

SaniForce® 1590 Air-Operated High Sanitation Diaphragm Pump

3A6781F

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.

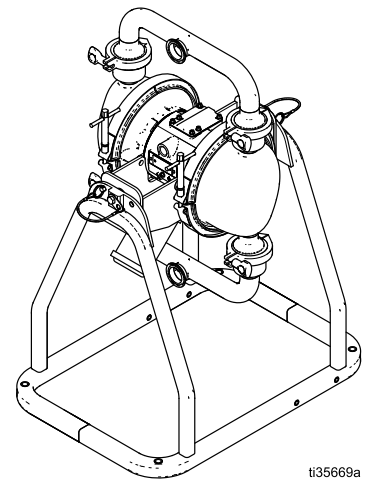


Important Safety Instructions

Read all warnings and instructions in this manual and related manuals before using the equipment. **Save all instructions.**

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

See page 6 for approvals.



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Related Manuals

Manual Number	Title
3A5999	SaniForce High Sanitation Diaphragm Pumps, Operation
3A6976	Leak Detection System, Instructions/Parts

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 symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 <h1 style="margin: 0;">WARNING</h1>	
   	<p>FIRE AND EXPLOSION HAZARD</p> <p>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 and explosion:</p> <ul style="list-style-type: none"> • 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. • 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.
  	<p>PRESSURIZED EQUIPMENT HAZARD</p> <p>Fluid from the equipment, leaks, or ruptured components can splash in the eyes or on skin and cause serious injury.</p> <ul style="list-style-type: none"> • 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.

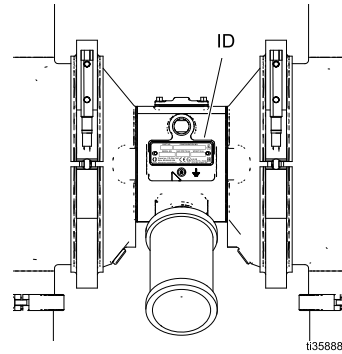
 <h1 style="margin: 0;">WARNING</h1>	
 	<p>EQUIPMENT MISUSE HAZARD</p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> • Do not operate the unit when fatigued or under the influence of drugs or alcohol. • Do not exceed the maximum working pressure or temperature rating 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.
	<p>TOXIC FLUID OR FUMES HAZARD</p> <p>Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> • 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.
	<p>BURN HAZARD</p> <p>Equipment surfaces and fluid that's heated can become very hot during operation. To avoid severe burns:</p> <ul style="list-style-type: none"> • Do not touch hot fluid or equipment.
	<p>PERSONAL PROTECTIVE EQUIPMENT</p> <p>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 protective equipment includes but is not limited to:</p> <ul style="list-style-type: none"> • 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., SP15.0023): _____

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



Sample Configuration Number: **1590HS.PSP1ASSASSPTPSEP21**





1590	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	
1590	3A	3-A compliant	P	Pneumatic	S01A	Stainless Steel, for all but 2-piece PS diaphragms	SSA	Stainless steel, TriClamp, horizontal
	HS	High Sanitation			S02A	Stainless Steel, 3-A	SSB	Stainless steel, DIN, horizontal
	PH	Pharmaceutical			S03A	Stainless Steel, PH, for all but 2-piece PS diaphragms	SSC	Stainless steel, TriClamp, SDU, STU use
					SP1A	Stainless Steel, PS diaphragms, for 2-piece PS diaphragms only	SSD	Stainless steel, DIN, SDU, STU use
					SP3A	Stainless Steel, PH, PS diaphragms, for 2-piece PS diaphragms only		

Seat Material		Checks		Diaphragm Material		Seals		Certification	
FL	316 Stainless Steel, Flapper	—	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, 2 piece				
		PT	PTFE Ball	SP	Santoprene				
		SP	Santoprene Ball						

Ordering Information

Approvals	
Except for 3-A pumps, all pumps are approved to:	 II 2 GD Ex h IIC 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 [Technical Specifications, page 29](#), for the maximum fluid operating temperature for your specific pump model.

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. To locate, search on **selector**.

To Order Replacement Parts

Please call your distributor.

Troubleshooting



- Follow the [Pressure Relief Procedure, page 9](#) , before checking or servicing the equipment.
- Check all possible problems and causes before disassembly.

Problem	Cause	Solution
Pump cycles at stall or fails to hold pressure at stall.	Worn checks or seats.	Replace.
Pump will not cycle, or cycles once and stops.	Air valve is stuck or dirty.	Disassemble and clean air valve. Use filtered air.
	Check ball is severely worn and wedged in seat or manifold.	Replace ball and seat component.
	Check valve ball is severely wedged into seat due to overpressurization.	Follow Pressure Relief Procedure, page 9 . Disassemble ball check assembly and inspect for damage.
	Clogged dispensing valve .	Follow Pressure Relief Procedure, page 9 . Clear valve.
	Leak detector has activated a shut-down solenoid.	Investigate failure and reset leak detector.
Reduced pump performance.	Clogged suction line.	Inspect; clear.
	Sticky or leaking check balls or flapper checks.	Clean or replace.
	Flap valves installed upside-down.	Install the flapper valve with the text side facing the seat.
	Ruptured diaphragm.	Replace. See standard or overmolded diaphragm repair procedure.
	Restricted exhaust.	Remove restriction.
Air bubbles in fluid.	Loose suction line.	Tighten.
	Ruptured diaphragm.	Replace. See standard or overmolded diaphragm repair procedure.
	Loose inlet manifold, damaged seal between manifold and fluid cover, or damaged gaskets.	Tighten manifold clamps or replace gaskets or seating components.
Leak in inlet or outlet sanitary fitting.	Loose sanitary clamp.	Tighten clamp.
	Damaged or worn gasket.	Replace gasket.
	Misalignment of inlet/outlet fluid line or pipe.	Use flexible fluid lines at pump inlet and outlet.

Troubleshooting

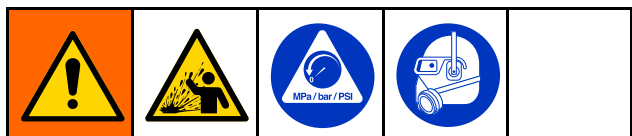
Problem	Cause	Solution
Manifolds do not fit for installation onto fluid covers.	Use of incorrect air cover gaskets results in misalignment.	Install correct air cover gaskets for the type of diaphragms in use. See Parts list for correct gasket.
Fluid in exhaust air.	Diaphragm ruptured.	Replace. See standard or overmolded diaphragm repair procedure.
	Loose diaphragm plate.	Tighten or replace. See standard or overmolded diaphragm repair procedure.
Pump exhausts excessive air at stall.	Worn air valve block, plate, pilot block, u-cups, or pilot pin o-rings.	Repair or replace.
	Worn shaft seals.	Replace. See standard or overmolded diaphragm repair procedure.
Pump leaks air externally.	Loose air valve cover.	Tighten screws.
	Air valve gasket or air cover gasket is damaged.	Inspect; replace.
	Loose air cover clamps	Tighten clamps.
Pump leaks fluid externally from ball check valves.	Loose manifolds, damaged seal between manifold and fluid cover, or damaged gaskets.	Tighten manifold clamps or replace seats or clamps.
Chattering.	Check valve balls not seating properly/cleanly due to imbalance between fluid inlet and outlet line sizing. Noise is accentuated with light viscosity fluids.	Reduce size/diameter of inlet line relative to outlet line. Outlet line size should not exceed pump size.

Repair

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.
3. If fluid is still in the outbound fluid lines, isolate this fluid as follows:
 - 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).

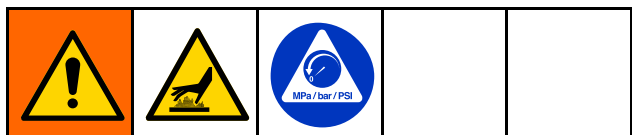
Air Valve Repair

Tools Required

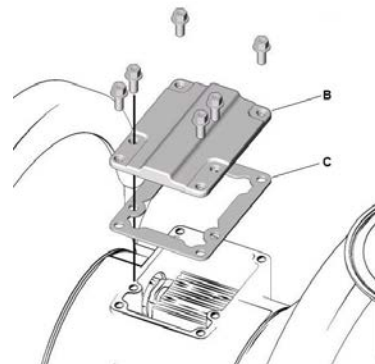
- Torque wrench
- Torx (T20) screwdriver or 7 mm (9/32 in.) socket wrench
- Needle-nose pliers
- O-ring pick
- Lithium base grease

Air valve repair kit 255122 is available. Use all parts in the kit for best results.

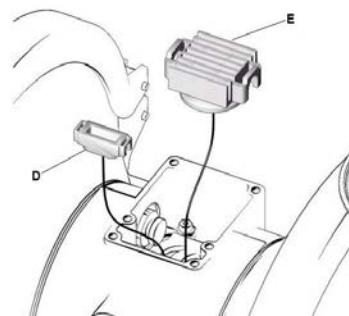
Disassemble Air Valve



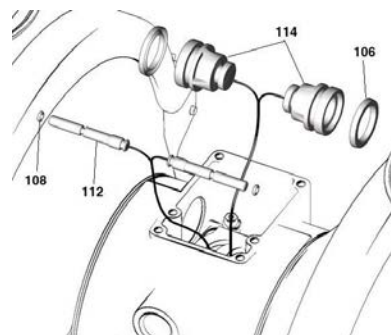
1. Follow the [Pressure Relief Procedure, page 9](#).
2. With a Torx (T20) screwdriver or 7 mm (9/32 in.) socket wrench, remove the six screws (107), air valve cover (109), and gasket (118).



3. Move the valve carriage (105) to the center position and pull it out of the cavity. Using a needle-nose pliers, pull the pilot block (116) straight up and out of the cavity.

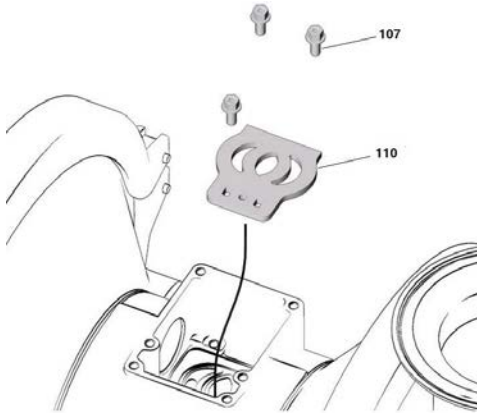


4. Pull the two actuator pistons (114). Remove the u-cups (106) from the pistons. Pull the pilot pins (112). Remove the o-rings (108) from the pilot pins.



Repair

5. Inspect the valve plate (110) in place. If damaged, use a Torx (T20) screwdriver or 7 mm (9/32 in.) socket wrench to remove the three screws (107). Remove the valve plate (110).



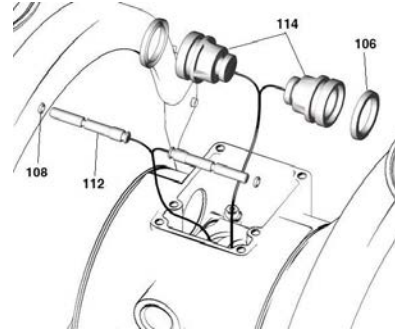
6. Inspect the bearings (113, 115) in place. See [Parts, page 22](#). The bearings are tapered and, if damaged, must be removed from the outside. This requires disassembly of the fluid section. See [Center Section Repair, page 19](#).
7. Clean all parts and inspect for wear or damage. Replace as needed.

Reassemble Air Valve

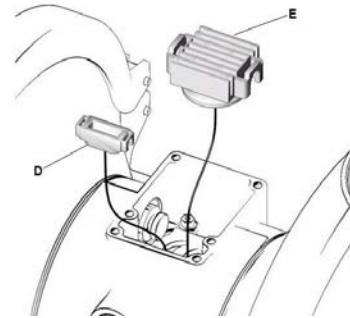
NOTE: If repairs involve removing fluid covers, perform the steps in [Reassemble the Overmolded Diaphragms, page 17](#), prior to reassembly of the air valve. The air valve configuration will be modified to aid fluid cover installation.

1. If the center section was disassembled to replace the bearings (113, 115), complete the [Center Section Repair, page 19](#), before continuing with the air valve reassembly.
2. Install the valve plate (110) in the cavity, seal down. Install the three screws (107), using a Torx (T20) screwdriver or 7 mm (9/32 in.) socket wrench. Tighten until the screws bottom out on the housing.

3. Install an o-ring (108) on each pilot pin (112). Grease the pins and o-rings. Insert the pins into the bearings, **narrow** end first.

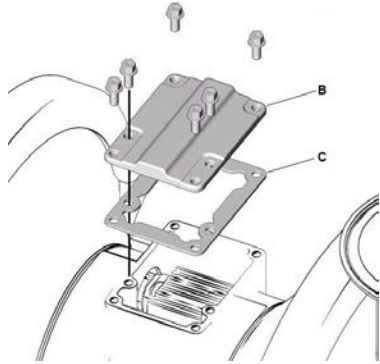


4. Install u-cups (106) on each actuator piston (114), so the lips of the packings face the **narrow** end of the pistons.
5. Lubricate the u-cups (106) and actuator pistons (114). Insert the actuator pistons in the bearings (115), **wide** end first. Leave the narrow end of the pistons exposed.
6. Grease the lower face of the pilot block (116) and install so its tabs snap into the grooves on the ends of the pilot pins (112).



7. Grease the lower face of the valve carriage (105).
8. Install the valve carriage (105) so its tabs slip into the grooves on the narrow end of the actuator pistons (114).

9. Align the valve gasket (118) and cover (109) with the six holes in the center housing (101). Secure with six screws (107), using a Torx (T20) screwdriver or 7 mm (9/32 in.) socket wrench. Torque to 50-60 in-lb (5.7-6.8 N•m).



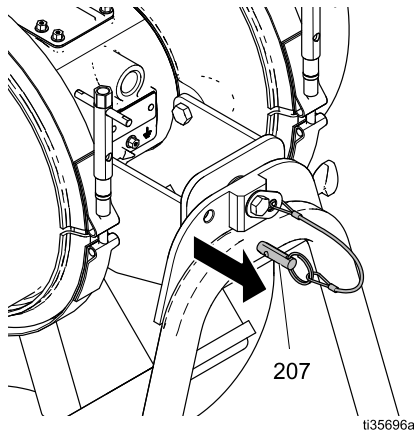
Check Valve Repair

NOTE: Kits are available for new check valve flappers, or check valve balls in a range of materials. Gasket kits also are available.

Disassemble Ball Check Valves



1. Follow the [Pressure Relief Procedure, page 9](#) . Disconnect all fluid and air lines.
2. To drain the pump, pull the frame quick-release pins (207) and rotate the pump.

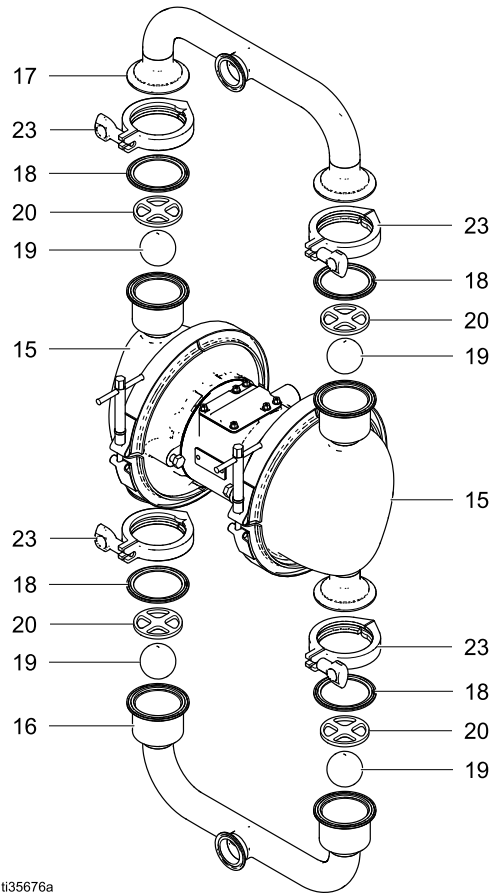


NOTE: After draining, rotate the pump to positions which will aid disassembly.

3. Remove the clamps (23) on the outlet manifold (17) and remove the manifold.

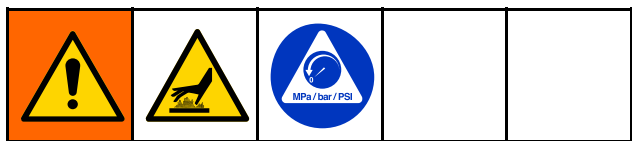
NOTE: Use care while removing manifolds to avoid damage to check valve components.

4. Remove remaining clamps (23), manifolds (16, 17), gaskets (18), and check valves (19, 20).

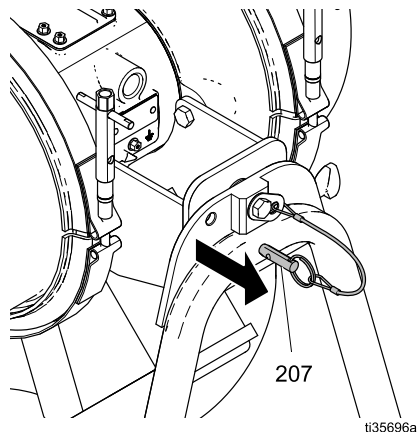


5. Clean and inspect gaskets, balls, ball stops, and seating surfaces for any damage and replace as necessary.
6. To continue with diaphragm disassembly, see [Disassemble the Standard Diaphragms, page 14](#).

Disassemble Flapper Check Valves



1. Follow the [Pressure Relief Procedure, page 9](#) . Disconnect all fluid and air lines.
2. To drain the pump, pull the frame quick-release pins (207) and rotate the pump.

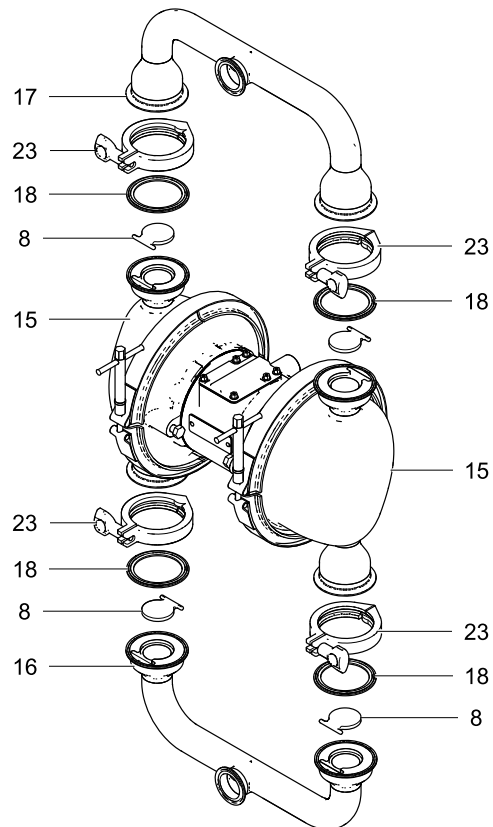


NOTE: After draining, rotate the pump to positions which will aid disassembly.

3. Remove the clamps (23) on the outlet manifold (17) and remove the manifold.

NOTE: Use care while removing manifolds to avoid damage to check valve components.

4. Remove remaining clamps (23), manifolds (16, 17), gaskets (18), and check valves (8).



5. Clean and inspect gaskets, flappers, and seating surfaces for any damage and replace as necessary.
6. To continue with diaphragm disassembly, see [Disassemble the Standard Diaphragms, page 14](#).

Reassemble the Check Valves

NOTE: Lubricate clamps, clamping surfaces, and gaskets with waterproof, sanitary lubricant.

1. Reassemble check assembly in reverse order.

NOTE: Install the flapper valve (8) with the text side facing the seat.

2. Loosely tatch the manifolds to the fluid covers. Once all components are properly aligned, tighten clamps hand tight.

Standard Diaphragm Repair

NOTE: Overmolded diaphragms are covered in [Overmolded Diaphragm Repair, page 16](#).

Tools Required:

- Torque wrench
- 5/8 in. wrench
- 19 mm open end wrench
- O-ring pick
- Lithium base grease

NOTE: Center section gasket is dependent on diaphragm material. If changing diaphragm material, it may be necessary to also replace the center section air cover gaskets. See [Parts, page 22](#), for affected air cover gaskets.

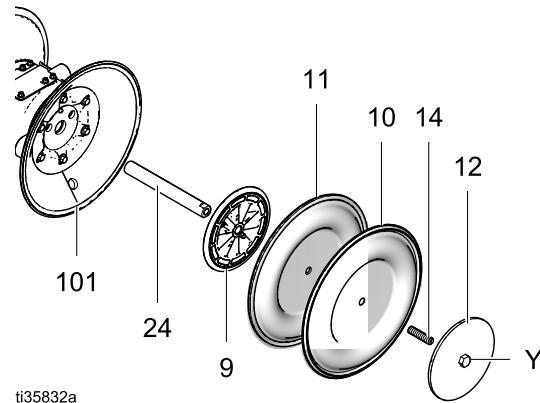
Disassemble the Standard Diaphragms



NOTE: Diaphragm kits are available in a range of materials and styles. See Parts section.

1. Follow the [Pressure Relief Procedure, page 9](#).
2. Remove the manifolds and disassemble the check valves as explained in [Check Valve Repair, page 12](#).
3. Remove the clamps (21) from the fluid covers (15), then pull the fluid covers off of the pump.
4. With both fluid covers removed, using two 5/8 in. wrenches, hold the wrench flats on the plates (Y) of each diaphragm assembly and loosen. One diaphragm assembly will come free and the other will remain attached to the shaft.

5. Disassemble the free diaphragm assembly.
6. Remove plate (12) with bolt (14) installed, diaphragm (10), backer (11) if present, and plate (9).



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7. Pull the other diaphragm assembly and the diaphragm shaft (24) out of the center housing (101). Hold the shaft flats with a 19 mm open end wrench, and remove the diaphragm assembly from the shaft. Disassemble the remaining diaphragm assembly.
8. Inspect the diaphragm shaft (24) for wear or scratches. If it is damaged, inspect the bearings (111) in place. If the bearings are damaged, refer to [Center Section Repair, page 19](#).
9. Reach into the center housing (101) with an o-ring pick and hook the u-cups (106), then pull them out of the housing. This can be done with the bearings (111) in place.
10. Clean all parts and inspect for wear or damage. Replace parts as needed.

Reassemble the Standard Diaphragms

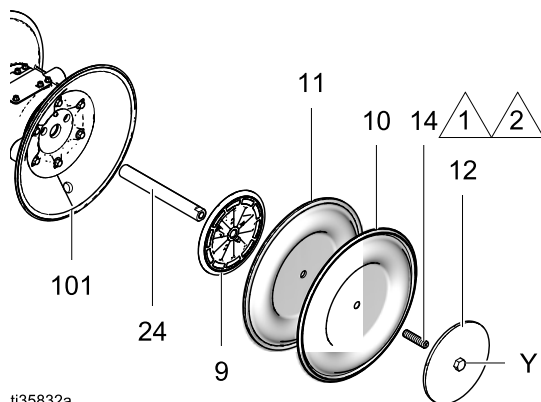
NOTICE

After reassembly, allow the thread locker to cure for 12 hours, or per manufacturer's instructions, prior to operating the pump. Damage to the pump will occur if the diaphragm shaft bolt loosens.

TIP: If you are also repairing or servicing the center section, follow [Center Section Repair, page 19](#), before replacing diaphragms.

1. Lubricate and install the shaft u-cups (106) so the lips face **out** of the housing (101).
2. Assemble diaphragm (10), backer (11) if present, and plate (9) onto plate (12) with screw (14). Rounded side of plate (9) should face diaphragm. Make sure the side marked AIR SIDE faces the center housing.

NOTE: Thread locker must be applied to screw (14) as shown for all diaphragm assemblies.



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1 Apply a high-strength thread locker to attach the screw to the diaphragm plate, if needed.

2 Apply a medium-strength thread locker to the shaft side of the screw.

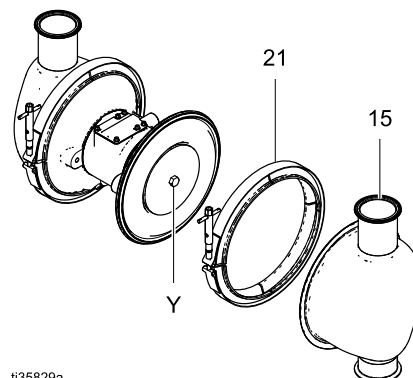
3. Screw assembled diaphragm assembly into shaft (24) and hand tighten.
4. Grease the length of the diaphragm shaft (24), and slide it through the housing (101).
5. Assemble the other diaphragm assembly to the shaft as explained in step 2.
6. Using a 5/8 in. wrench hold the wrench flats of one diaphragm assembly and torque the other diaphragm to 60-70 ft-lb (81-94 N•m).

NOTE: Apply waterproof, sanitary lubricant to the clamp (21) and clamping surface of the cover (15) to ease assembly.

NOTE: To ensure proper spacing and alignment of manifolds, install clamps (21) loose enough to allow for fluid cover movement before securing the covers and clamps in place.

7. Align the fluid covers (15) and the center housing. Secure the covers with the clamps (21) and hand tighten.

NOTE: Use a food grade anti-seize lubricant on the clamp threads to aid assembly.



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8. Reassemble the ball check valves and manifolds as explained in [Check Valve Repair, page 12](#).

Overmolded Diaphragm Repair

Tools Required:

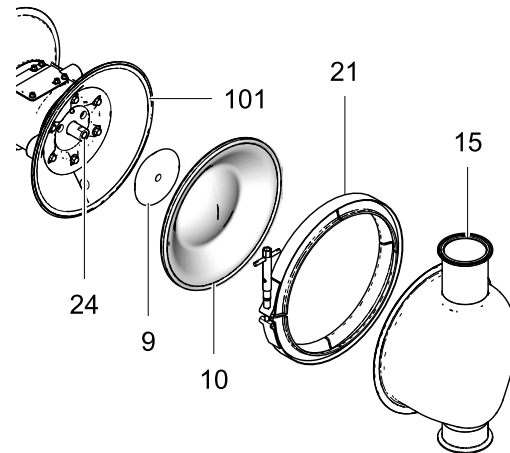
- Torque wrench
- 19 mm open end wrench
- O-ring pick
- Lithium base grease

Disassemble the Overmolded Diaphragms



NOTE: Diaphragm kits are available in a range of materials and styles. See Parts section.

1. Follow the [Pressure Relief Procedure, page 9](#).
2. Remove the manifolds and disassemble the check valves as explained in [Check Valve Repair, page 12](#).
3. Remove the clamps (21) from the fluid covers (15), then pull the fluid covers off of the pump.
4. Once the fluid covers are removed, the diaphragm on the side of the pump which was last pressurized with air will be separated from the center section/air cover. This allows you to grip the diaphragms.
5. To loosen, grip both diaphragms securely around the outer edge and rotate counterclockwise. One diaphragm assembly will come free and the other will remain attached to the shaft. Remove the freed diaphragm (10) with screw (14) and air side plate (9).
6. Pull the opposite diaphragm assembly and shaft (24) out of the center housing (101). Hold the shaft flats with a 19 mm open end wrench and remove the diaphragm and air side plate from the shaft.
7. Inspect the diaphragm shaft (24) for wear or scratches. If it is damaged, inspect the bearings (111) in place. If the bearings are damaged, refer to [Center Section Repair, page 19](#).
8. Reach into the center housing (101) with an o-ring pick and hook the u-cups (110), then pull them out of the housing. This can be done with the bearings (111) in place.
9. Clean all parts and inspect for wear or damage. Replace parts as needed.



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Reassemble the Overmolded Diaphragms

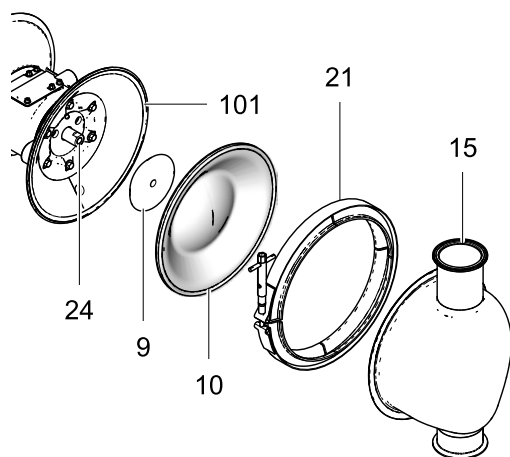
NOTICE

After reassembly, allow the thread locker to cure for 12 hours, or per manufacturer's instructions, prior to operating the pump. Damage to the pump will occur if the diaphragm shaft bolt loosens.

TIP: If you are also repairing or servicing the center section, follow [Center Section Repair, page 19](#), before replacing diaphragms.

1. Lubricate and install the shaft u-cups (106) so the lips face **out** of the housing (101).
2. Assemble plate (9) onto diaphragm (10) with screw (14). Rounded side of plate (9) should face diaphragm. Make sure the side marked AIR SIDE faces the center housing.

NOTE: Thread locker must be applied to screw (14) for all diaphragm assemblies.



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1. Apply a high-strength thread locker to attach the screw to the diaphragm.
2. Apply a medium-strength thread locker to the shaft side of the screw.

3. Screw assembled diaphragm assembly into shaft (24) and hand tighten.
4. Grease the length of the diaphragm shaft (24), and slide it through the housing (101).
5. Assemble the other diaphragm assembly to the shaft as explained in step 2.

6. Grip both diaphragms securely around their outer edge and rotate clockwise until bottomed on the shaft.

NOTE: Apply waterproof, sanitary lubricant to the clamp (21) and clamping surface of the cover (15) to ease assembly.

NOTE: To ensure proper spacing and alignment of manifolds, install clamps (21) loose enough to allow for fluid cover movement before securing the covers and clamps in place.

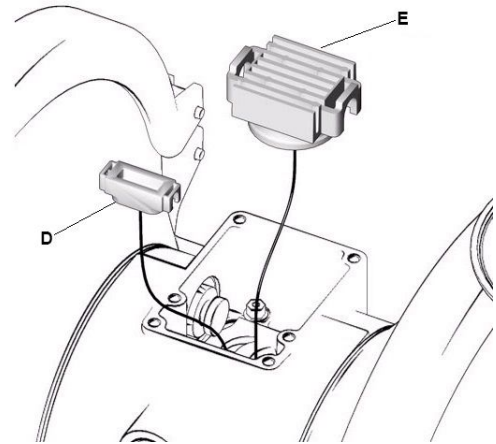
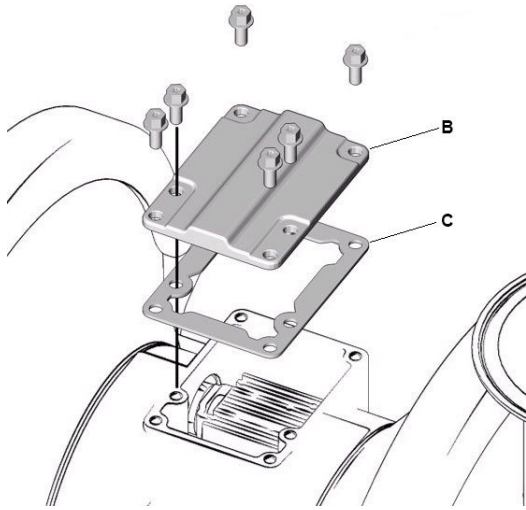
NOTE: Use a food grade anti-seize lubricant on the clamp threads to aid in assembly.

7. Align the fluid covers (15) and the center housing. Secure the covers with the clamps (21) and hand tighten. If, after installing the first fluid cover, the opposing diaphragm protrudes away from the center housing, leaving a gap between the center housing and the second fluid cover, do not try to force the diaphragm into position. Instead, complete the following procedures in steps 7a–7i to attach the second fluid cover.

- a. Remove the air valve cover (B), the gasket (C), and the pilot cup (D). See the image in step i.
 - b. Within the drive, shift the main air valve carriage (E) away from the installed fluid cover. This will expose the air passage that feeds the assembled side.
 - c. Reinstall the gasket (C) and the air valve cover (B). Torque all bolts according to instructions in your pump manual.
 - d. Supply the pump with 10–20 psi (0.07–0.14 MPa, 0.7–1.4 bar) air pressure, just enough to move the diaphragm. The diaphragm will shift so the second fluid cover will seat properly. Keep the air pressure on while air flows out of the exhaust.
- NOTE:** Too much air pressure may cause the diaphragm to deform and seat incorrectly.
- e. Install the remaining fluid cover.
 - f. Follow the [Pressure Relief Procedure, page 9](#). Disconnect the air supply from the pump.
 - g. Remove the air valve cover (B) and the gasket (C).
 - h. Lubricate and reinstall the pilot cup (D).

Repair

- i. Reinstall the gasket (C) and the air valve cover (B). Torque all bolts according to instructions in your pump manual.



8. Reassemble the ball check valves and manifolds as explained in [Check Valve Repair, page 12](#).

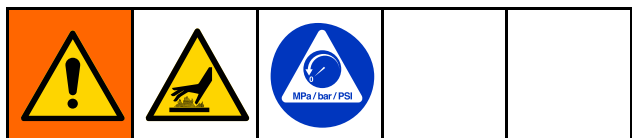
Center Section Repair

Tools Required:

- Torque wrench
- 10 mm socket wrench
- 9/16 in. socket wrench
- Bearing puller
- O-ring pick
- Press, or block and mallet

Disassemble the Center Section

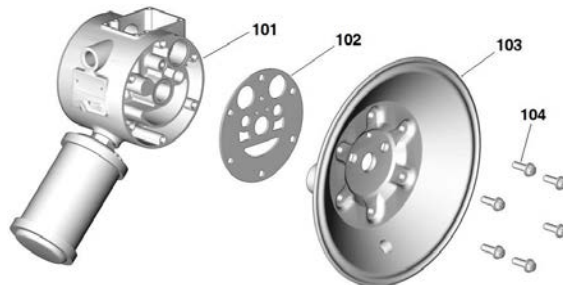
NOTE: Do not remove undamaged bearings.



1. Follow the [Pressure Relief Procedure, page 9](#) . Disconnect all fluid and air lines.
2. Remove the manifolds and check valve parts as directed in [Disassemble Ball Check Valves, page 12](#).
3. Remove the fluid covers and diaphragms as directed in [Disassemble the Standard Diaphragms, page 14](#) or [Disassemble the Overmolded Diaphragms, page 16](#).

NOTE: If you are removing only the diaphragm shaft bearing (111), skip step 4.
4. Disassemble the air valve as explained in [Air Valve Repair, page 9](#) .
5. Use a 9/16 in. socket wrench to remove the screws (3) and nuts (105) holding the air covers to the frame.

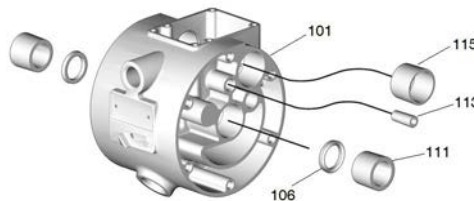
6. Use a 10 mm socket wrench to remove the screws (104) holding the air covers (103) to the center housing (101).



7. Remove the air cover gaskets (102). Always replace the gaskets with new ones.

NOTE: If removing the diaphragm shaft bearings (111), use an o-ring pick to remove the u-cups (106) first.

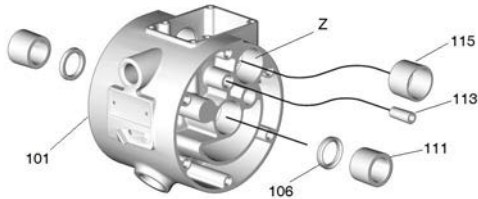
8. Use a bearing puller to remove the diaphragm shaft bearings (111), air valve bearings (115) or pilot pin bearings (113). Do not remove undamaged bearings.



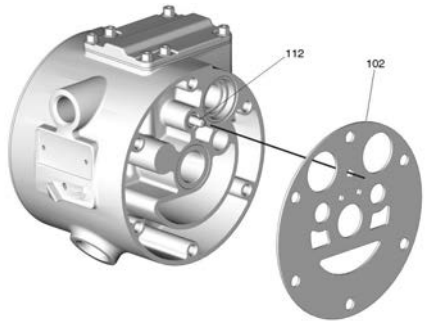
9. Inspect the u-cups. Replace as needed.

Reassemble the Center Section

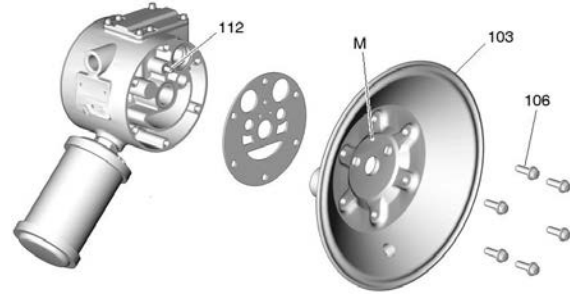
1. Install the shaft u-cups (106) so the lips face **out** of the housing.
2. Insert new bearings (111, 113, and 115) into the center housing (101), **tapered end first**. Using a press or a block and rubber mallet, press-fit the bearing so it is flush with the surface of the center housing.



3. Reassemble the air valve as explained in [Reassemble Air Valve, page 10](#)
4. Align the new air cover gasket (102) so the pilot pin (112) protruding from the center housing (101) fits through the proper hole in the gasket.



5. Align the air cover (103) so the pilot pin (112) fits in the middle hole (M) of the three small holes near the center of the cover.



6. Apply a medium-strength thread locker to the threads of the screws (106). Install the screws (106), hand tight. Using a 10 mm socket wrench, torque the screws oppositely and evenly to 130-150 in-lb (15-17 N•m). Install the diaphragm assemblies and fluid covers as explained in [Diaphragms, page 26](#).
7. See [Reassemble the Check Valves, page 13](#).

Leak Detectors

Leak detectors are sensors that are mounted in the air covers of the pump to monitor for fluid leakage caused by a diaphragm rupture. Leak detectors are provided with 3-A pumps and can be ordered separately for other pumps. For leak sensor electrical and configuration information, refer to the leak detection system manual (3A6976).

Available leak detection kits:

Kit	Description
17Z666	Kit, Standard, non-ATEX, 2 sensors, 2 bushings; provided with 3-A pumps
17Z667	Kit, ATEX, 2 sensors, 2 bushings, 2 o-rings
25P303	Kit, Leak detection control box; not approved for use in an ATEX environment
25P305	Kit, Leak detection control box mounting bracket and mounting hardware

Leak Detector Testing

1. Obtain a small container of the material being pumped.
2. Perform the [Pressure Relief Procedure, page 9](#).
3. Unscrew and remove both leak detector bushings (with installed leak detectors) from the air side diaphragm covers.
4. For each leak detector, dip the bushing, with the leak detector still installed, into the material container in an orientation that mimics how it would be oriented in the air side diaphragm cover. Observe whether the leak detector senses the presence of the material.
5. If the leak detector successfully detected the material, clean the bushing and leak detector and re-install the leak detector and bushing as described in step 6. Ensure that both leak detectors successfully detected the material before installing.

NOTE: If the leak detector fails to sense the material, troubleshoot the leak detector to see if the leak sensor has failed or the leak detector is unable to detect the material.

6. To install the leak detector to the pump:
 - a. If the leak detector needs to be installed in the bushing, simply screw the leak detector in just past finger tight.

NOTE: If using the ATEX leak detector, install the o-ring onto the leak detector before installation into the bushing.
 - b. If the bushing is not installed in the air side diaphragm cover, screw the bushing into the air side diaphragm cover.
 - c. If the leak detector was disconnected from the monitoring device, re-attach the leak detector wires to the monitoring device.
7. Repeat steps 3–6 for the other leak detector.

Leak Detector Removal

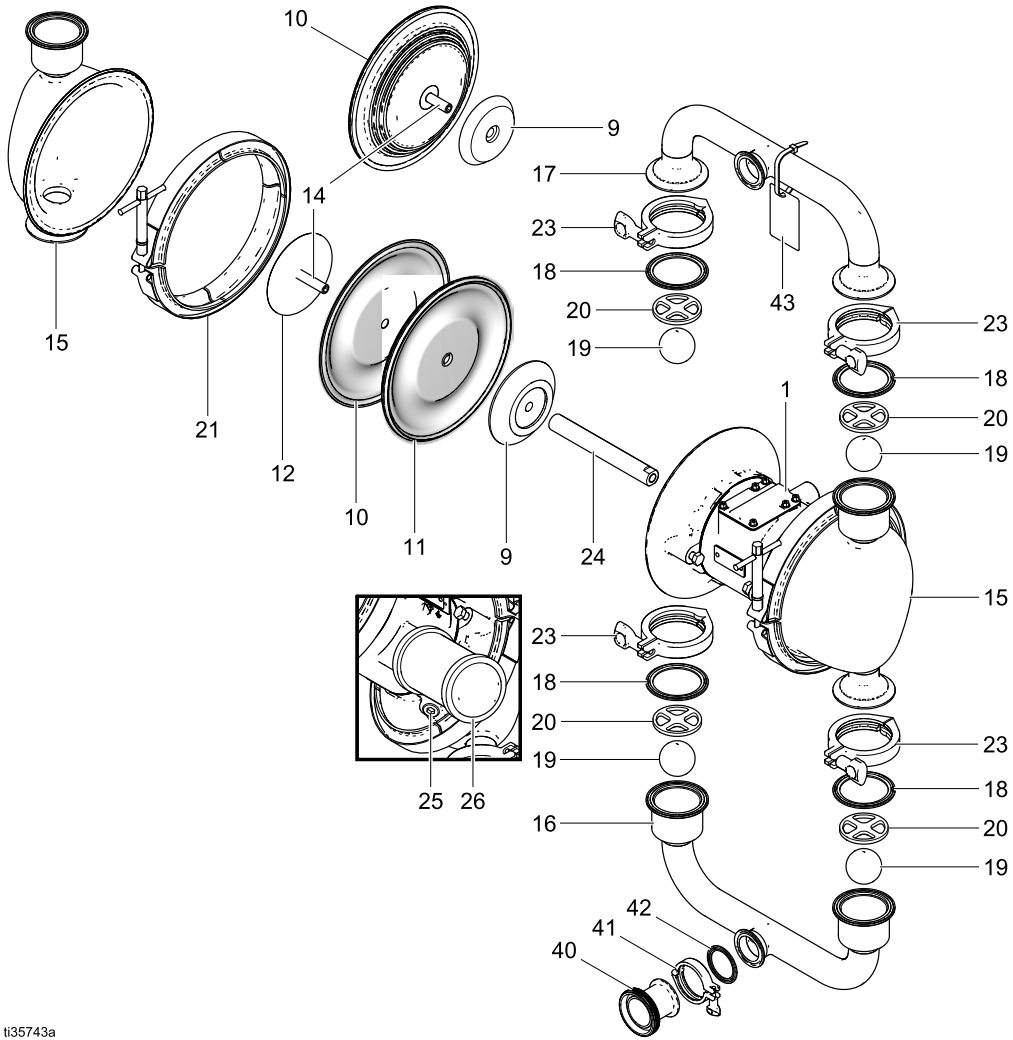
1. Follow the [Pressure Relief Procedure, page 9](#).
2. Note the connection locations of the leak detector wires within the monitoring device, then disconnect the leak detector wires.
3. Remove the leak detector from the bushing in the air side diaphragm cover.
4. If desired, repeat to remove the other leak detector from the other air side diaphragm cover.

Leak Detector Installation

1. If the leak detector needs to be installed in the bushing, simply screw the leak detector in just past finger tight.

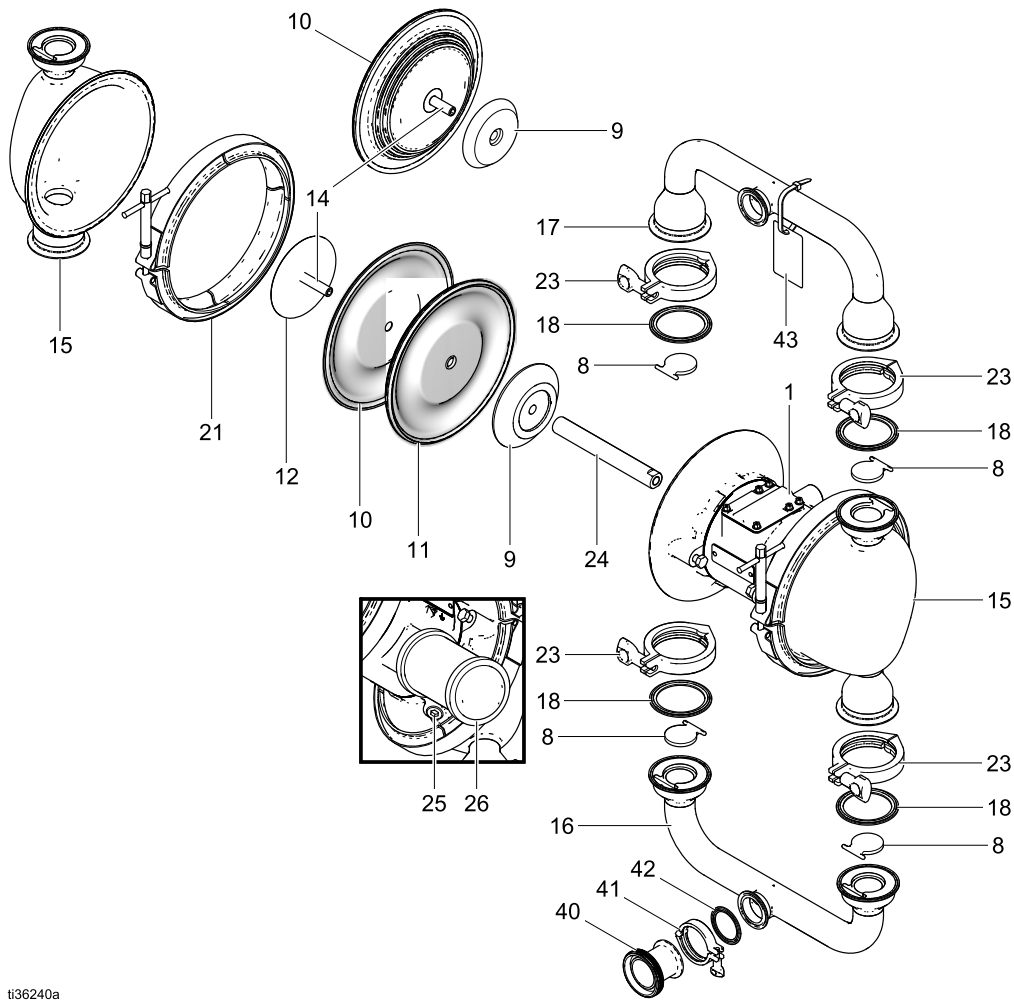
NOTE: If using the ATEX leak detector, install the o-ring onto the leak detector before installation into the bushing.
2. If the bushing is not installed in the air side diaphragm cover, screw the bushing into the air side diaphragm cover.
3. Wire the leak detector to the monitoring device.

Parts



135743a

Ball Check pump shown



ti36240a

Flapper Check pump shown

Replacement Unloader Pumps

To order a replacement pump for use in a drum or tote unloader, obtain the six digit number from the pump being replaced and refer to the table below to determine the part number to order.

Tag Marking	Order Pump p/n
25P211	SP15.0070
25P212	SP15.0074
25P213	SP15.0076
25P214	SP15.0080

Parts/Kits Quick Reference

Use this table as a quick reference for parts/kits. Go to the pages indicated in the table for a full description of kit contents.

Ref.	Part/Kit	Description	Qty.
1	---	MODULE, motor; <i>See page 25</i>	1
2	24L978	FRAME; <i>includes Ref. 3</i>	1
3	15D008	BOLT, frame attachment	4
8	25P088	FLAPPER, pkg of 4	1
9		PLATE, air side	2
	15K448	BN, EO, FK, PS, SP diaphragms	
	15H810	PO diaphragms	
10	---	DIAPHRAGM, kit; <i>See page 26</i>	1 kit
11	---	DIAPHRAGM, backup, <i>included with Ref. 10 where needed</i>	2
12	15K288	PLATE, fluid side, BN, FK, PS, SP only	2
14	15D021	SCREW, diaphragm	2
15		COVER, fluid	2
	25N996	HS, 3-A BALL	
	25P041	PH BALL	
	25N997	HS FLAPPER	
16		MANIFOLD, inlet;	1
	25P020	HS, 3-A BALL, horizontal	
	25P046	HS BALL, vertical	
	25P048	PH BALL	
	25P022	HS, 3-A FLAPPER	
17		MANIFOLD, outlet;	1
	25P021	HS, 3-A BALL, horizontal	
	25P047	HS BALL, vertical	
	25P049	PH BALL	
	25P023	HS, 3-A FLAPPER	
18		GASKET, pkg of 4	1
	25P061	EPDM	
	25R601	Buna-N	
	26A891	FKM	

Ref.	Part/Kit	Description	Qty.
19		BALLS, check valve, pkg of 4	1
	D0B070	Buna-N	
	25R607	EPDM	
	26C245	PTFE	
	26C246	Santoprene	
	24W230	Fluoroelastomer	
	D0B0H0	Polychloroprene weighted	
20	25P100	STOP, ball, pkg of 4	1
21	15H341	CLAMP, fluid cover	2
22	---	HANDLE, tee <i>Included with Ref 21</i>	2
23	620223	CLAMP, sanitary	4
24	189245	SHAFT, diaphragm	1
25	103778	PLUG	2
26	15G332	MUFFLER	1
40		ADAPTER, DIN, kit, 1 each of 40-42	2
	25P109	HS, 3-A	
	25P119	PH	
41	118598	CLAMP, DIN adapter	2
42	25P201	GASKET, EPDM, kit, DIN adapter; pkg of 2; <i>included with Ref. 40</i>	1
43†	25P457	LABEL, kit; includes ref 44 & 45	1
44	---	TAG	1
45	---	TIE	1

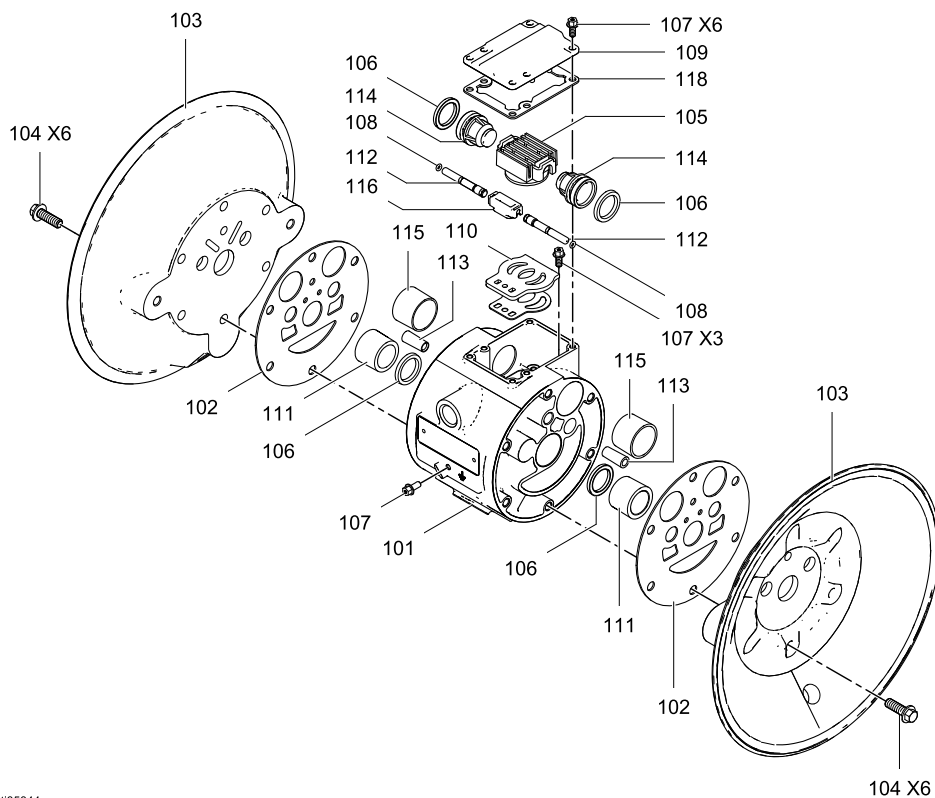
--- Not sold separately.

† Replacement safety labels, tags, and cards are available at no cost.

Center Section

Sample Configuration Number

Pump Model	Wetted Section Material	Drive	Center Section and Air Valve Material	Manifolds	Seats	Checks	Diaphragms	Seals	Certification
1590	HS	P	SP1A	SSA	SS	PT	PS	EP	21



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Ref	Part	Description	Qty
101	15K009 15K010	HOUSING, center, assembly HS, 3-A PH	1
102	25P113 25P114	GASKET, air cover kit; pkg of 2 use with PS diaphragms use with all diaphragms except PS diaphragms	1
103	15G668 15G694	COVER, air HS, 3-A PH	2
104	25P125	SCREW, pkg of 12	1
105†	248904	CARRIAGE assembly	1
106†	112181	U-CUP	4
107	116344	SCREW	10

Ref	Part	Description	Qty
108†	157628	O-RING	2
109	25P128 25P129	COVER HS, 3-A PH	1
110†	15H178	PLATE, valve	1
111	188609	BEARING, shaft	2
112	188610	PIN, push	2
113	188611	BEARING, push	2
114	188612	PISTON	2
115	188613	BEARING, piston	2
116†	188614	BLOCK, pilot	1
118†	188618	GASKET, cover	1

† Included in Air Valve Repair Kit 255122.

Diaphragms

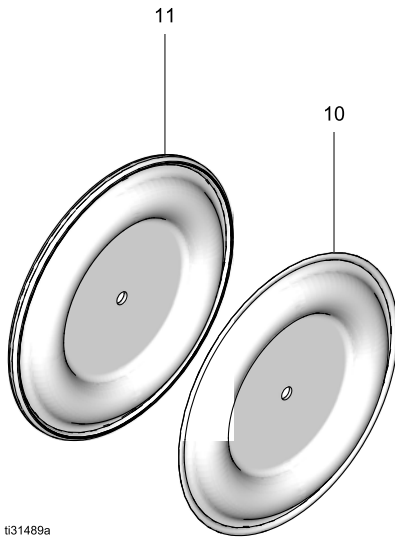
Sample Configuration Number

Pump Model	Wetted Section Material	Drive	Center Section and Air Valve Material	Manifolds	Seats	Checks	Diaphragms	Seals	Certification
1590	HS	P	SP1A	SSA	SS	PT	PS	EP	21

Bolt-Through Diaphragm Kits		
Material	Kit	Qty.
BN	25R609	1
FK	25P209	1
PS	25P207	1
SP	25P206	1

Kits include:

- 2 diaphragms (10)
- 2 diaphragm backers (11), if applicable
- 1 packet anaerobic adhesive
- 2 o-rings

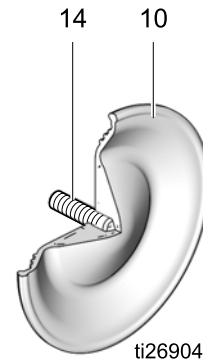


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Overmolded Diaphragm Kits		
Material	Kit	Qty.
EO	25P210	1
PO	25P208	1

Kits include:

- 2 overmolded diaphragms (10) with set screw (14)



ti26904a

Optional Sanitary Gasket Kits

Part/Kit	Material
26A891	FKM
26A914	PTFE/EPDM Bonded (offered only as replacement)
25P061	EPDM
25R601	Buna-N

Kit descriptions appear in the following order: *Pump model, seat material, ball material, diaphragm material, gasket material.* For example, *1590HS FL,--,EO,EP.* Refer to [Configuration Number Matrix, page 5](#), to define components.

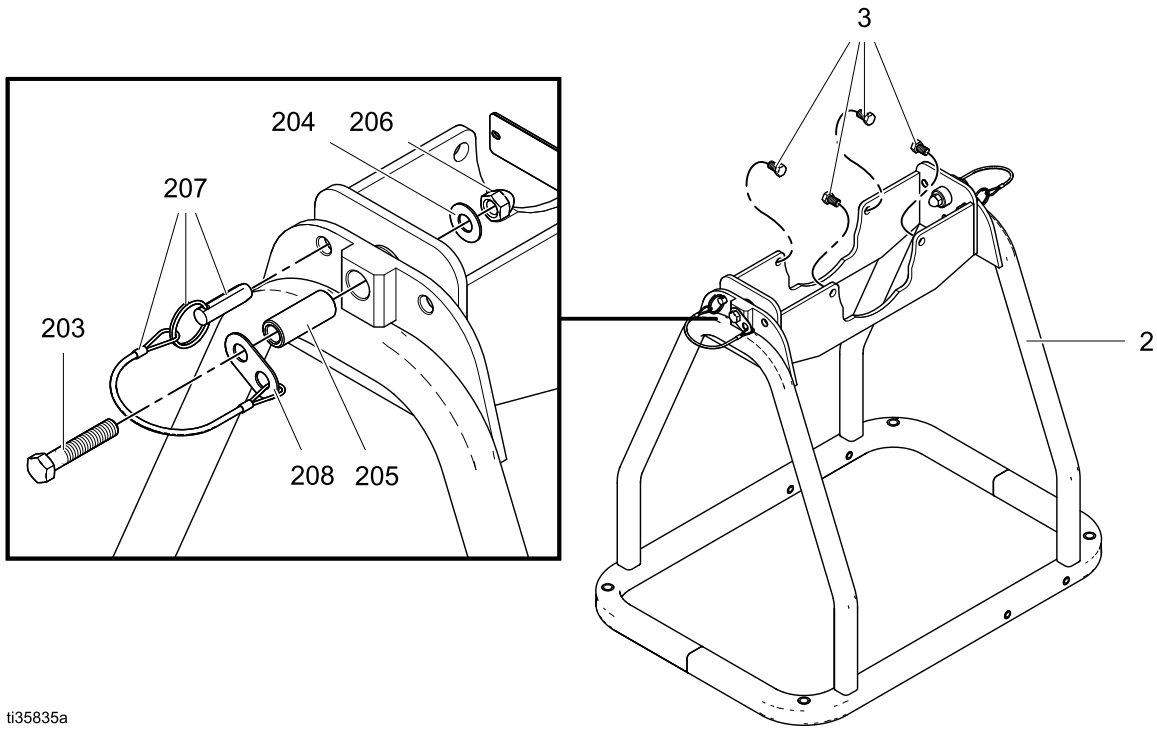
Fluid Section Repair Kits		
Kit	Description	Qty.
25R679	1590HS FL,--,EO,EP	1
25R680	1590HS FL,--,FK,FK	1
25R681	1590HS FL,--,PO,EP	1
25R682	1590HS FL,--,PS,EP	1
25R683	1590HS FL,--,SO,EP	1
25R684	1590HS FL,--,SP,EP	1
25R685	1590HS-PH --,BN,BN,BN	1
25R686	1590HS-PH --,CW,FK,FK	1
25R687	1590HS-PH --,CW,EO,EP	1
25R688	1590HS-PH --,CW,SP,EP	1
25R689	1590HS-PH --,EP,EO,EP	1

Fluid Section Repair Kits		
Kit	Description	Qty.
25R690	1590HS-PH --,EP,SP,EP	1
25R691	1590HS-PH --,FK,FK,FK	1
25R692	1590HS-PH --,PT,EO,EP	1
25R693	1590HS-PH --,PT,PO,EP	1
25R694	1590HS-PH --,PTPS,EP	1
25R695	1590HS-PH --,PT,SP,EP	1
25R696	1590HS-PH --,SP,SO,EP	1
25R697	1590HS-PH --,SP,SP,EP	1

Kits include:

- 4 balls (19) or flapper valves (8)
- 2 diaphragms (10)
- 2 diaphragm backers (11), if applicable
- 4 gaskets (18)
- 1 packet anaerobic adhesive
- 2 o-rings

Frames



ti35835a

24L978 shown; includes items 2 & 3

Ref.	Part/Kit	Description	Qty.
203†	---	SCREW, 3/8-16 unc	2
204†	111743	WASHER, flat	2
205†	---	BUSHING	2
206†	---	NUT, acorn	2
207*	---	PIN, quick release	2
208*	---	RETAINER	2

† Included in hinge repair kit 24N798.

* Included in quick release pin kit 24N799.

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 flapper	12.7 mm 30.5 mm
Fluid displacement per cycle	ball flapper	2.46 liters 1.17 liters
Maximum free-flow delivery	ball flapper	397.5 lpm 302.8 lpm
Maximum pump speed	ball flapper	165 cpm 260 cpm
Weight		
	ball flapper	40.4 kg 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		

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	Stainless Steel Pump Fluid Temperature Range	
	Fahrenheit	Celsius
Buna-N (BN)	10° to 180°F	-12° to 82°C
FKM Fluoroelastomer (FK)	-40° to 275°F	-40° to 135°C
Polychloroprene check balls (CW)	14° to 176°F	-10° to 80°C
PTFE check balls (PT)	-40° to 220°F	-40° to 104°C
PTFE overmolded diaphragm (PO)	-40° to 180°F	-40° to 82°C
2-piece PTFE/Santoprene diaphragm (PS)	-40° to 180°F	-40° to 82°C
Santoprene (SP)	-40° to 180°F	-40° to 82°C

California Proposition 65

CALIFORNIA RESIDENTS

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

Notes

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.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

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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Graco Information

For the latest information about Graco products, visit www.graco.com.
For patent information, see www.graco.com/patents.

To place an order, contact your Graco Distributor or call to identify the nearest distributor.

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 3A6781

Graco Headquarters: Minneapolis
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