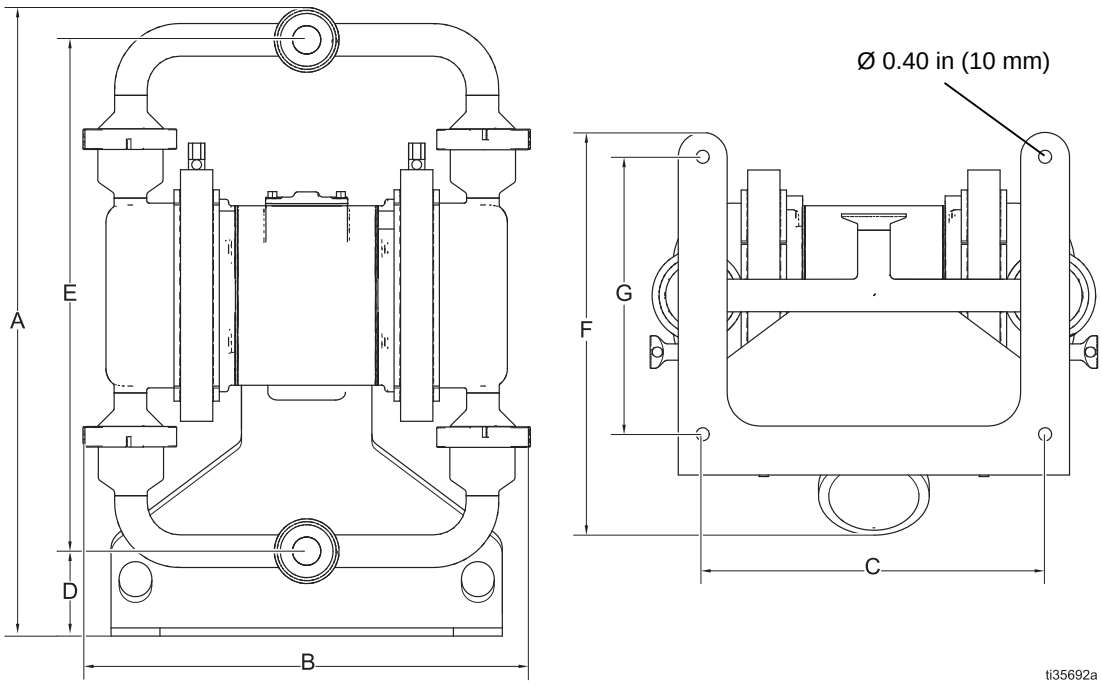
1. Flush the system. See **Flushing and Storage** above.
2. Follow the **Pressure Relief Procedure,** page 13.
3. If disassembly of the pump is required for cleaning, refer to the appropriate repair manual.
4. Using a brush or other C.O.P. methods, wash all product contact pump parts with a sanitizing solution at the manufacturer's recommended temperature and concentration.
5. Rinse these parts again with water and allow parts to completely dry.
6. Inspect the parts and re-clean any soiled parts.
7. Immerse all product contact parts in an approved sanitizer before assembly. Leave the parts in the sanitizer, taking them out only one-by-one as needed for assembly.
8. Lubricate the clamps, clamping surfaces, and gaskets with waterproof sanitary lubricant.
9. Circulate the sanitizing solution through the pump and the system prior to use. Cycle the pump as the sanitizing solution is circulated.

Tightening Connections

Before each use, check and tighten all pump clamps and fluid connections before operating the equipment. Replace worn or damaged parts as necessary.

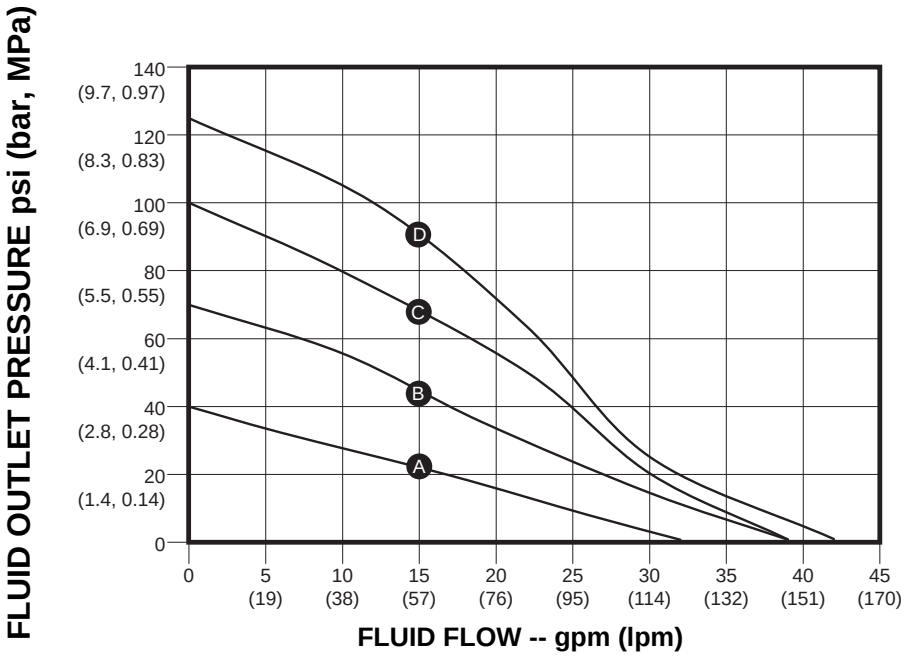
1040 Specifications

1040 Dimensions



A 19.3 in (49.0 cm)
B 13.7 in (34.8 cm)
C 10.5 in (26.7 cm)
D 2.6 in (6.6 cm)
E 15.7 in (39.9 cm)
F 12.3 in (31.2 cm)
G 8.5 in (21.6 cm)

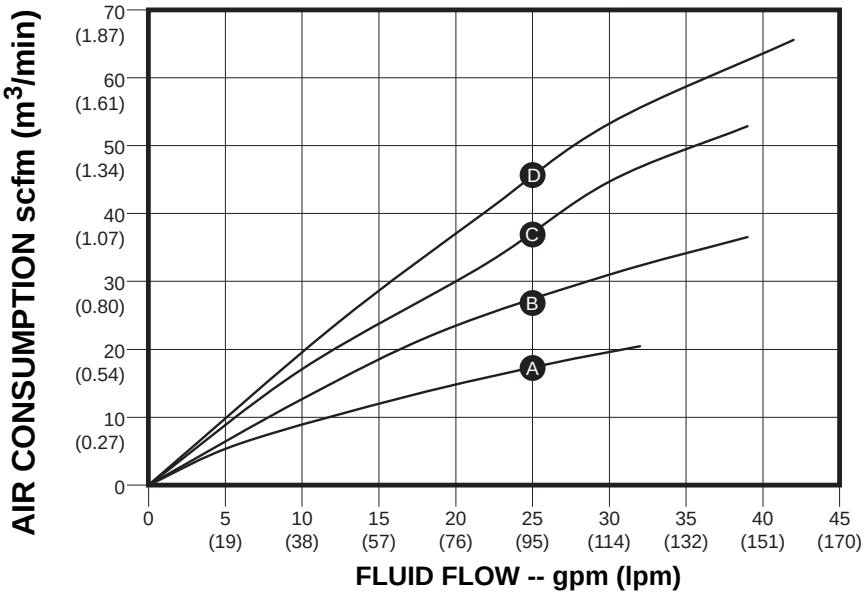
1040 Performance Chart



AIR PRESSURE

D 120 psi air (8.4 bar, 0.84 MPa)
C 100 psi air (7 bar, 0.7 MPa)
B 70 psi air (4.8 bar, 0.48 MPa)
A 40 psi air (2.8 bar, 0.28 MPa)

(Pump tested in water with inlet submerged)



To find Fluid Outlet Pressure

(psi/MPa/bar) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

To find Pump Air Pressure

(scfm or m^3/min) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

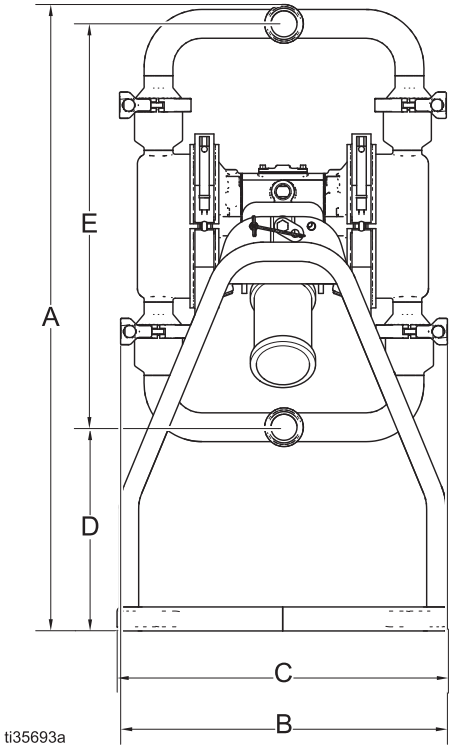
1. Locate fluid flow rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read fluid outlet pressure.

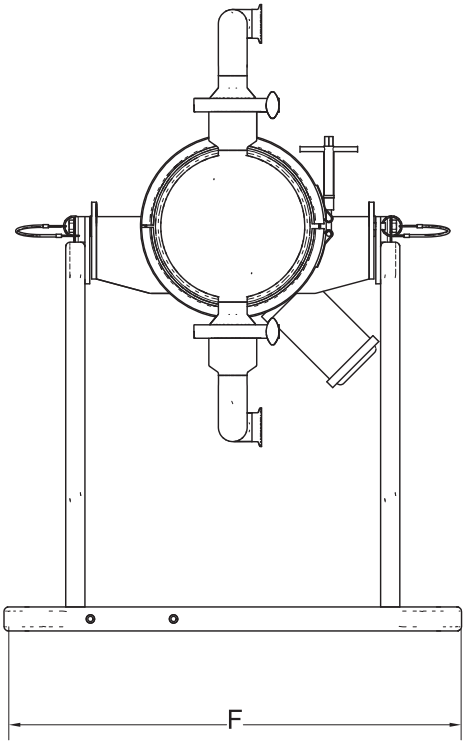
1040 Technical Specifications

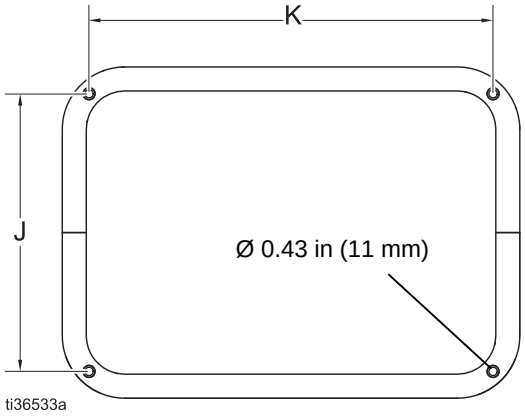
SaniForce 1040 Air-Operated Double Diaphragm Pump		
	US	**Metric**
Maximum fluid working pressure	120 psi	0.8 MPa, 8 bar
Air pressure operating range	20 to 120 psi	0.14 to 0.8 MPa, 1.4 to 8 bar
Air inlet size	1/2 in. npt(f)	
Maximum suction lift (reduced if balls don't seat well due to damaged balls or seats, lightweight balls, or extreme speed of cycling)	Wet 30 ft Dry: 10 ft	Wet 9.1 m Dry: 3.0 m
Maximum size pumpable solids	0.5 in.	12.7 mm
Fluid displacement per cycle	0.17 gallons	0.64 liters
Maximum free-flow delivery	41 gpm	155.2 lpm
Maximum pump speed	240 cpm	
Weight	50.5 lb	22.9 kg
Fluid Inlet and Outlet Size		
Stainless Steel	1.0 in sanitary flange or RD52 x 1/6 DIN	
Noise Data		
Sound Power (measured per ISO-9614–1)		
at 100 psi fluid pressure, full flow	103 dBa	
Sound Pressure		
at 70 psi fluid pressure and 50 cpm	85 dBa	
at 100 psi fluid pressure, full flow	90 dBa	
Wetted Parts		
Wetted parts include material(s) chosen for seat, ball, and diaphragm options, plus 316 Stainless Steel		
Non-wetted External Parts		
Non-wetted external parts include 300–series SST, Nickel plated aluminum, 17-4 PH SST, Santoprene, LDPE, VHB acrylic		

1590 Specifications

1590 Dimensions



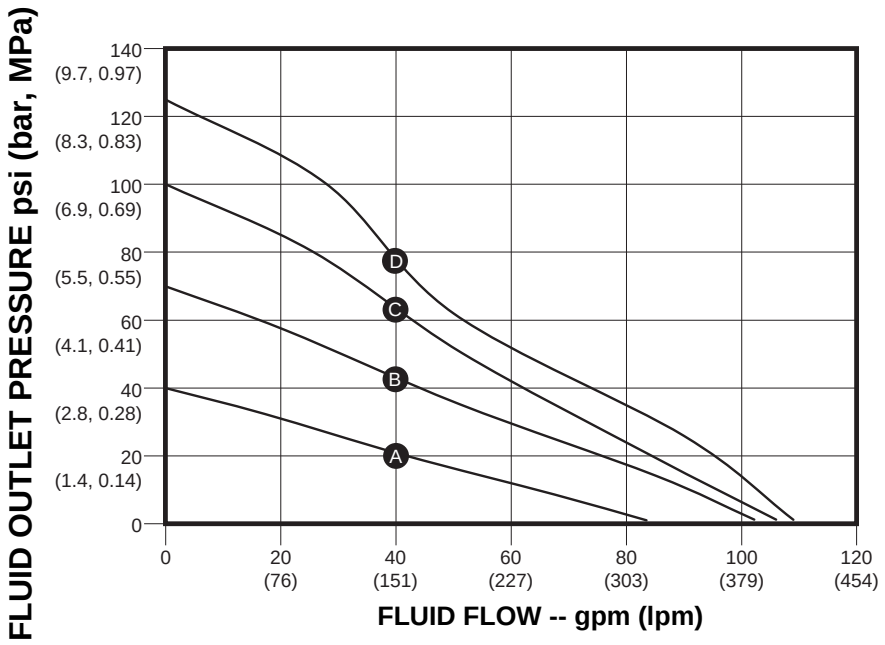




A 32.6 in (82.8 cm)
B 17.0 in (43.2 cm)
C 17.3 in (43.9 cm)
D 10.6 in (26.9 cm)
E 21.0 in (53.3 cm)
F 23.8 in (60.5 cm)
J 14.5 in (36.8 cm)
K 21.0 in (53.3 cm)

1590 Performance Charts

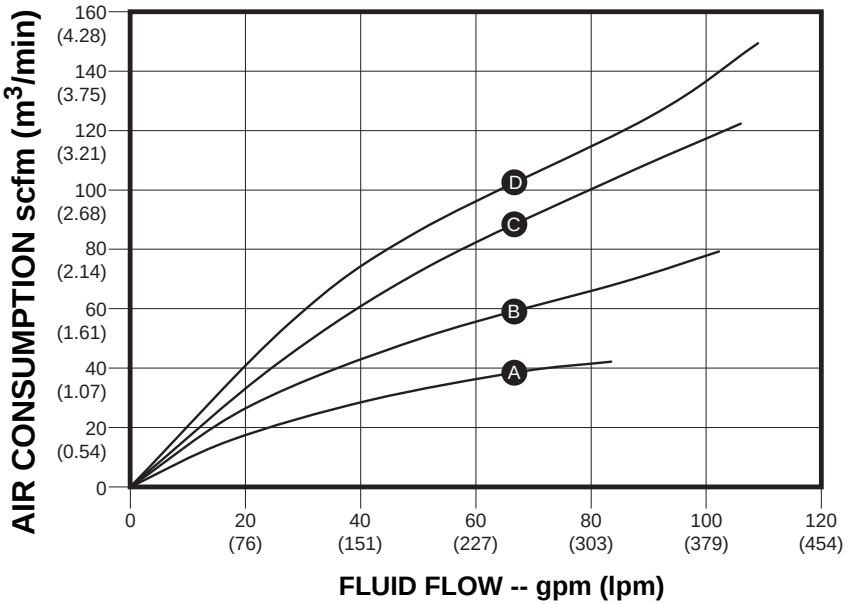
Ball Check pump



Pump tested in water with inlet submerged.

AIR PRESSURE

- **D** 120 psi air (8.4 bar, 0.84 MPa)
- **C** 100 psi air (7 bar, 0.7 MPa)
- **B** 70 psi air (4.8 bar, 0.48 MPa)
- **A** 40 psi air (2.8 bar, 0.28 MPa)



To find Fluid Outlet Pressure

(psi/MPa/bar) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

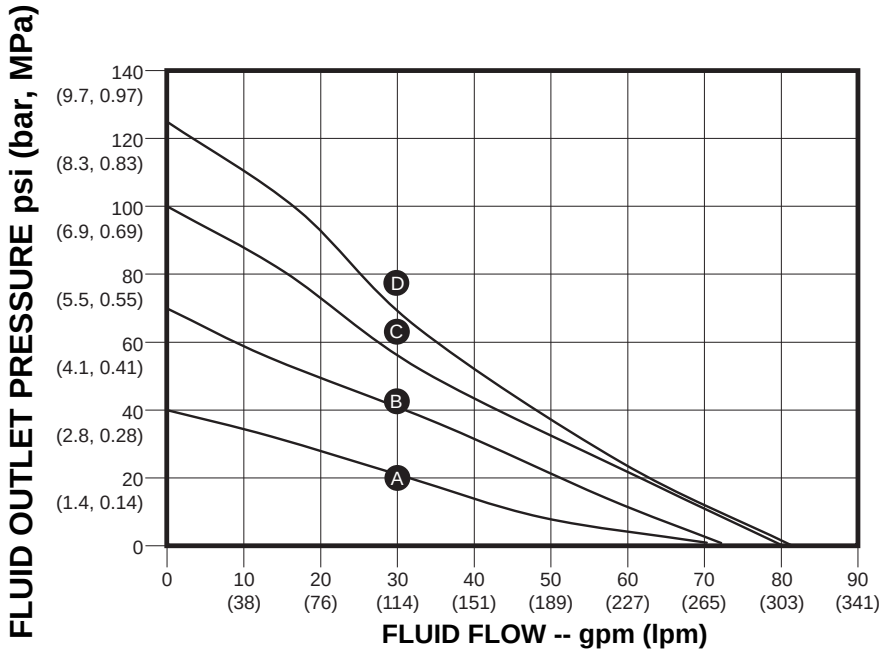
To find Pump Air Pressure

(scfm or m^3/min) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read fluid outlet pressure.

1590 Performance Charts Continued

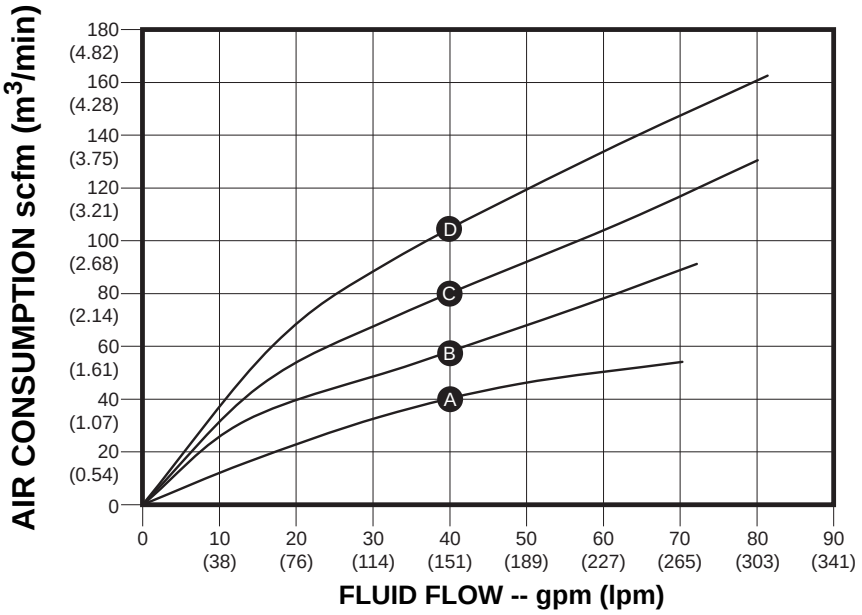
Flapper Check pump



Pump tested in water with inlet submerged.

AIR PRESSURE

D 120 psi air (8.4 bar, 0.84 MPa)
C 100 psi air (7 bar, 0.7 MPa)
B 70 psi air (4.8 bar, 0.48 MPa)
A 40 psi air (2.8 bar, 0.28 MPa)



To find Fluid Outlet Pressure

(psi/MPa/bar) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

To find Pump Air Pressure

(scfm or m^3/min) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

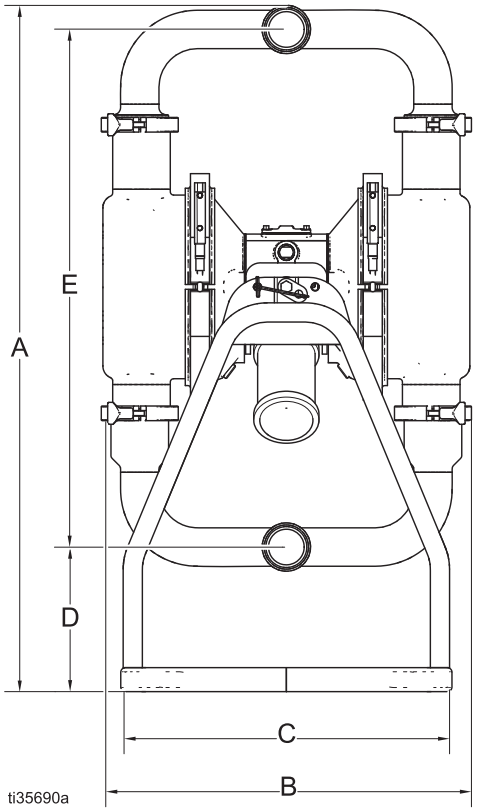
1. Locate fluid flow rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read fluid outlet pressure.

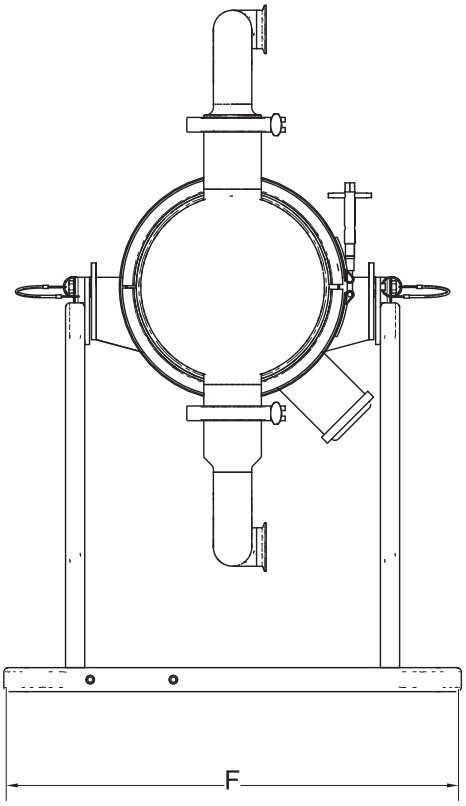
1590 Technical Specifications

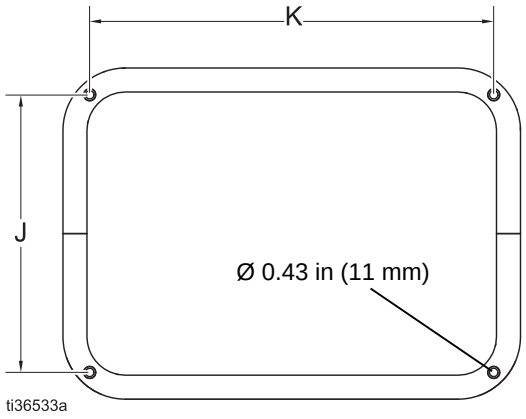
SaniForce 1590 Air-Operated Double Diaphragm Pump		
	US	**Metric**
Maximum fluid working pressure	120 psi	0.8 MPa, 8 bar
Air pressure operating range	20 to 120 psi	0.14 to 0.8 MPa, 1.4 to 8 bar
Air inlet size	1/2 in. npt(f)	
Maximum suction lift (reduced if balls don't seat well due to damaged balls or seats, lightweight balls, or extreme speed of cycling)	Wet: 30 ft Dry: 10 ft	Wet: 9.1 m Dry: 3.0 m
Maximum size pumpable solids		
ball	0.5 in.	12.7 mm
flapper	1.2 in.	30.5 mm
Fluid displacement per cycle		
ball	0.65 gallons	2.46 liters
flapper	0.31 gallons	1.17 liters
Maximum free-flow delivery		
ball	105 gpm	397.5 lpm
flapper	80 gpm	302.8 lpm
Maximum pump speed		
ball	165 cpm	
flapper	260 cpm	
Weight		
ball	89 lb	40.4 kg
flapper	83 lb	37.6
Fluid Inlet and Outlet Size		
Stainless Steel	1.5 in sanitary flange or 40 mm DIN 11851 male thread	
Noise Data		
Sound Power (measured per ISO-9614–1)		
at 100 psi fluid pressure, full flow	103 dBa	
Sound Pressure		
at 70 psi fluid pressure and 50 cpm	85 dBa	
at 100 psi fluid pressure, full flow	90 dBa	
Wetted Parts		
Wetted parts include material(s) chosen for seat, ball, and diaphragm options, stainless steel		
Non-wetted parts		
Non-wetted external parts include 300–series SST, Nickel plated aluminum, 17-4 PH SST, Santoprene, LDPE, VHB acrylic		

2150 Specifications

2150 Dimensions

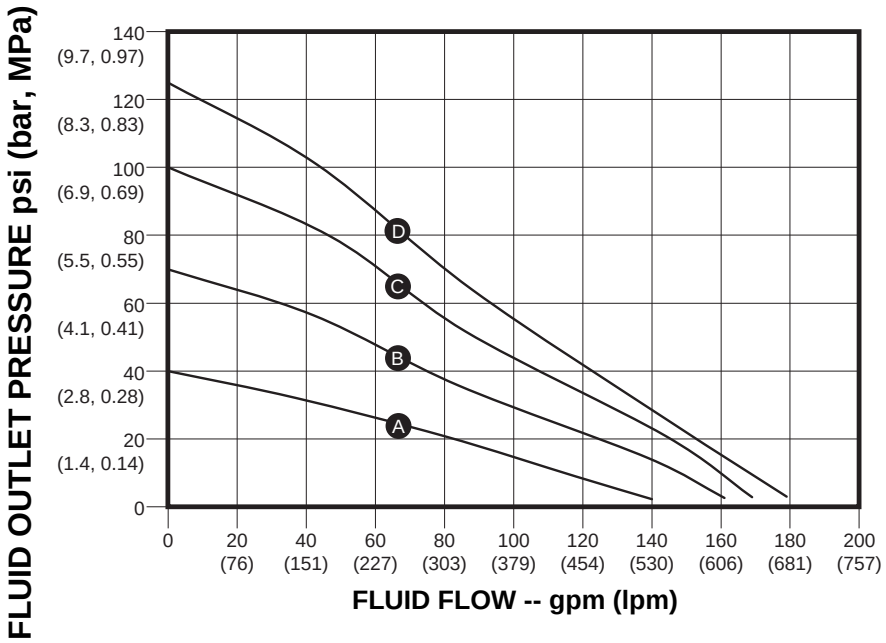






A 35.7 in (90.7 cm)
B 19.3 in (49.0 cm)
C 17.3 in (43.9 cm)
D 7.5 in (19.1 cm)
E 27.0 in (68.6 cm)
F 23.8 in (60.5 cm)
J 14.5 in (36.8 cm)
K 21.0 in (53.3 cm)

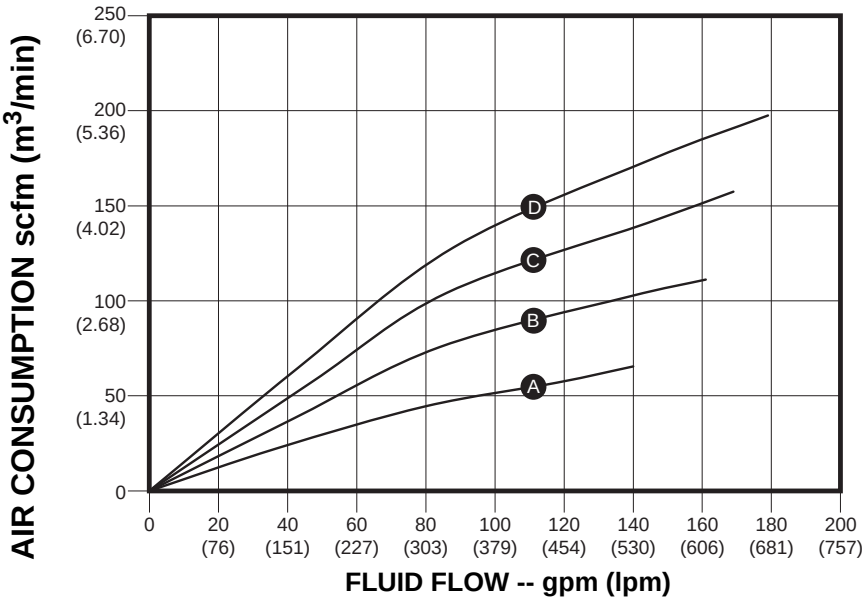
2150 Performance Chart



(Pump tested in water with inlet submerged)

AIR PRESSURE

- **D** 120 psi air (8.4 bar, 0.84 MPa)
- **C** 100 psi air (7 bar, 0.7 MPa)
- **B** 70 psi air (4.8 bar, 0.48 MPa)
- **A** 40 psi air (2.8 bar, 0.28 MPa)



To find Fluid Outlet Pressure

(psi/MPa/bar) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

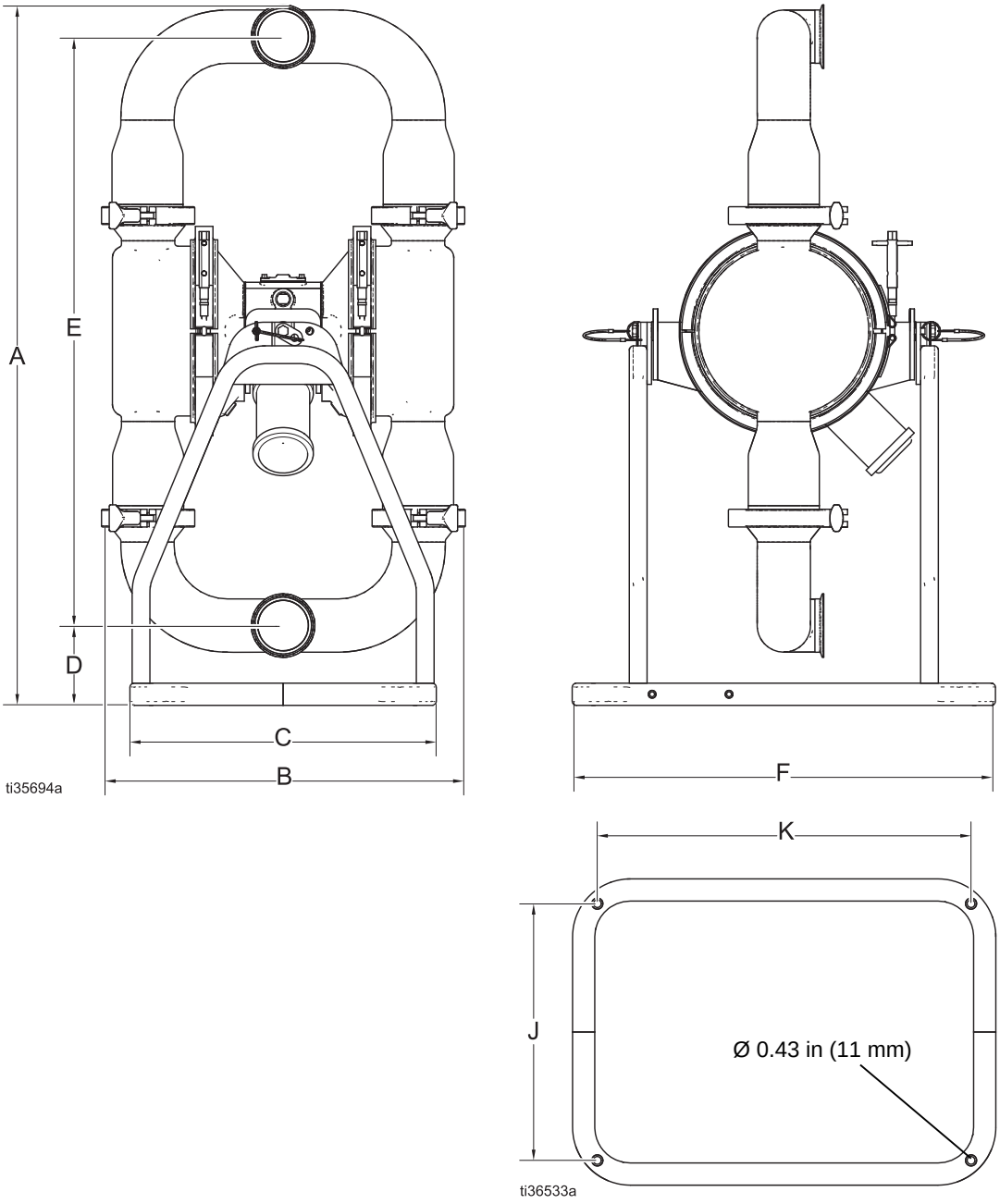
To find Pump Air Pressure

(scfm or m^3/min) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read fluid outlet pressure.

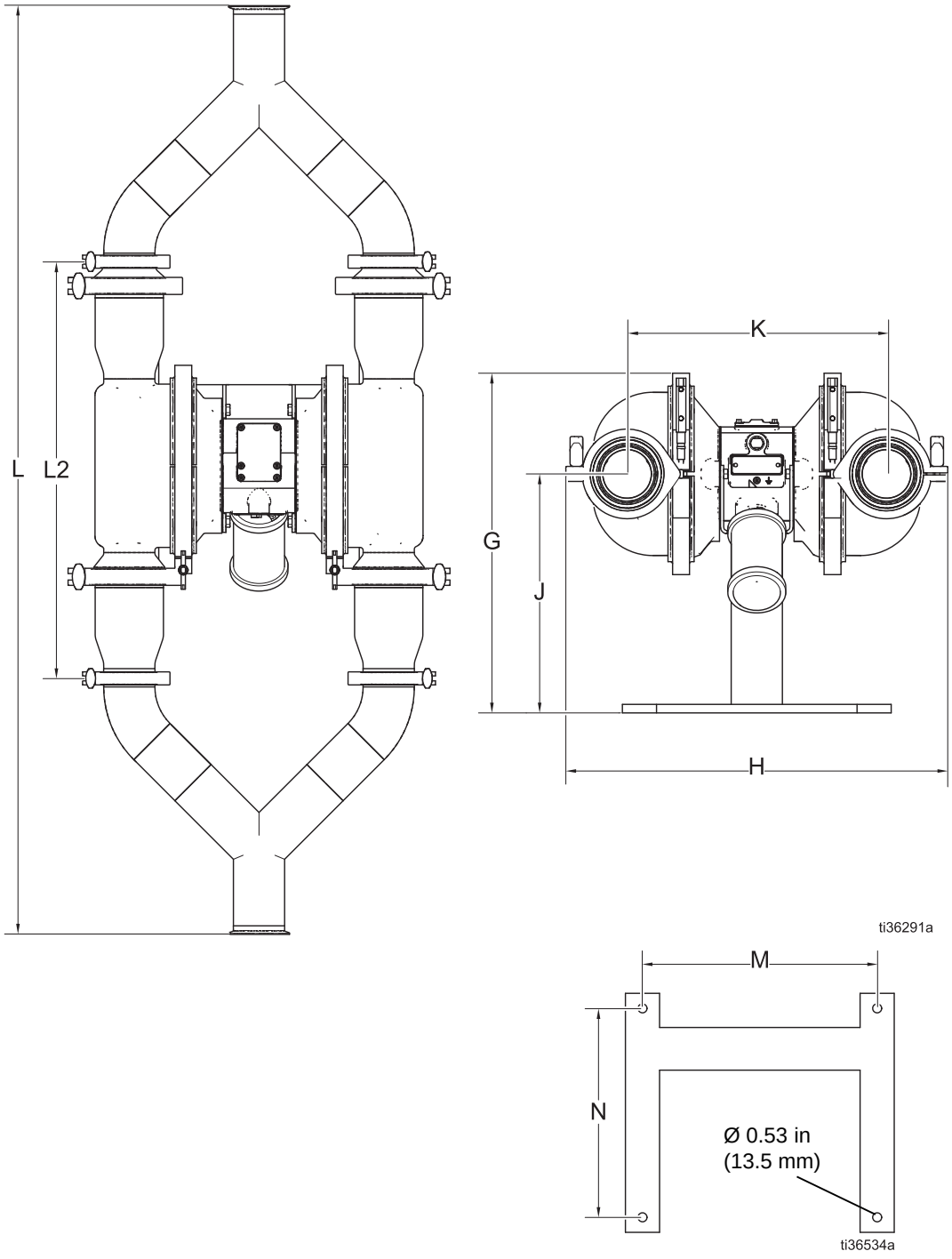
3150 Specifications

3150 Dimensions



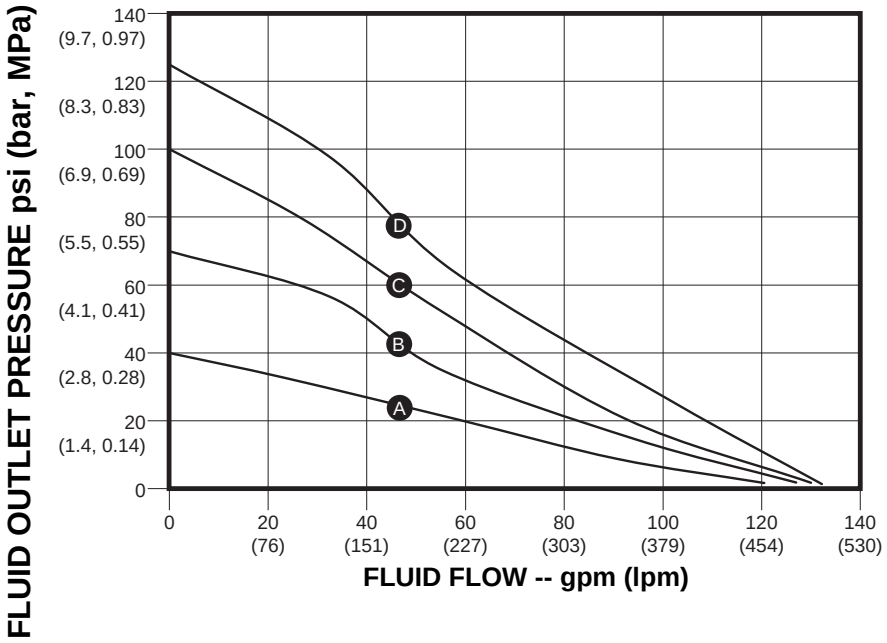
A 39.5 in (100.3 cm)
B 20.5 in (52.1 cm)
C 17.3 in (43.9 cm)
D 4.5 in (11.4 cm)
E 33.2 in (84.3 cm)
F 23.8 in (60.5 cm)
J 14.5 in (36.8 cm)
K 21.0 in (53.3 cm)

3150 Horizontal Mount



G 19.9 in (50.5 cm)
H 22.4 in (56.9 cm)
J 14.0 in (35.6 cm)
K 15.2 in (38.6 cm)
L 54.5 in (138.4 cm)
L2 23.0 in (58.4 cm)
M 13.8 in (35.1 cm)
N 12.2 in (31.0 cm)

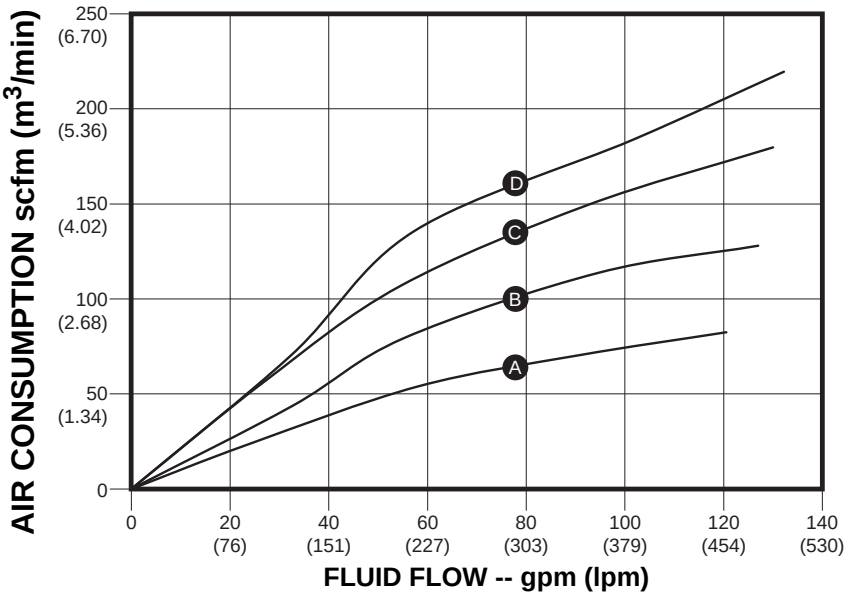
3150 Performance Chart



Pump tested in water with inlet submerged

AIR PRESSURE

- **D** 120 psi air (8.4 bar, 0.84 MPa)
- **C** 100 psi air (7 bar, 0.7 MPa)
- **B** 70 psi air (4.8 bar, 0.48 MPa)
- **A** 40 psi air (2.8 bar, 0.28 MPa)



To find Fluid Outlet Pressure

(psi/MPa/bar) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

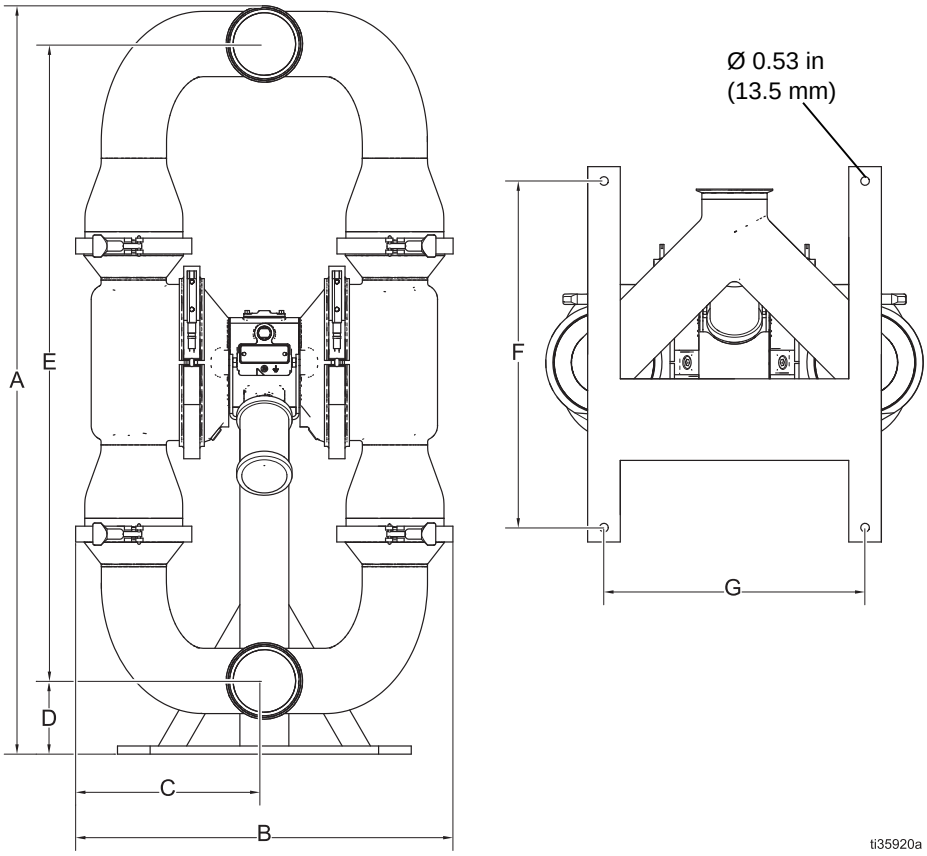
To find Pump Air Pressure

(scfm or m^3/min) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read fluid outlet pressure.

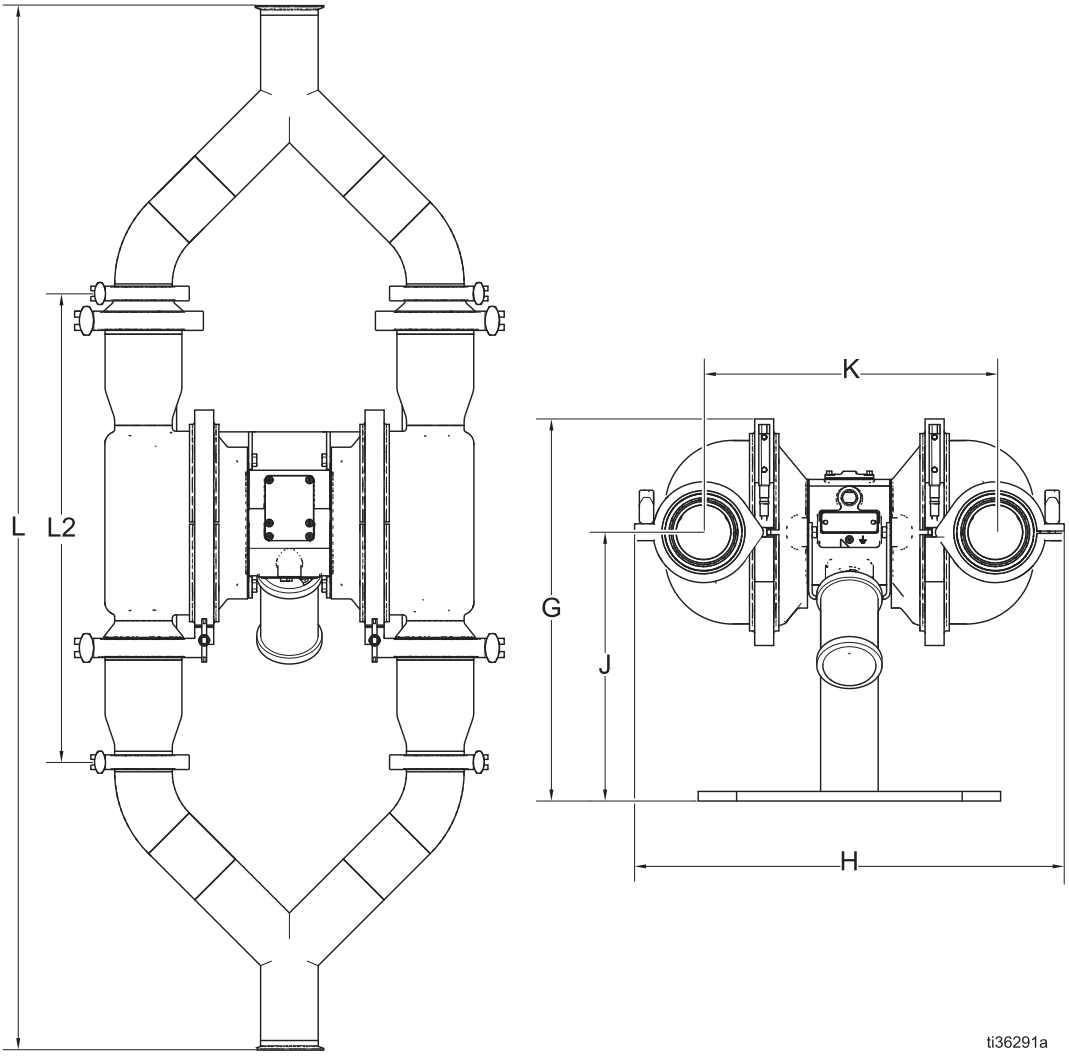
4150 Specifications

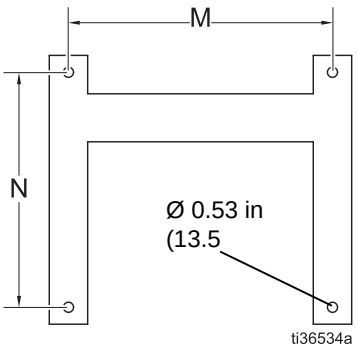
4150 Dimensions



A 45.9 in (116.6 cm)
B 23.1 in (58.7 cm)
C 11.6 in (29.5 cm)
D 4.5 in (11.4 cm)
E 39.0 in (99.1 cm)
F 21.2 in (53.8 cm)
G 16.0 in (40.6 cm)

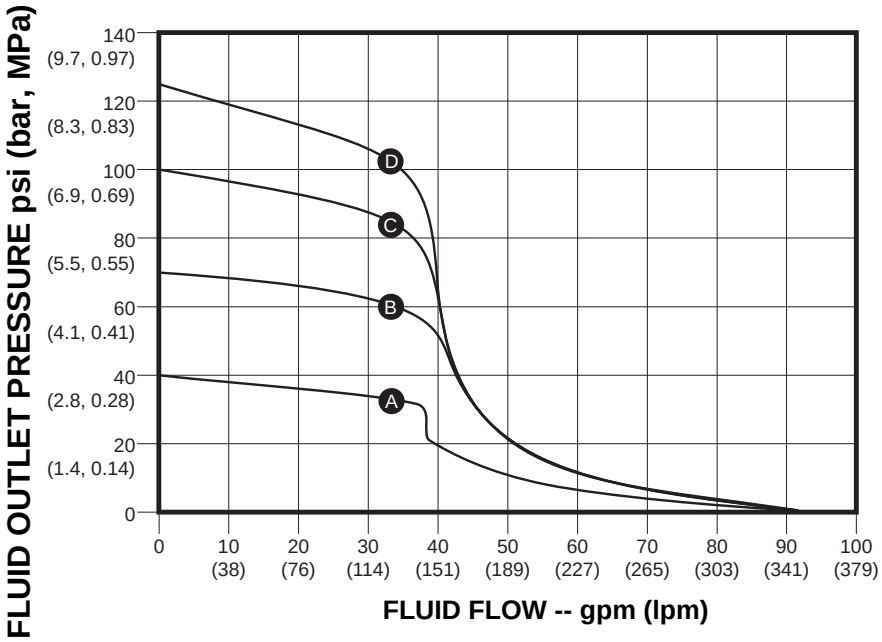
4150 Horizontal Mount





G 19.9 in (50.5 cm)
H 24.4 in (62.0 cm)
J 14.0 in (35.6 cm)
K 16.0 in (40.6 cm)
L 58.5 in (148.6 cm)
L2 23.7 in (60.2 cm)
M 13.8 in (35.1 cm)
N 12.2 in (31.0 cm)

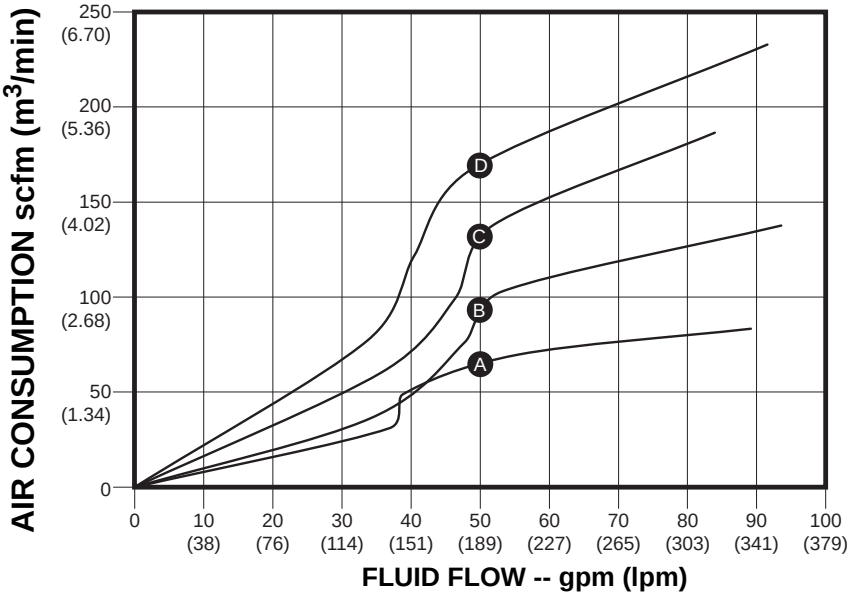
4150 Performance Chart



Pump tested in water with inlet submerged

AIR PRESSURE

- **D** 120 psi air (8.4 bar, 0.84 MPa)
- **C** 100 psi air (7 bar, 0.7 MPa)
- **B** 70 psi air (4.8 bar, 0.48 MPa)
- **A** 40 psi air (2.8 bar, 0.28 MPa)



To find Fluid Outlet Pressure

(psi/MPa/bar) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Follow vertical line up to intersection with selected fluid outlet pressure curve.
3. Follow left to scale to read fluid outlet pressure.

To find Pump Air Pressure

(scfm or m^3/min) at a specific fluid flow (gpm/lpm) and operating air pressure (psi/MPa/bar):

1. Locate fluid flow rate along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve.
3. Follow left to scale to read fluid outlet pressure.

2150, 3150, 4150 Technical Specifications

SaniForce 2150, 3150, 4150 Air-Operated Double Diaphragm Pump			
		US	**Metric**
Maximum fluid working pressure		120 psi	0.8 MPa, 8 bar
Air pressure operating range		20 to 120 psi	0.14 to 0.8 MPa, 1.4 to 8 bar
Air inlet size		1/2 in. (npt(f)	
Maximum suction lift (reduced if balls don't seat well due to damaged balls or seats, lightweight balls, or extreme speed of cycling)			
	Wet:	30 ft	9.1 m
	Dry:	10 ft (2150)	3.0 m (2150)
		6 ft (3150)	1.8 m (3150)
		5 ft (4150)	1.5 m (4150)
Maximum size pumpable solids	2150 ball	0.5 in.	12.7 mm
	3150 flapper	2.46 in.	62.5 mm
	4150 flapper	3.8 in.	96.5 mm
Fluid displacement per cycle	2150 ball	1.3 gallons	4.9 liters
	3150 flapper	0.7 gallons	2.65 liters
	4150 flapper	0.4 gallons	1.5 liters
Maximum free-flow delivery	2150 ball	180 gpm	681 lpm
	3150 flapper	130 gpm	492 lpm
	4150 flapper	90 gpm	340 lpm
Maximum pump speed	2150 ball	135 cpm	
	3150 flapper	180 cpm	
	4150 flapper	225 cpm	
Weights Values are for vertical pumps, horizontal pumps slightly lower			
	2150 ball	111 lb	50.3 kg
	3150 flapper	118 lb	53.5 kg
	4150 flapper	168 lb	76.2 kg
Fluid Inlet and Outlet Size , stainless steel			
	2150 ball	2 in sanitary flange or 50 mm DIN 11851 male thread	
	3150 flapper	3 in sanitary flange or 80 mm DIN 11851 male thread	
	4150 flapper	4 in sanitary flange or 100 mm DIN 11851 male thread	
Noise Data			
Sound Power (measured per ISO-9614–1)			
at 10psi fluid pressure, full flow		103 dBa	
Sound Pressure			
at 70 psi fluid pressure and 50 cpm		85 dBa	
at 100 psi fluid pressure, full flow		90 dBa	
Wetted Parts			
Wetted parts include material(s) chosen for seat, ball, and diaphragm options, stainless steel			
Non-wetted parts			
Non-wetted external parts include 300-series SST, Nickel plated aluminum, 17-4 PH SST, Santoprene, LDPE, VHB acrylic			

California Proposition 65

CALIFORNIA RESIDENTS

⚠ **WARNING:** Cancer and reproductive harm – www.P65warnings.ca.gov.

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

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GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

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For patent information, see www.graco.com/patents.

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Phone: 612-623-6921 **or Toll Free:** 1-800-328-0211 **Fax:** 612-378-3505

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Graco reserves the right to make changes at any time without notice.

Original instructions. This manual contains English. MM 3A5999
Graco Headquarters: Minneapolis
International Offices: Belgium, China, Japan, Korea

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