

# SaniForce™ Ram Packages

3A0591E  
EN

**For use in sanitary applications to transfer medium to high viscosity fluids.  
For professional use only.**

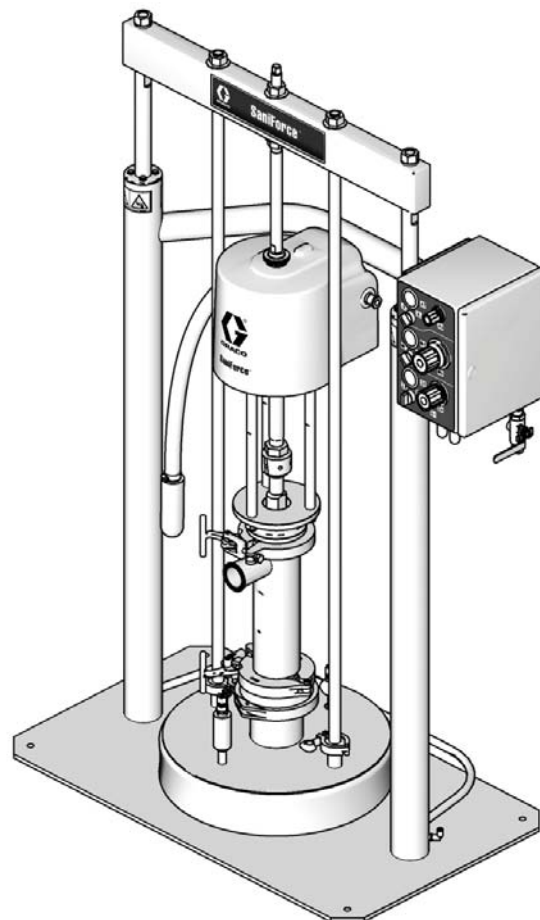
**Not for use in European Explosive Atmosphere locations.**

*See pages 2- 3 for model information, including maximum fluid working pressure.*



## **Important Safety Instructions**

Read all warnings and instructions in this manual. Save these instructions.



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## Models

### Piston Pumps

**Maximum Package Air Inlet Pressure: 100 psi (0.7 MPa, 6.9 bar)**

Model	Frame		Controls		Pump Description	Ratio	Maximum Ram Air Inlet Pressure, psi (MPa, bar)	Maximum Pump Air Inlet Pressure, psi (MPa, bar)	Maximum Fluid Working Pressure, psi (MPa, bar)
	SS*	CS*	SS*	CS*					
24D708	✓			✓	Priming Piston, Drum	5:1	100 (0.7, 6.9)	80 (0.6, 5.5)	410 (2.8, 28.3)
24D712		✓		✓	Priming Piston, Drum	5:1	100 (0.7, 6.9)	80 (0.6, 5.5)	410 (2.8, 28.3)
24D714	✓		✓		Priming Piston, Drum	5:1	100 (0.7, 6.9)	80 (0.6, 5.5)	410 (2.8, 28.3)
24D720	✓			✓	Double Ball, Drum	5:1	100 (0.7, 6.9)	80 (0.6, 5.5)	410 (2.8, 28.3)
24D724		✓		✓	Double Ball, Drum	5:1	100 (0.7, 6.9)	80 (0.6, 5.5)	410 (2.8, 28.3)
24D726	✓		✓		Double Ball, Drum	5:1	100 (0.7, 6.9)	80 (0.6, 5.5)	410 (2.8, 28.3)
24D776	✓			✓	Priming Piston, Stubby	6:1	100 (0.7, 6.9)	100 (0.7, 6.9)	650 (4.5, 44.8)
24D780		✓		✓	Priming Piston, Stubby	6:1	100 (0.7, 6.9)	100 (0.7, 6.9)	650 (4.5, 44.8)
24D782	✓		✓		Priming Piston, Stubby	6:1	100 (0.7, 6.9)	100 (0.7, 6.9)	650 (4.5, 44.8)
24D788	✓			✓	Double Ball, Drum	6:1	100 (0.7, 6.9)	100 (0.7, 6.9)	650 (4.5, 44.8)
24D792		✓		✓	Double Ball Drum	6:1	100 (0.7, 6.9)	100 (0.7, 6.9)	650 (4.5, 44.8)
24D794	✓		✓		Double Ball, Drum	6:1	100 (0.7, 6.9)	100 (0.7, 6.9)	650 (4.5, 44.8)
24D647	✓			✓	Priming Piston, Stubby	12:1	100 (0.7, 6.9)	100 (0.7, 6.9)	1450 (10, 100.0)
24D651		✓		✓	Priming Piston, Stubby	12:1	100 (0.7, 6.9)	100 (0.7, 6.9)	1450 (10, 100.0)
24D653	✓		✓		Priming Piston, Stubby	12:1	100 (0.7, 6.9)	100 (0.7, 6.9)	1450 (10, 100.0)
24F188	✓			✓	Priming Piston, Stubby**	12:1	100 (0.7, 6.9)	100 (0.7, 6.9)	1450 (10, 100.0)
24F189		✓		✓	Priming Piston, Stubby**	12:1	100 (0.7, 6.9)	100 (0.7, 6.9)	1450 (10, 100.0)
24F190	✓		✓		Priming Piston, Stubby**	12:1	100 (0.7, 6.9)	100 (0.7, 6.9)	1450 (10, 100.0)

\* SS = Stainless Steel; CS = Carbon Steel

\*\* This model has an additional seal for viscous, sticky materials.

## Air-Operated Diaphragm Pumps

**Maximum Package Air Inlet Pressure: 120 psi (0.8 MPa, 8 bar)**

Model	Frame		Controls		Pump Description	Ratio	Maximum Ram Air Inlet Pressure, psi (MPa, bar)	Maximum Pump Air Inlet Pressure, psi (MPa, bar)	Maximum Fluid Working Pressure, psi (MPa, bar)
	SS*	CS*	SS*	CS*					
24G542	✓			✓	SaniForce 2150, Air-Operated Double Diaphragm, Ball Check, PTFE	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24F191		✓		✓	SaniForce 2150, Air-Operated Double Diaphragm, Ball Check, PTFE	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24G543	✓		✓		SaniForce 2150, Air-Operated Double Diaphragm, Ball Check, PTFE	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24F192	✓			✓	SaniForce 2150, Air-Operated Double Diaphragm, Ball Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24F193		✓		✓	SaniForce 2150, Air-Operated Double Diaphragm, Ball Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24F194	✓		✓		SaniForce 2150, Air-Operated Double Diaphragm, Ball Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D922	✓			✓	SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, EPDM	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D926		✓		✓	SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, EPDM	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D928	✓		✓		SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, EPDM	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24J364	✓			✓	SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, PTFE	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24J365		✓		✓	SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, PTFE	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24J366	✓		✓		SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, PTFE	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D932		✓		✓	SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D936	✓		✓		SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D940	✓			✓	SaniForce 3150, Air-Operated Double Diaphragm, Ball Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D944	✓			✓	SaniForce 3150, Air-Operated Double Diaphragm, Flapper Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D948		✓		✓	SaniForce 3150, Air-Operated Double Diaphragm, Flapper Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)
24D952	✓		✓		SaniForce 3150, Air-Operated Double Diaphragm, Flapper Check, Santoprene	1:1	100 (0.7, 6.9)	120 (0.8, 8.2)	120 (0.8, 8.2)

\* SS = Stainless Steel; CS = Carbon Steel

## Inflatable Seal

Part	Description	Normal Air Operating Pressure	Maximum Air Operating Pressure
16G242	Inflatable Seal	10-25 psi (0.07- 0.17 MPa, 0.69-1.7 bar)	30 psi (0.21 MPa, 2.1 bar)



## Material Certification

Reference: SaniForce Product Family

Issue Date: September 14, 2011

All fluid contact materials in the SaniForce product family are FDA-Compliant and meet the United States Code of Federal Regulations (CFR) Title 21, Section 177 or are of a corrosion resistant grade Stainless Steel. This includes the below product groups:












1. SaniForce 1040, 1590, 2150 Air-Operated Double Diaphragm Pumps
2. SaniForce 1590, 3150 HS Air-Operated Double Diaphragm Pumps
3. SaniForce 1590, 3150 HS 3-A Certified Air-Operated Double Diaphragm Pumps
4. SaniForce 5:1, 6:1 and 12:1 Air-Operated Piston Pumps
5. SaniForce Diaphragm Pump and Piston Pump Drum Unloaders
6. SaniForce Diaphragm Pump and Piston Pump Bin Evacuation Systems

A handwritten signature in black ink that reads 'Bradley A. Byron'.

Bradley A. Byron  
Quality Manager  
Graco Inc.

# 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, 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.

 <b>WARNING</b>	
  	<p><b>SKIN INJECTION HAZARD</b></p> <p>High-pressure fluid from dispensing device, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. <b>Get immediate surgical treatment.</b></p> <ul style="list-style-type: none"> <li>Do not point dispensing device at anyone or at any part of the body.</li> <li>Do not put your hand over the fluid outlet.</li> <li>Do not stop or deflect leaks with your hand, body, glove, or rag.</li> <li>Follow the <b>Pressure Relief Procedure</b> when you stop dispensing and before cleaning, checking, or servicing equipment.</li> <li>Tighten all fluid connections before operating the equipment.</li> <li>Check hoses and couplings daily. Replace worn or damaged parts immediately.</li> </ul>
  	<p><b>MOVING PARTS HAZARD</b></p> <p>Moving parts can pinch, cut or amputate fingers and other body parts.</p> <ul style="list-style-type: none"> <li>Keep clear of moving parts.</li> <li>Do not operate equipment with protective guards or covers removed.</li> <li>Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the <b>Pressure Relief Procedure</b> and disconnect all power sources.</li> </ul>
   	<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Flammable fumes, such as solvent and paint fumes, in <b>work area</b> can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>Use equipment only in well ventilated area.</li> <li>Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc).</li> <li>Keep work area free of debris, including solvent, rags and gasoline.</li> <li>Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present.</li> <li>Ground all equipment in the work area. See <b>Grounding</b> instructions.</li> <li>Use only grounded hoses.</li> <li>Hold gun firmly to side of grounded pail when triggering into pail.</li> <li>If there is static sparking or you feel a shock, <b>stop operation immediately</b>. Do not use equipment until you identify and correct the problem.</li> <li>Keep a working fire extinguisher in the work area.</li> </ul>

# 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 Data** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Data** in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS from distributor or retailer.
- Do not leave the work area while equipment is energized or under pressure. 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.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.



## SPLATTER HAZARD

Hot or toxic fluid can cause serious injury if splashed in the eyes or on skin. During blow off of platen, splatter may occur.

- Use minimum air pressure when removing platen from drum.



## 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 MSDSs 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's heated can become very hot during operation. To avoid severe burns:

- Do not touch hot fluid or equipment.






## PERSONAL PROTECTIVE EQUIPMENT

You must wear appropriate protective equipment when operating, servicing, or when in the operating area of the equipment to help protect you from 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.

# Installation

## Grounding

						
<p>The equipment must be grounded. Grounding reduces the risk of static and electric shock by providing an escape wire for the electrical current due to static build up or in the event of a short circuit.</p>						

**Pump:** Connect a ground wire (Graco PN 238909) to the ground screw on the bottom cover of the air motor, under the shield. Connect the other end of the ground wire to a true earth ground.

**Air and fluid hoses:** use only electrically conductive hoses with a maximum of 500 ft. (150 m) combined hose length to ensure grounding continuity. Check electrical resistance of hoses. If total resistance to ground exceeds 25 megohms, replace hose immediately.

**Air compressors:** follow manufacturer’s recommendations.

**Dispense valve:** ground through connection to a properly grounded fluid hose and pump.

**Material supply container:** follow local code.

**Container(s) that receive material:** follow local code.

**Solvent pails used when flushing:** follow local code. 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 grounding continuity.

**To maintain grounding continuity when flushing or relieving pressure:** hold metal part of the dispense valve firmly to the side of a grounded metal pail, then trigger the valve.

## Location

Position the ram so the air controls are easily accessible. Ensure that there is sufficient overhead clearance when the ram is fully raised. See **Repair**, page 19.

Position the ram in an area with adequate access for servicing and cleaning the equipment and adjacent areas to maintain the required level of hygiene. Locate equipment away from sources of air currents, dust, or liquids derived from leakage, condensation, or aerosols.

Using the holes in the ram base as a guide, drill holes for 1/2 in. (13 mm) anchors.

Check that the ram base is level in all directions. If necessary, level the base using metal shims. Secure the base to the floor using 1/2 in. (13 mm) anchors that are long enough to prevent the ram from tipping.

## Setup

**NOTE:** Reference numbers and letters in parentheses in the text refer to the callouts in the figures and the parts drawings.

Accessories are available from Graco. Make certain all accessories are sized and pressure-rated to meet your system requirements

FIG. 1 and FIG. 2 are guides for selecting and installing system components and accessories. Contact your Graco distributor for assistance in designing a system to suit your particular needs.

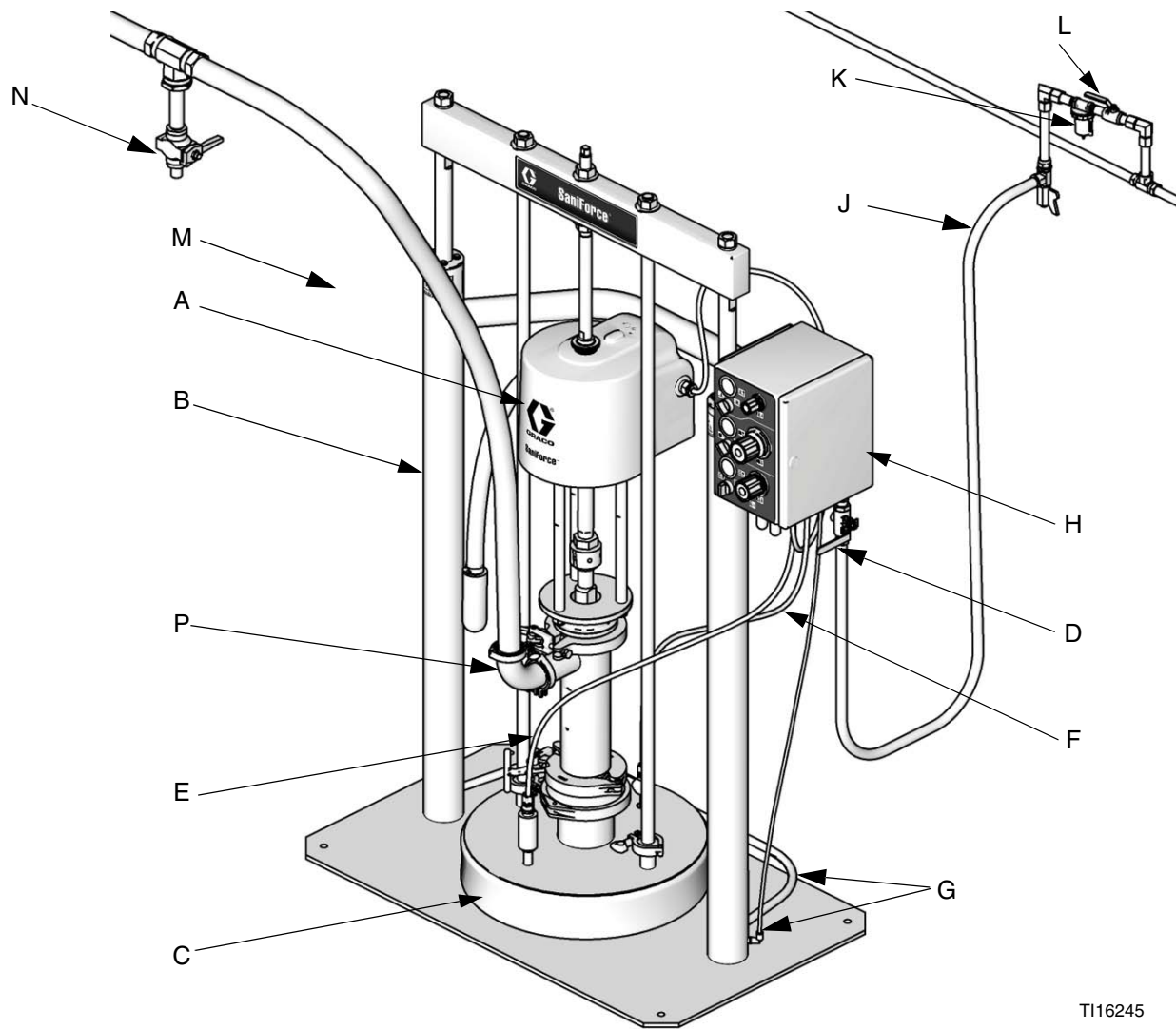
- **Inflatable Seal (C):** Adjust inflation level so the seal fits snug against the drum. A properly inflated seal wipes the sides of the drum and prevents material from passing the plate, to minimize waste.
- **Main air bleed valve (D):** Required in your system to shut off the air supply to the pump and ram. When closed, the valve bleeds off all air in the ram and pump.

### Air and Fluid Accessories

The following accessories are recommended for your system, and are available from your Graco distributor. Make certain all accessories are sized and pressure-rated to meet your system requirements

- **Fluid Drain Valve (M):** Required in your system to relieve fluid pressure between the pump and the dispense device.
- **Fluid Outlet Elbow (P):** Recommended for ram packages with piston pumps. Connects the fluid outlet hose to the pump fluid outlet.
- **Air Line Filter (K):** Removes harmful dirt and moisture from the compressed air supply.
- **Second bleed-type air valve (L):** isolates air line accessories and supply system for servicing. Locate upstream from all other air line accessories.





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**Key:**

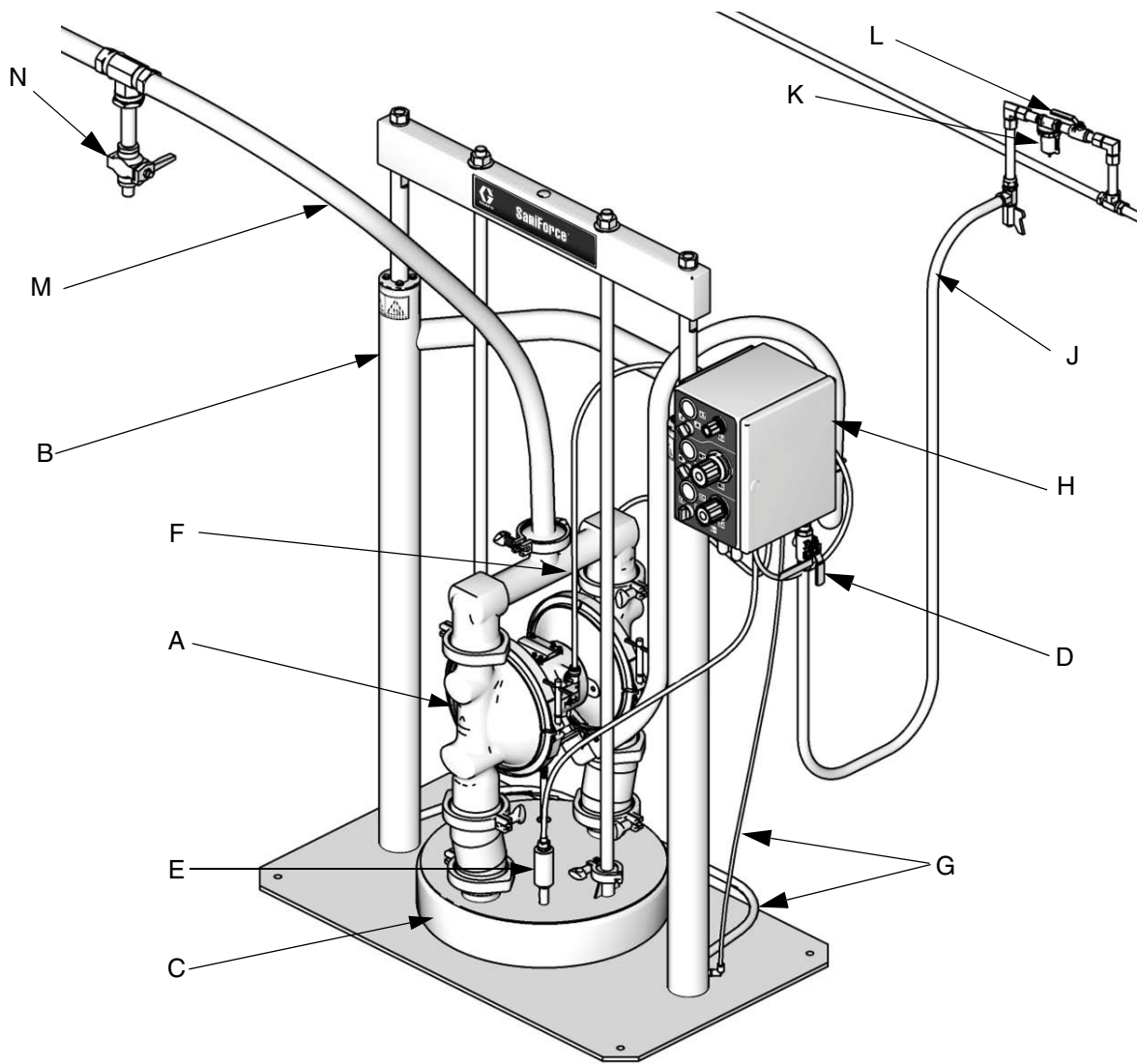
**Ram Package Components (Supplied)**

- A Pump
- B Ram
- C Inflatable Seal
- D Main Air Bleed Valve (required for pump and ram)
- E Air Assist Air Supply
- F Inflatable Seal Air Supply (partially visible)
- G Ram Director Air Supply
- H Enclosed Air Controls (see FIG. 3; exposed air controls also available.)

**Accessories (Not Supplied)**

- J Air Supply Hose (use 1/2 in. air hose, minimum)
- K Air Line Filter
- L Second Bleed-Type Air Valve
- M Fluid Outlet Hose
- N Fluid Drain Valve (required for pump)
- P Fluid Outlet Elbow

**FIG. 1: Typical Installation, Piston Pump**



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**FIG. 2. Typical Installation, Diaphragm Pump**

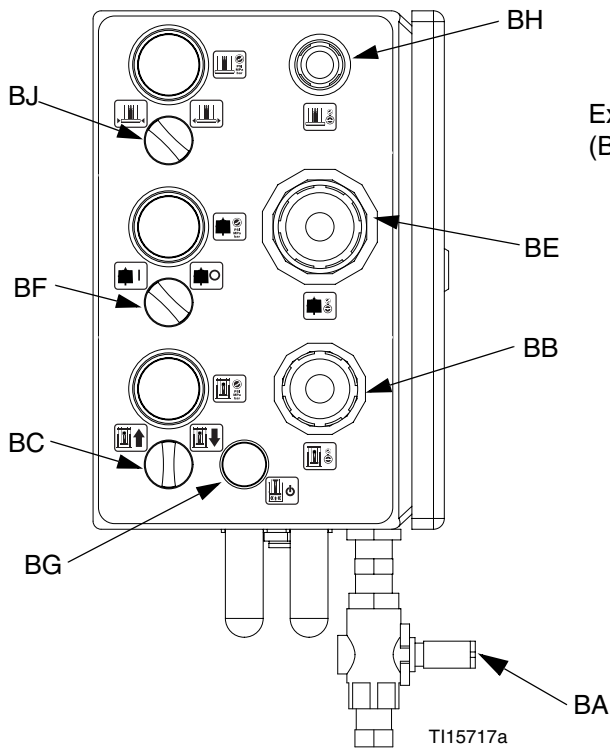
**Ram Package Components (Supplied)**

- A Pump
- B Ram
- C Inflatable Seal
- D Main Air Bleed Valve (required for pump and ram)
- E Air Assist Air Supply
- F Inflatable Seal Air Supply (partially visible)
- G Ram Director Air Supply
- H Enclosed Air Controls (*see Fig. 3; exposed air controls also available.*)

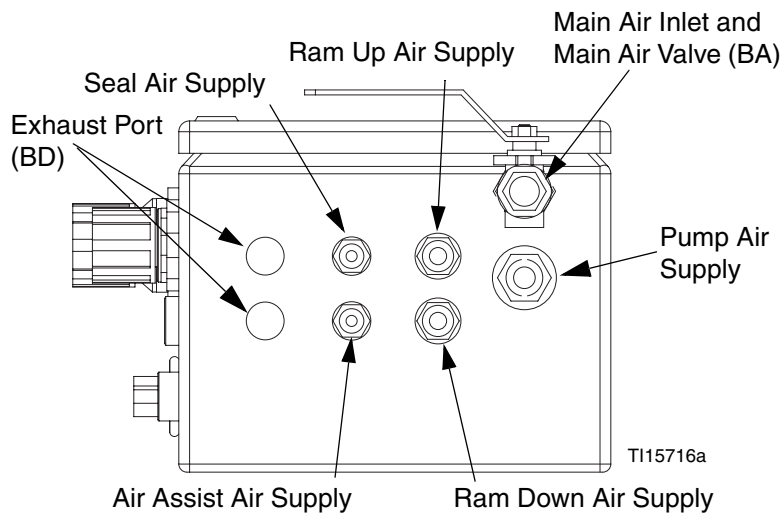
**Accessories (Not Supplied)**

- J Air Supply Hose (use 1/2 in. air hose, minimum)
- K Air Line Filter
- L Second Bleed-Type Air Valve
- M Fluid Outlet Hose
- N Fluid Drain Valve (required for pump)

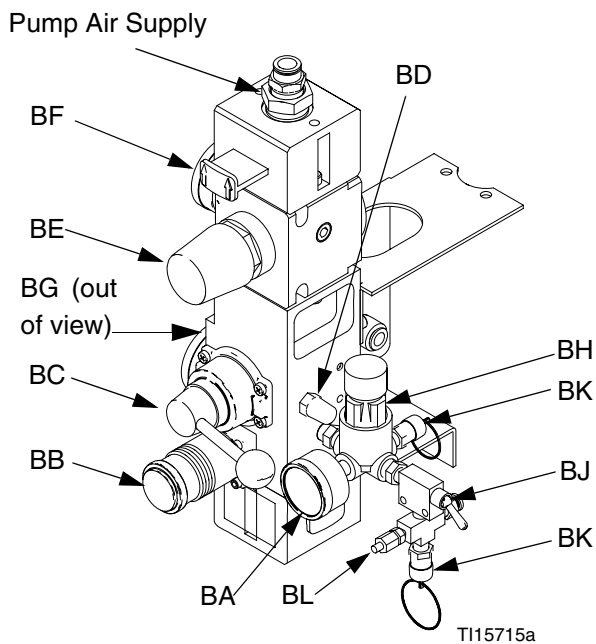
**Enclosed Air Control Module  
(Side View)**



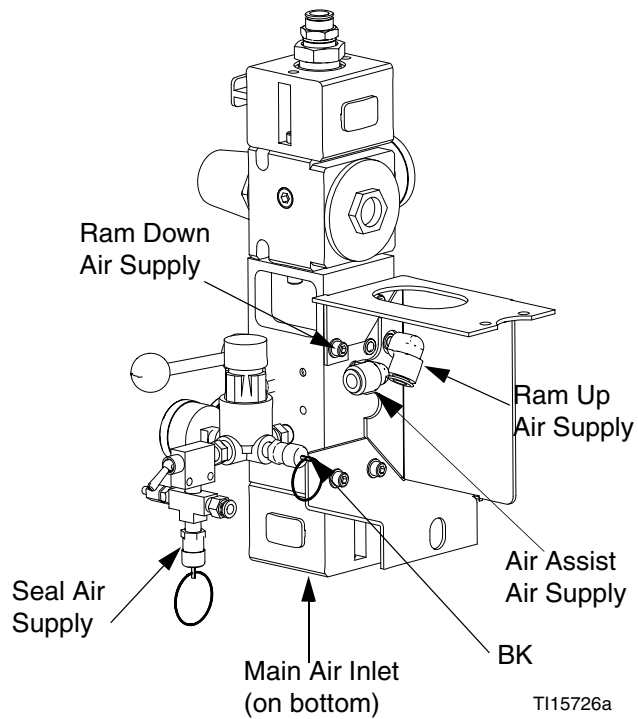
**Enclosed Air Control Module  
(Bottom View)**



**Exposed Air Control Module  
(Front View)**



**Exposed Air Control Module  
(Rear View)**



**FIG. 3: Air Control Modules**

## Integrated Air Controls

See FIG. 3. Air inlet size is 1/2 npt(f) on the Enclosed Air Controls and 3/4 npt(f) on the Exposed Air Controls. The integrated air controls include:

- **Main air valve (BA):** turns air on and off to the system. When closed, the valve relieves pressure downstream.
- **Ram air regulator (BB):** controls ram up and down pressure.
- **Ram director switch/valve (BC):** controls ram direction.
- **Exhaust port with muffler (BD)**
- **Air motor regulator (BE):** Controls air pressure to motor.
- **Air motor switch/slider valve (BF):** turns air on and off to the air motor. When closed, the valve relieves air trapped between it and the air motor.
- **Air assist valve (BG):** turns air on and off to push the ram plate out of an empty drum. Uses line air.
- **Inflatable seal air regulator (BH):** controls air pressure to the inflatable seal.
- **Inflatable seal switch (BJ):** controls the inflation and deflation of the ram plate seal.
- **Air relief valve (BK):** automatically relieves excessive pressure.
- **Seal bleed off valve (BL):** bleeds air from inflatable seal as needed for drum tapering. For Exposed Air Control Modules, See FIG. 3. For Enclosed Air Control Modules, the valve is located inside the box. See FIG. 4, page 15.
- **Muffler with needle valve (BN):** Allows adjustment of travel rate when lowering the ram plate. Located inside the box on the Enclosed Air Control Module. Not needed with the Exposed Air Control Module because ram rate can be adjusted with the director valve.

# Operation

## Pressure Relief Procedure

<p>Trapped air can cause the pump to cycle unexpectedly, which could result in serious injury from injection, splashing or moving parts. Relieve pressure when you stop pumping and before cleaning, checking, or servicing equipment.</p>					

**NOTE:** Do not close the main air valve until Step 6. The Enclosed Air Controls will not operate when the main air supply is in the Off position.

1. **Enclosed Air Controls:** See FIG. 3. Turn the air motor switch (BF) to off.  
**Exposed Air Controls:** See FIG. 3. Close the air motor slider valve (BF).
2. Back the ram director air regulator down to zero. Set the ram director switch/valve (BC) to DOWN. The ram will slowly drop.
3. Jog the director valve up and down to bleed air from ram cylinders.
4. Turn the inflatable seal switch (BJ) to off.
5. Open the fluid ball valve and/or dispensing valve to relieve fluid pressure.
6. Close the main air valve (BA).

## Flush Before First Use

The sanitary pump was assembled using sanitary lubricant on moving parts and was tested in water. Flush the pump thoroughly with an appropriate cleaning solution or disassemble and sanitize the parts before using the pump. See your separate pump manual for complete flushing and cleaning procedures for a sanitary pump. Check national, state, and local codes for specific limitations.

## Setting Inflatable Seal Pressure

1. Set an empty drum on the ram base. Set the director valve (BC) to DOWN. Lower the seal into the drum to the point of the drum's largest inside diameter.
2. Set the inflatable seal switch (BJ) to On. Adjust the seal air regulator until the seal just touches the inside of the drum.
3. Leave regulator set at this setting for this style of drum.
4. Set the inflatable seal switch to Off to deflate seal before raising the ram. Set the director valve (BC) to UP and let the ram rise to its full height.
5. Remove the empty drum.

**NOTE:** Use the lowest seal pressure possible to achieve desired results. Excessive seal pressure may cause the seal to roll off of the follower plate. To prevent overpressurization, a relief valve limits seal pressure to 30 psi (2.1 bar, 0.21MPa).

## Starting and Adjusting the Ram



- Do not inflate the seal when not installed on the follower plate. Wear safety glasses when operating the seal. Seal burst could result in injury.
- Keep hands and fingers away from the ram plate, pump fluid inlet, and lip of the fluid container when raising or lowering the ram to reduce risk of serious injury from moving parts.

1. Close all air regulators and air valves.
2. Turn on the main air supply.
3. Open the main air valve (BA), and set the ram director air regulator (BB) to 2.8 bar, 0.26 MPa (40 psi). Set the director valve (BC) to UP and let the ram rise to its full height.
4. Lubricate inflatable seal (C) with sanitary lubricant.
5. Set a full drum of fluid on the ram base, slide it back against the tube stop, and center it under the follower plate.
6. Remove the drum cover, and smooth the surface of the fluid with a straightedge.
7. Secure the bag liner to the drum with tape or a strap, to prevent it from sliding into the drum.

### NOTICE

Do not use drums that have side bungs or large dents with this ram. Rough bung openings or large dents will damage the inflatable seal or stop the ram plate, resulting in a runaway pump.

8. Set the director valve to DOWN. Set ram air regulator at about 40 psi (0.28 MPa, 2.8 bar). Lower the ram until the ram plate is about to enter the drum, and set the valve to neutral. Reposition the drum as necessary so the inflatable seal does not hit the drum lip.

**NOTE: Enclosed Controls:** To increase or decrease the speed of downward travel on the ram plate, adjust the valve on the muffler (BN) inside the control box. See FIG. 4, page 15.

**Exposed Controls:** To increase or decrease the speed of downward travel on the ram plate, adjust the director valve (BC).

9. Set the director valve to DOWN, and continue to lower the ram until the ram plate contacts the fluid.
10. Set seal air pressure regulator to pressure determined in **Setting Inflatable Seal Pressure**, page 13. Set the inflatable seal switch to On to inflate seal.

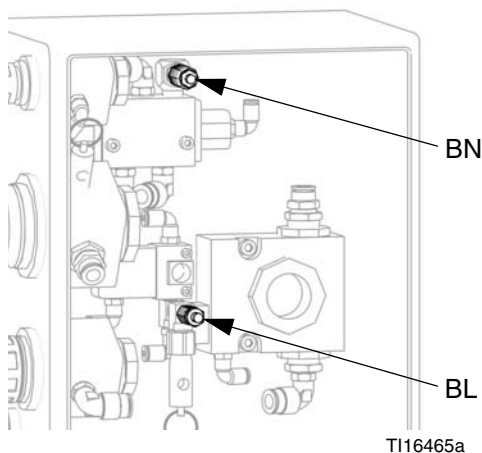
**NOTE:** If fluid leaks past the seal, increase the air pressure to the seal gradually until leaking stops. To prevent overpressurization, a relief valve limits seal pressure to 30 psi (2.1 bar, 0.21MPa).

## Starting and Adjusting the Pump



See FIG. 3, page 11.

1. Be sure the pump air regulator (BE) is closed. Set the ram air regulator (BB) to about 3.5 bar, 0.35 MPa (50 psi). Set the director valve (BC) to DOWN.
2. Start the pump as explained in the separate pump instruction manual.
3. Keep the director valve (BC) set to DOWN while the pump is operating.



### NOTES ON ADJUSTING PRESSURE:

Different combinations of seal and ram pressure may be necessary for proper seal and pump operation.

- If the pump does not prime properly with heavier fluids, increase air pressure to the ram.
- If fluid is forced out around the inflatable seal, decrease pressure to the ram.
- For diaphragm pump models, adjust DOWN pressure to the minimum level, to ensure that the pump inlet balls seat properly.

**NOTE:** If seal pressure builds when the seal enters a tapered portion of the drum, the relieve valve will activate. Turn the seal bleed-off valve (BL) counterclockwise to open it.

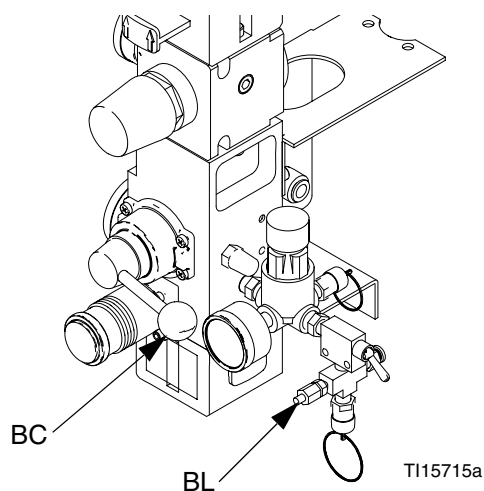


FIG. 4. Seal Bleed Valve and Muffler with Valve

## Changing Drums



Moving parts can pinch, cut, or amputate fingers and other body parts. Keep your hands and fingers away from the priming piston, ram plate, and lip of drum during operation and whenever the pump or ram is charged with air.

1. Stop the pump. Close the air motor valve (BF).
2. Set the inflatable seal valve (BJ) to deflate.
3. Set the director valve (BC) to UP to raise the ram plate.
4. Raise the ram plate until it is completely out of drum.
5. If needed, use air assist (BG) to help lift the ram plate.



Excessive air pressure in the material drum could cause the drum to rupture, causing serious injury and equipment damage. The platen must be free to move out of the drum.

- Never use drum blowoff air assist with a damaged drum.
- Always deflate the seal prior to lifting ram plate or engaging air assist.

6. Remove the empty drum.
7. Inspect the ram plate and, if necessary, remove any remaining material or buildup.
8. Place a full drum on ram base.
9. Lower the ram, and adjust the position of the drum relative to the ram plate, as explained under **Setting Inflatable Seal Pressure** on page 13.

## Shutdown

1. Set the director valve (BC) to neutral.
2. Follow **Pressure Relief Procedure**, page 13.
3. Follow the pump shutdown instructions in your separate pump manual.



## Cleaning Procedure



**NOTE:** The following instructions are a basic procedure for cleaning a sanitary ram.

- **Be sure** to follow your national and state sanitary standard codes and local regulations.
  - Use appropriate cleaning and disinfecting agents, at intervals appropriate for product processed.
  - Follow cleaning product manufacturer's instructions.
1. Remove the pump from the fluid container. Operate it to pump out as much fluid as possible.
  2. Flush the system thoroughly with an appropriate cleaning solution.
  3. Set the inflatable seal valve (BJ) to deflate.
  4. Set the director valve (BC) to UP to raise the ram plate.
  5. If needed, use air assist (BG) to help lift the ram plate.
  6. Raise the ram plate until it is completely out of the drum. Remove the empty drum.
  7. Disconnect inflatable seal supply air.

8. Pull the inflatable seal down to remove. Clean and sanitize the seal.

**NOTE:** Discoloration of the inflatable seal is normal, depending on the material being pumped.

9. Set the director valve to DOWN. Lower the ram plate.
10. Follow the **Pressure Relief Procedure**, page 13.
11. Disconnect all remaining air and fluid hoses, and remove air inlet and exhaust fittings.
12. Remove and clean the pump.

**NOTE:** The pump **must be disassembled** to thoroughly clean it. See your separate pump manual for complete flushing and cleaning procedures for a sanitary pump. Any damaged rubber parts **must** be replaced as they could harbor microorganisms that can contaminate the fluid.

13. Remove, clean, and sanitize the clamps (12, 13), ram plate (5) and seal (8).
14. Remove the air motor cover. Open the control box door. Wipe out any residual cleaning fluid or moisture.
15. Clean external surfaces of all parts before reassembly.

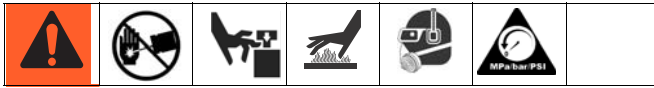
# Troubleshooting



1. Follow **Pressure Relief Procedure**, page 13.
2. Check all possible remedies in the Troubleshooting Chart before disassembling the pump.

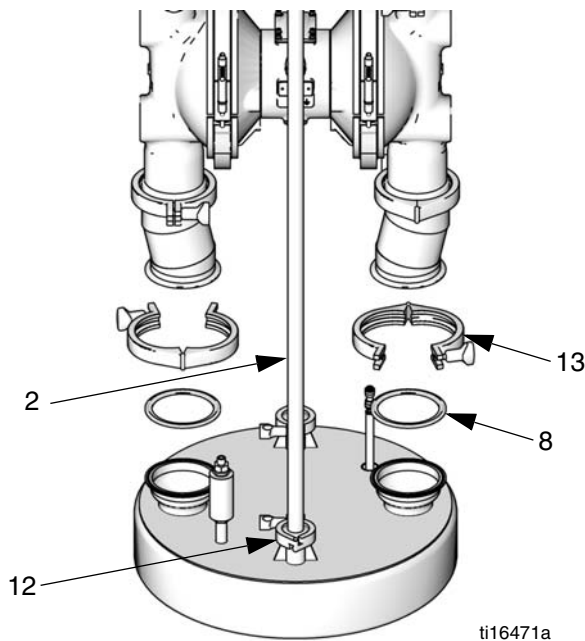
Problem	Cause	Solution
Ram will not raise or lower.	Closed air valve or clogged air line.	Open, clear.
	Not enough ram air pressure.	Increase.
	Worn or damaged piston.	Replace.
	Hand valve closed or clogged.	Open, clear.
Ram raises and lowers too fast.	Air pressure is too high.	Decrease.
	Travel rate is not properly adjusted.	Exposed Air Controls - open the director valve less for slower travel, more for faster travel. Enclosed Air Controls - open the needle valve on the muffler more for slower downward travel, less for faster downward travel.
Air leaks around cylinder rod.	Worn rod seal.	Replace.
Fluid squeezes past ram plate wipers.	Ram air pressure too high.	Decrease ram pressure.
	Worn or damaged wipers.	Replace.
	Inflatable seal pressure too low.	Increase seal pressure
Pump will not prime properly or pumps air.	Closed air valve or clogged air line.	Open, clear.
	Not enough air pressure.	Increase.
	Worn or damaged piston.	Replace. See pump manual.
	Hand valve closed or clogged.	Open, clear.
	Hand valve is dirty, worn, or damaged.	Clean, service.
Air assist valve will not hold drum down or push plate up.	Closed air valve or clogged air line.	Open, clear.
	Not enough air pressure.	Increase.
	Valve passage clogged.	Clean.
Seal pressure builds when drum tapers, activating the automatic pressure relief.	Seal bleed-off valve (BL) is closed	Open. See <b>Integrated Air Controls</b> , page 12.

# Repair



## Disconnect Diaphragm Pump

1. Follow **Pressure Relief Procedure**, page 13.
2. Disconnect inflatable seal supply air and air assist supply air.
3. Remove two clamps (13) holding the pump to the ram plate. Remove gaskets (8).
4. Lift pump carefully up and away from ram plate.
5. Remove two clamps (12) holding the tie rods (2) to the ram plate. Remove gaskets (7).
6. Open main air valve (BA). Set the director valve (BC) to UP to raise the ram. Set the director valve to neutral. Close main air valve (BA).
7. Pull the inflatable seal down to remove.



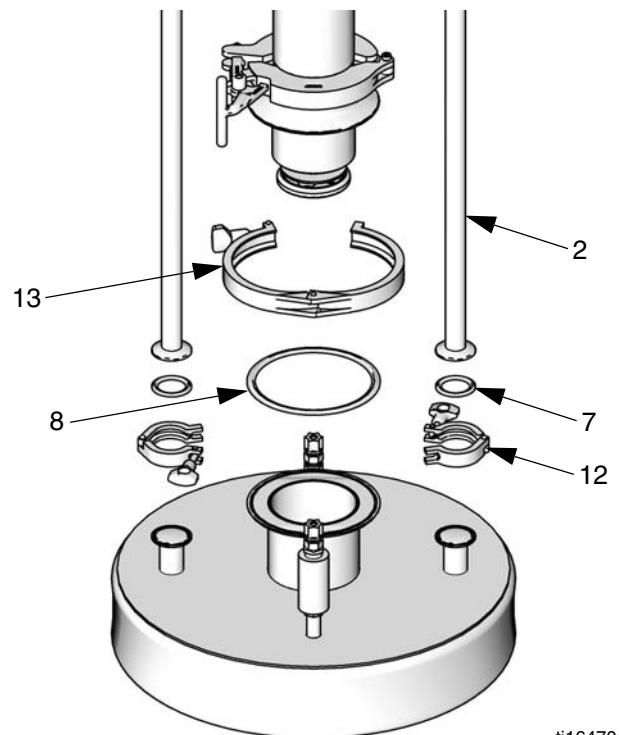
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**FIG. 5. Disconnect Diaphragm Pump**

**NOTE:** See your diaphragm pump manual for cleaning, repair, and parts information.

## Disconnect Piston Pump

1. Follow **Pressure Relief Procedure**, page 13.
2. Disconnect inflatable seal supply air and air assist supply air.
3. Remove two clamps (12) holding the tie rods (2) to the ram plate. Remove gaskets (7).
4. Remove nut (4) and washer (3) holding the air motor connecting rod (10) to the tie beam (114).
5. Open main air valve (BA). Set the director valve (BC) to UP to raise the ram. Set the director valve to neutral. Close main air valve (BA).
6. To remove the pump from the ram plate, remove clamp (13) and gasket (8). Carefully lift the pump up and away from the plate, using two people if needed.



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**FIG. 6. Remove piston pump**

**NOTE:** See your piston pump manual and air motor manual for cleaning, repair, and parts information.

## Service Ram Pistons



Always service both cylinders at the same time. When you service the piston rod always install new o-rings in the piston rod seal and ram piston.

- Order Piston Repair Kit 24G853 for a stainless steel ram. Parts are marked with a † in the illustrations and parts list.
- Order Piston Repair Kit 24G854 for a carbon steel ram. Parts are marked with an \* in the illustrations and parts list.

### Disassemble Piston and Seal

1. Follow **Pressure Relief Procedure**, page 13.
2. Follow **Disconnect Diaphragm Pump**, page 19, or **Disconnect Piston Pump**, page 19.
3. Remove nuts (117) and lock washers (116) holding the tie bar (114) to the piston rods (102). Also remove nuts (4) and washers (3) holding the tie bar to the tie rods (2).
4. **Stainless Steel Rams:** Remove four screws (124) and washers (123), then remove the piston cap (120). Remove outer o-ring (121) and inner o-ring (122) from piston cap.
5. Remove retaining ring (115).
6. Carefully pull the piston rod out of the top of the cylinder.

#### NOTICE

Do not tilt the piston rod when removing it from the base or when installing it. Such movement can damage the piston or the inside surface of the base cylinder.

7. Slide the piston seal housing (103) and spring (104) up off of the piston rod (102). Remove outer o-ring (105) and inner o-ring (106) from the piston seal housing (103).
8. Remove retaining ring (112) and bearing (111) from the piston seal housing (103).

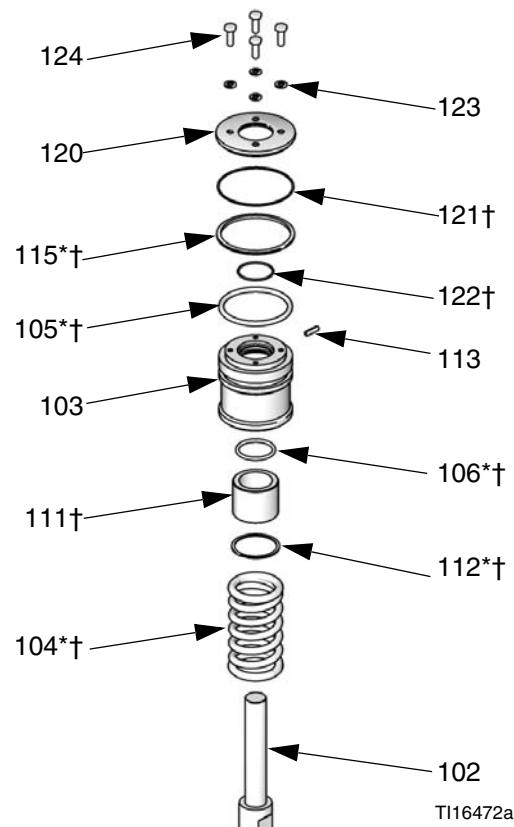


FIG. 7. Piston Rod Seal

9. Carefully lay piston (107) and rod (102) down so rod will not be bent. Remove nut (108), washer (109), and piston (107). Remove outer o-ring (105) and inner o-ring (110).
10. Inspect parts for wear or damage. Replace as necessary.

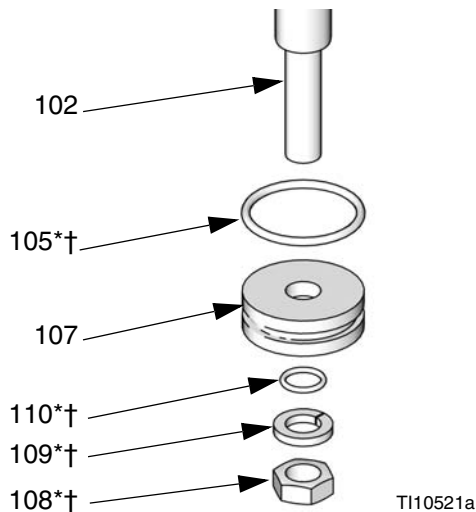


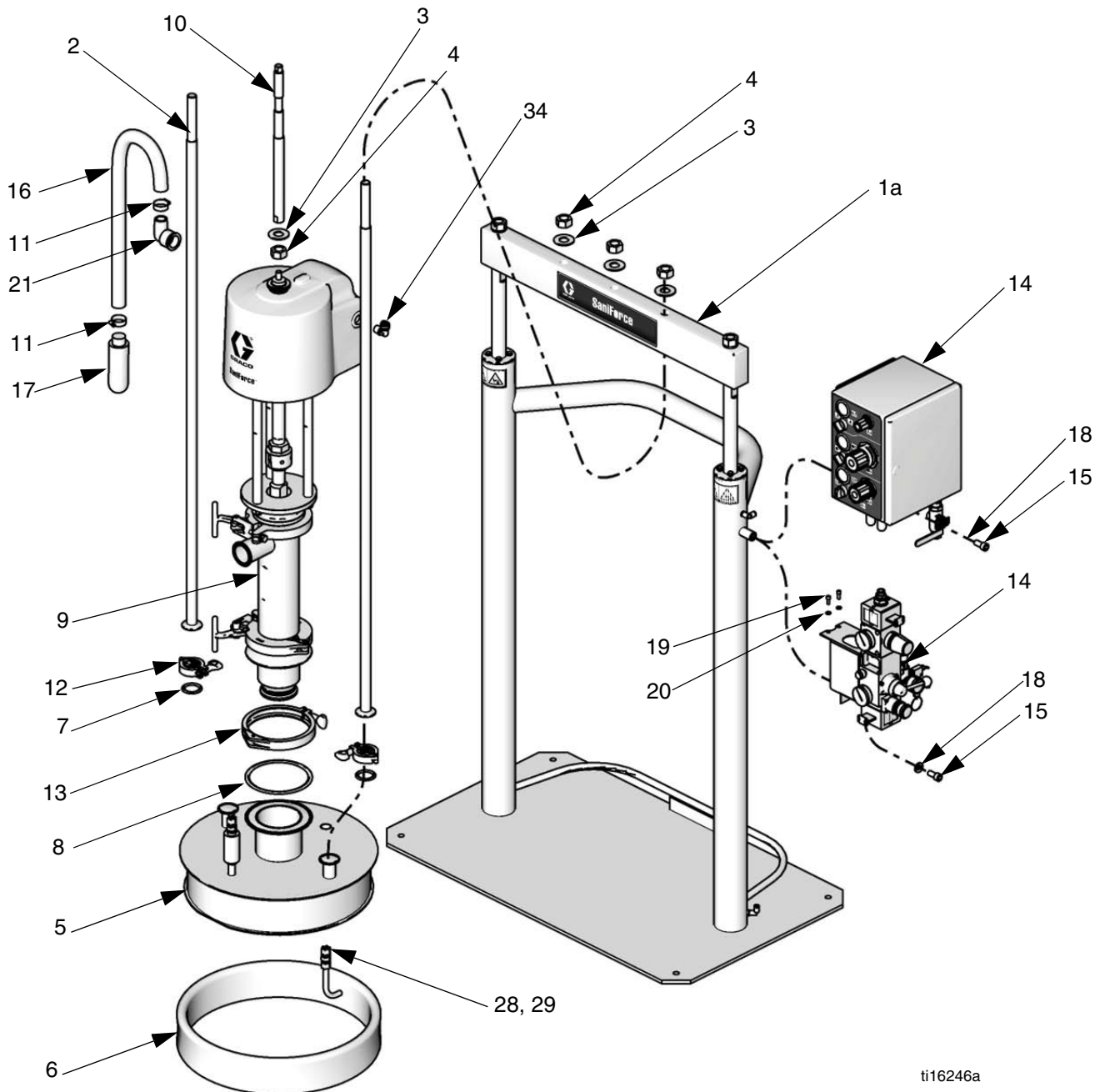
FIG. 8. Ram Piston.

### Reassemble Piston and Seal

1. Install new o-rings (105 and 110) and lubricate piston (107) and o-rings.
2. Apply medium strength thread sealant. Install piston (107), washer (109), and nut (108) on piston rod (102).
3. Carefully insert piston into cylinder and push piston rod straight down into cylinder.
4. Lubricate o-ring (106) and bearing (111). Install o-ring (106), bearing (111), and retaining ring (112) into piston seal housing (103).
5. Install new o-ring (105) on piston seal housing (103).
6. **Carbon Steel Rams:** Install new pin (113) if necessary, or be sure it is in place.
7. Lubricate o-ring (105) and piston seal housing (103).
8. Slide spring (104) and piston seal housing (103) on the rod (102). **Carbon Steel Rams:** orient the pin to the slot in the cylinder. **Stainless Steel Rams:** be careful not to push the piston seal housing down into cylinder.
9. Install retaining ring (115).
10. **Stainless Steel Rams:** Lubricate and install inner o-ring (122) into piston cap (120). Install outer o-ring (121) onto piston cap. Then install piston cap (120) onto the cylinder with screws (124) and washers (123).
11. Reattach the tie bar (114), washers (116, 3), and nuts (117, 4).

# Parts

## Piston Pump Ram Packages



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**Table 1. Common Parts, All Piston Pump Ram Packages (5:1, 6:1, and 12:1)**

Ref.	Part	Description	Qty
1	See Table 2	RAM, kit, includes Parts 1a, 14, 15, and 18; <i>see pages 26-29</i>	1
1a	-----	FRAME, ram, assembly, includes piston assembly	1
2	16G477	TIE ROD	2
3	512743	WASHER, flat 18-8 sst 7/8 in.	4
4	510221	NUT, hex st sst 7/8-9	4
5	16G240	PLATE, sanitary ram	1
6	16G242	SEAL, inflatable, 18.0 id	1
7	16D169	GASKET, sanitary 1.5	2
8	16D246	GASKET, 6" sanitary	1
9	See Table 2	PUMP	1
10	See Table 2	ROD, air motor connecting	1
11	101818	CLAMP, exhaust hose; <i>see page 29</i>	2
12	118598	CLAMP, sanitary, 1.5 in	2
13	16D245	CLAMP, 6" sanitary	1
14	16G396 16G393	CONTROLS, air; <i>see page 30</i> Enclosed, stainless steel Exposed, carbon steel	1
15	-----	SCREW, shdc,ss,.500x1.00	1
16	-----	HOSE, exhaust; <i>see page 29</i>	1
17	512914	MUFFLER, polyethylene, <i>see page 29</i>	1
18	-----	WASHER, back-up piston sst	1
19	101682	SCREW, cap, sch	2
20	100016	WASHER, lock	2
21	16A942	FITTING, exhaust hose	1
23	16G391	HOSE, drain, 2 ft, includes Part 24, <i>shipped loose, not shown</i>	1
24	-----	CLAMP, hose, <i>included with Part 23, not shown</i>	1

Ref.	Part	Description	Qty
28	-----	FITTING, 1/4 ptc to 1/4 ptc, FDA; <i>see page 29</i>	1
29	-----	FITTING, 1/4 ptc to 1/4 barb, FDA; <i>see page 29</i>	1
34	-----	FITTING, 1/2 npt x 1/2 ptc, FDA; <i>see page 29</i>	1
36	120306 103347	VALVE, safety; shown on page 30 80 psi, Models with 5:1 pumps 100 psi, Models with 6:1 or 12:1 pumps	1
125▲	15J074	LABEL, warning, ram, not shown	1
126▲	280574	LABEL, warning, pump, not shown	1

----- Not available separately.

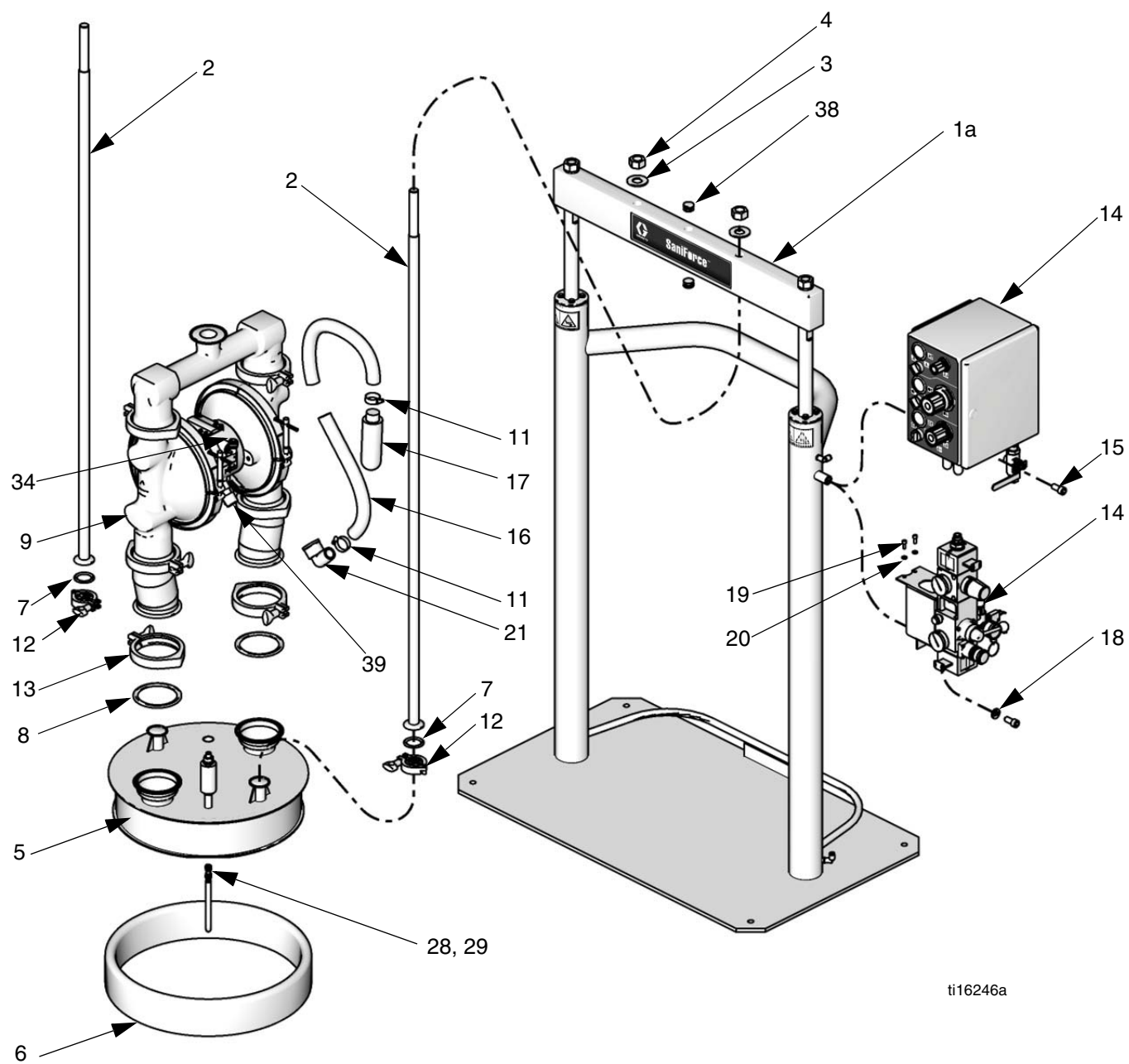
▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

**Table 2. Parts that Vary by Model**

Model	Ram Kit (1)	Pump (9)*	Rod (10)
24D708	24G861	24G741	16E169
24D712	24G860	24G741	16E169
24D714	24G859	24G741	16E169
24D720	24G861	24G742	16C303
24D724	24G860	24G742	16C303
24D726	24G859	24G742	16C303
24D776	24G861	24G739	16E168
24D780	24G860	24G739	16E168
24D782	24G859	24G739	16E168
24D788	24G861	24G740	16E169
24D792	24G860	24G740	16E169
24D794	24G859	24G740	16E169
24D647	24G861	24F625	16C303
24D651	24G860	24F625	16C303
24D653	24G859	24F625	16C303
24F188	24G861	24F626	16C303
24F189	24G860	24F626	16C303
24F190	24G859	24F626	16C303

\* See your pump manual for parts information.

# Diaphragm Pump Ram Packages



ti16246a



**Table 1. Common Parts, All Diaphragm Pump Ram Packages (2150 and 3150)**

Ref.	Part	Description	Qty.
1	See Table 2	RAM, kit, includes Parts 1a, 14, 15, and 18; <i>see pages 26-29</i>	1
1a	-----	FRAME, ram, assembly, includes piston assembly	1
2	16G477	TIE ROD	2
3	512743	WASHER, flat 18-8 sst 7/8 in.	2
4	510221	NUT, hex st sst 7/8-9	2
5	16G241	PLATE, ram	1
6	16G242	SEAL, inflatable, FDA, neoprene, 18 in. (46 cm)	1
7	16D169	GASKET, sanitary 1.5 in.	2
8	15D346	GASKET, sanitary	2
9	See Table 2	PUMP	1
11	101818	CLAMP, exhaust hose; <i>see page 29</i>	2
12	118598	CLAMP, 1.5 in	2
13	510490	CLAMP, 4 in.	2
14	16G396 16G393	CONTROLS, air; <i>see page 30</i> Enclosed, stainless steel Exposed, carbon steel	1
15	-----	SCREW, 1/2-13 unc, sst	1
16	-----	HOSE, exhaust; <i>see page 29</i>	1
17	512914	MUFFLER, polyethylene, <i>see page 29</i>	1
18	-----	WASHER, sst	1
19	101682	SCREW, cap, 1/4-20, carbon steel	2
20	100016	WASHER, lock	2
21	16A942	FITTING, exhaust hose	1
28	-----	FITTING, 1/4 ptc to 1/4 ptc, FDA; <i>see page 29</i>	1
29	-----	FITTING, 1/4 ptc to 1/4 barb, FDA; <i>see page 29</i>	1
34	-----	FITTING, 1/2 npt x 1/2 ptc, FDA; <i>see page 29</i>	1
36	113811	VALVE, safety, 100 psi	1
38	16D049	PLUG, Models 24D651 and 24F189 only	2
39	16C946	FITTING, air	1
125▲	15J074	LABEL, warning, ram, not shown	1
127▲	188621	LABEL, warning, pump, not shown	1
128▲	198382	LABEL, warning, pump, not shown	1

----- Not available separately.

▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

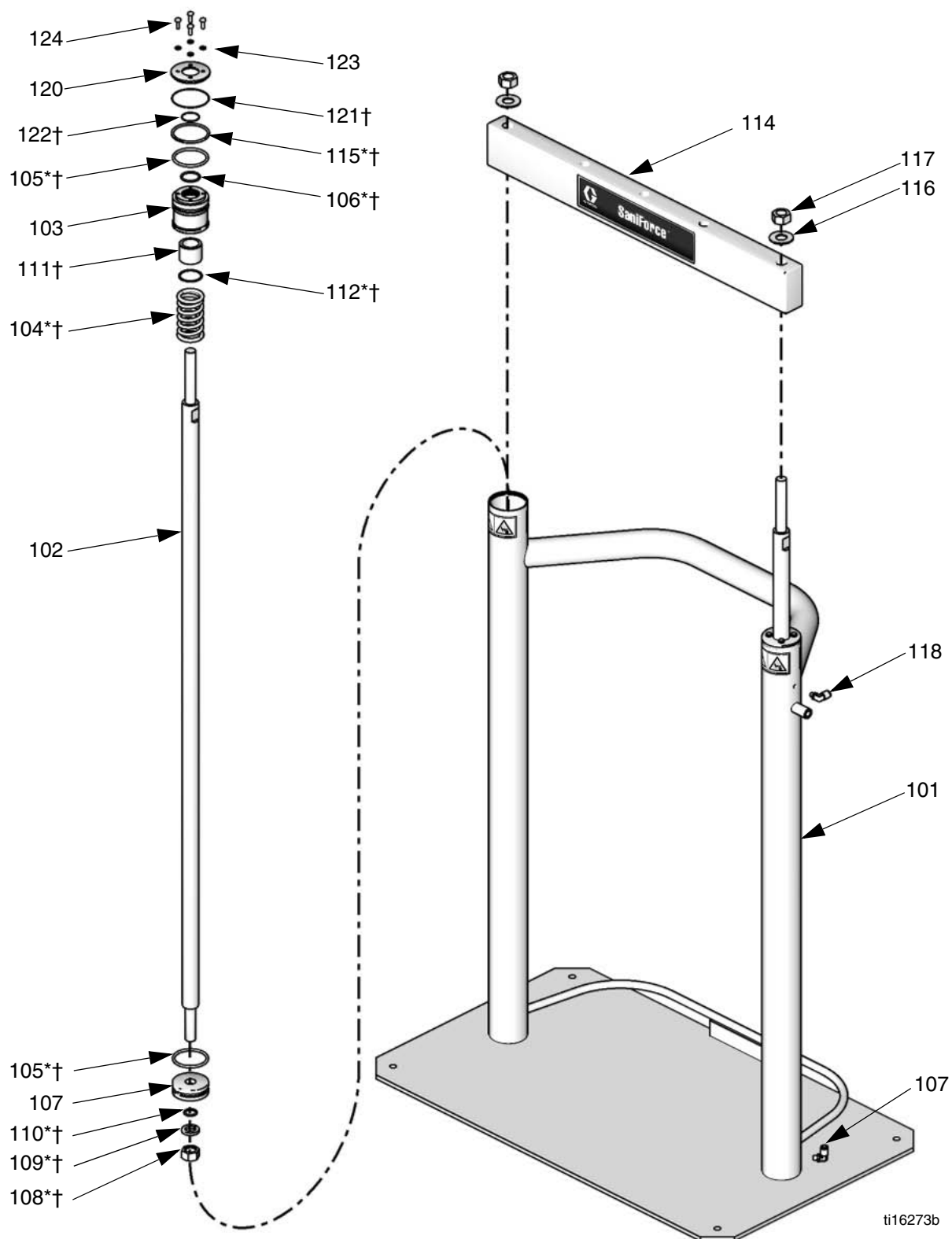
**Table 2. Parts that Vary by Model**

Model	Ram Kit (1)	Pump (9)*
24G542	24G861	24D663
24F191	24G860	24D663
24G543	24G859	24D663
24F192	24G861	24G744
24F193	24G860	24G744
24F194	24G859	24G744
24D922	24G861	24C124
24D926	24G860	24C124
24D928	24G859	24C124
24D932	24G860	24J388
24D936	24G859	24J388
24D940	24G861	24J388
24D944	24G861	248274
24D948	24G860	248274
24D952	24G859	248274
24J364	24G861	24J389
24J365	24G860	24J389
24J366	24G859	24J389

\* See your pump manual for parts information.

## Ram Kits

### Kits 24G859 and 24G861, Stainless Steel Frame



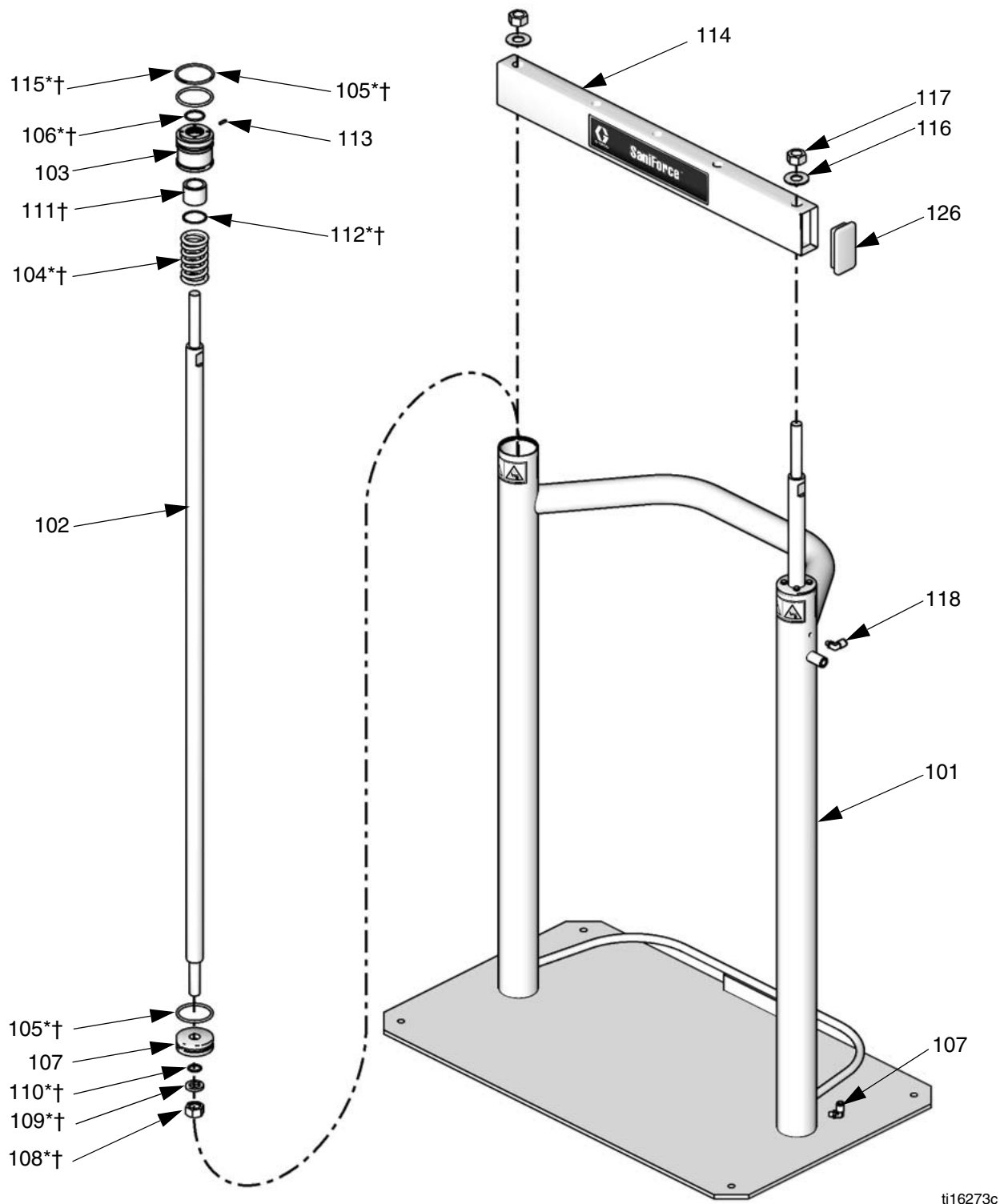
## Kits 24G859 and 24G861, Stainless Steel Frame

Ref.	Part	Description	Qty.
14	16G396 16G393	CONTROLS, air; <i>see page 30</i> Enclosed, stainless steel Exposed, carbon steel	1
15	-----	SCREW, 1/2-13 unc, sst	1
18	-----	WASHER, sst	1
101	-----	RAM, frame	1
102	16G478	ROD, piston	2
103	16E383	BEARING	1
104†	160138	SPRING, compression	1
105†	160258	O-RING	2
106†	156698	O-RING	1
107	16E384	PISTON	1
108†	101535	NUT	1
109†	101533	WASHER	1
110†	156401	O-RING	1
111†	-----	BEARING	1
112†	15F453	RING, retaining	1
114	16G480	BAR, tie	1
115†	-----	RING, retaining, 3.06 dia	2
116	512743	WASHER, flat 18-8 sst 7/8 in.	2
117	510221	NUT, hex st sst 7/8-9	2
118	24G857	FITTING, 1/8 npt to 3/8 ptc	2
120	16E648	CAP, piston	2
121†	-----	O-RING	2
122†	111098	PACKING, o-ring, cylinder	2
123	104123	WASHER, lock, spring	8
124	102023	SCREW, cap, hex hd	8
125▲	15J074	LABEL, warning, not shown	1

▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

† Parts included in stainless steel Piston Repair Kit 24G853.

# Ram Kit 24G860, Carbon Steel Frame



ti16273c

## Ram Kit 24G860, Carbon Steel Frame

Ref.	Part	Description	Qty.
14	16G396 16G393	CONTROLS, air; <i>see page 30</i> Enclosed, stainless steel Exposed, carbon steel	1
15	-----	SCREW, 1/2-13 unc, sst	1
18	-----	WASHER, sst	1
101	-----	RAM, frame	1
102	16G478	ROD, piston	2
103	15M295	BEARING	1
104*	160138	SPRING, compression	1
105*	160258	O-RING	2
106*	156698	O-RING	1
107	183943	PISTON	1
108*	101535	NUT	1
109*	101533	WASHER	1
110*	156401	O-RING	1
111*	-----	BEARING	1
112*	15F453	RING, retaining	1
113	15U979	PIN, spring	1
114	16G479	BAR, tie	1
115*	-----	RING, retaining, 3.06 dia	2
116	512743	WASHER, flat 18-8 sst 7/8 in.	2
117	510221	NUT, hex st sst 7/8-9	2
119	24G856	FITTING, Connector tube	2
125▲	15J074	LABEL, warning	4
126	189559	CAP, end	2

▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

\* Parts included in carbon steel Piston Repair Kit 24G854.

## Muffler Kit 16G390

Ref.	Part	Description	Qty.
17	512914	MUFFLER, polyethylene	2

## Exhaust Assembly Kit 16G389

Ref.	Part	Description	Qty.
17	512914	MUFFLER, polyethylene	1
16	-----	HOSE, exhaust, 6 ft.	1
11	101818	CLAMP, hose	2

## PTC Fittings Kit 16G392

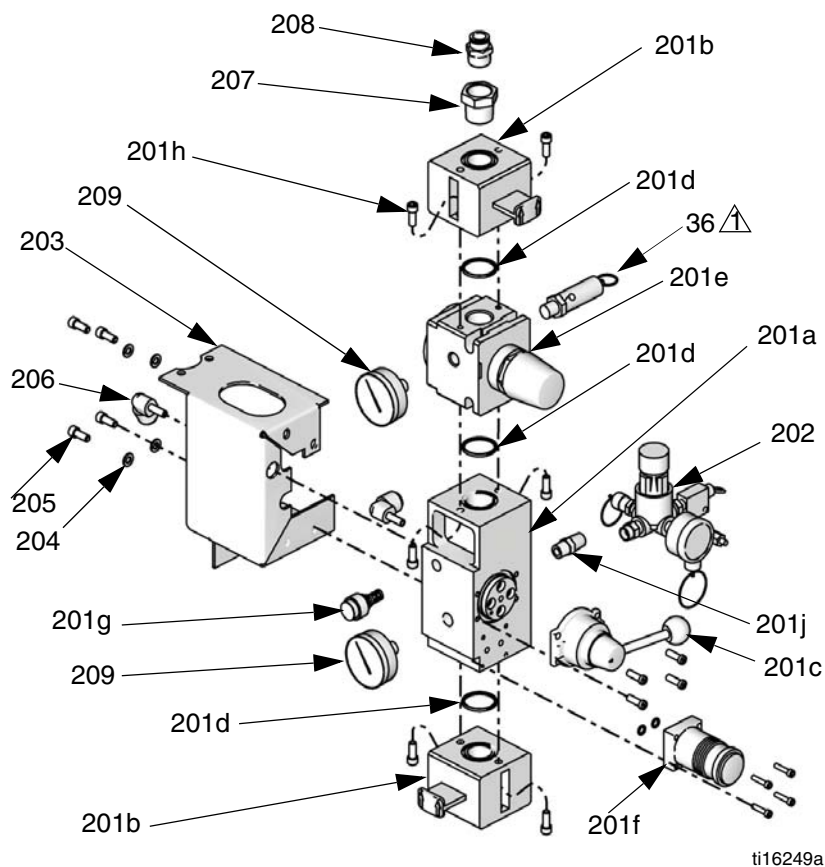
Ref.	Description	Qty.
28	FITTING, 1/4 ptc to 1/4 ptc, FDA	1
29	FITTING, 1/4 ptc to 1/4 barb, FDA	1
34	FITTING, 1/2 npt x 1/2 ptc, FDA	1

## Conversion Kit 24H370

Order this kit to convert a ram with a 12:1 piston pump to a ram with a 3150 diaphragm pump.

Ref.	Description	Qty.
5	PLATE, ram	1
6	SEAL, inflatable, FDA, neoprene, 18 in. (46 cm)	1
8	GASKET, sanitary	1
9	PUMP, 3150, Model 24C124	1
13	CLAMP, 4 in.	2
21	FITTING, exhaust hose	1
28	FITTING, 1/4 ptc to 1/4 ptc, FDA	1
29	FITTING, 1/4 ptc to 1/4 barb, FDA	1
34	FITTING, 1/2 npt x 1/2 ptc, FDA	1
39	FITTING, air	1
40	CONNECTOR, union, 1/2 to 1/2 PTC	1

## Air Controls Kits



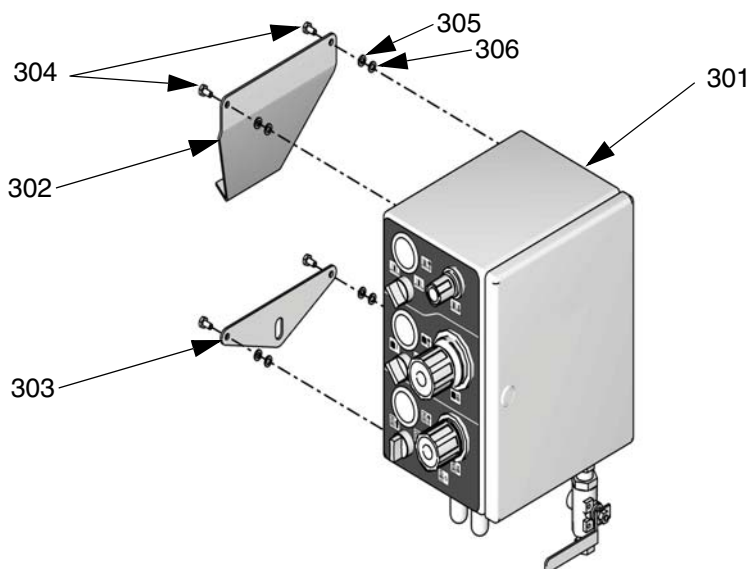
⚠ The safety valve is part of the ram package. See Table 1 on page 23 (piston pump packages) or page 25 (diaphragm pump packages).

### Kit 16G396 Air Controls Carbon Steel, Exposed

Ref.	Part	Description	Qty.
201	----	CONTROL, air, includes 201a-201m	1
201a	----	MANIFOLD	1
201b	121108	VALVE, shutoff	2
201c	121107	VALVE, control	1
201d	121110	O-RING	3
201e	----	REGULATOR	1
201f	121106	REGULATOR	1
201g	121109	VALVE, blow-off	1
201h	121112	SCREW, cap	6
201j	517449	MUFFLER, 1/4 npt	1
201k	100721	PLUG, pipe	1
201m	120602	FITTING, cartridge, not shown	3
202	16E534	CONTROL, air assist option	1
203	----	BRACKET, air control	1
204	100016	WASHER, lock	4
205	101682	SCREW, cap, sch	4
206	16A943	ELBOW, plug-in	2
207	100896	BUSHING, pipe	1
208	114111	CONNECTOR, male	1
209	C36260	GAUGE, pressure, air	2

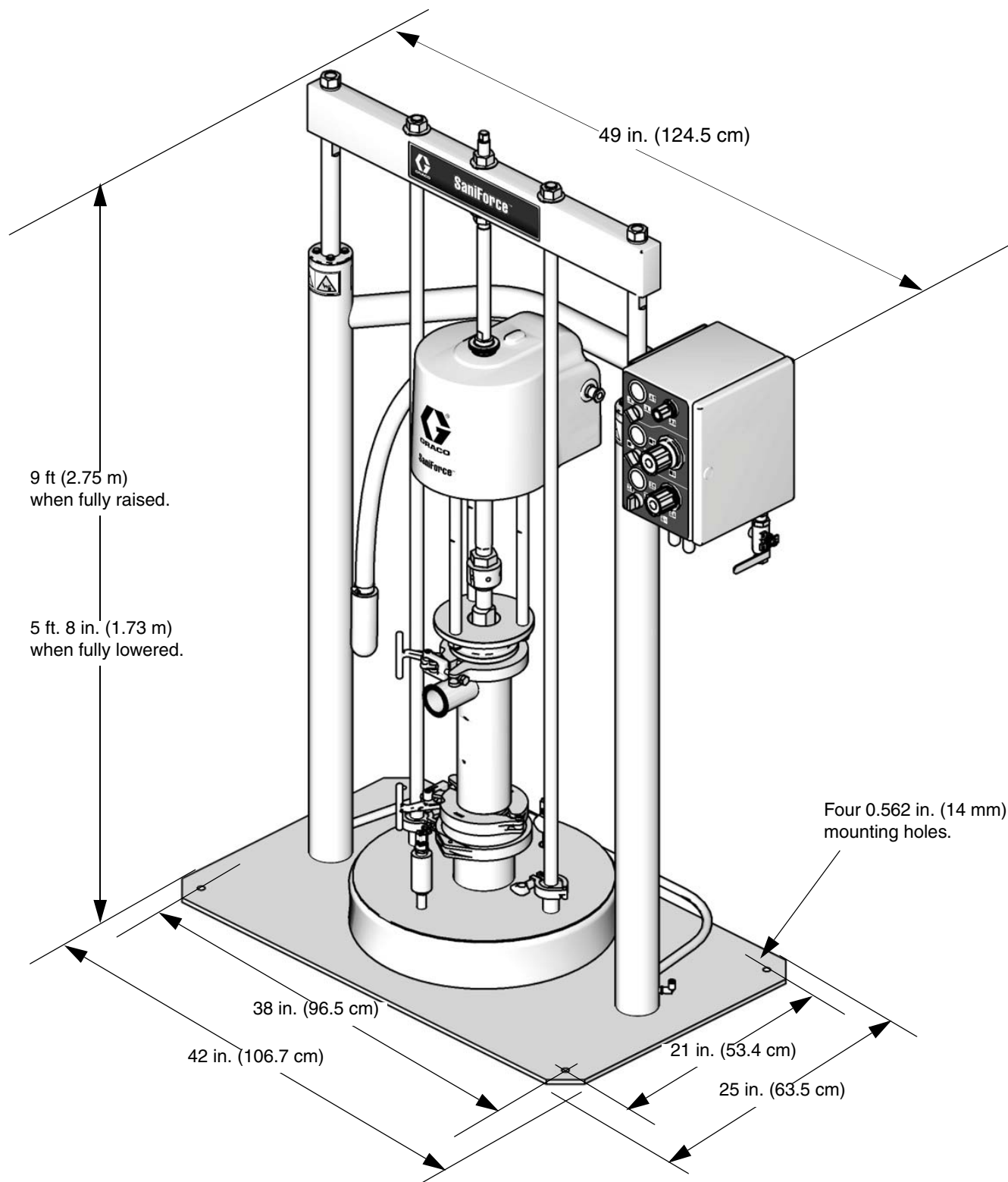
### Kit 16G393 Air Controls Stainless Steel, Enclosed

Ref.	Part	Description	Qty.
301	Parts not sold separately	CONTROL, air	1
302		BRACKET, control module	1
303		BRACKET, control module	1
304		SCREW, cap, hex hd	4
305		WASHER, lock, spring	4
306		NUT, full, hex, regular	4



ti16250a

# Dimensions



TI15713a

# Technical Data

## Maximum Fluid Working Pressure

5:1 Ratio Piston Pumps . . . . .	410 (2.8 MPa, 28.3 bar)
6:1 Ratio Piston Pumps . . . . .	650 (4.5 MPa, 44.8 bar)
12:1 Ratio Piston Pumps . . . . .	1450 (10 MPa, 100.0 bar)
Diaphragm Pumps . . . . .	120 (0.8 MPa, 8.2 bar)

## Maximum Package Air Inlet Pressure

Piston Pump Ram Packages . . . . .	100 psi (0.7 MPa, 6.9 bar)
Diaphragm Pump Ram Packages . . . . .	120 psi (0.8 MPa, 8 bar)

## Maximum Ram Air Inlet Pressure . . . . . 100 psi (0.7 MPa, 6.9 bar)

## Maximum Pump Air Inlet Pressure

6:1 and 12:1 Ratio Piston Pumps . . . . .	100 psi (0.7 MPa, 6.9 bar)
5:1 Ratio Piston Pumps . . . . .	80 psi (0.6 MPa, 5.5 bar)
Diaphragm Pumps . . . . .	120 psi (0.8 MPa, 8 bar)

## Air Inlet Size

Enclosed Controls . . . . .	1/2 npt(f)
Exposed Controls . . . . .	3/4 npt(f)

## Maximum Ram Package Operating Temperature

5:1 Ratio Piston Pump Ram Packages . . . . .	140°F (60°C)
All Other Ram Packages . . . . .	150°F (66°C)

## Maximum Drum ID . . . . . 24 in. (61 cm)

## Minimum Drum ID

Straight-Sided Drum . . . . .	19.4 in. (49 cm)
Tapered Drum . . . . .	19.0 in. (48 cm)

## Maximum Drum Height . . . . . 40.75 in. (104 cm)

## Sound Data . . . . . *See your pump manual.*

## Wetted Parts

Inflatable Seal . . . . .	Neoprene
Ram (plate, fittings, gaskets) . . . . .	300-Series Stainless steel, Buna-N, and Polypropylene
5:1 Ratio Piston Pumps ( <i>see pump manual</i> ) . . . . .	Stainless steel, Buna-N, FKM, PTFE and UHMWPE. Priming piston pumps also have Polychloroprene and Nylon. Model 24F197 also has Silicone.
6:1 Ratio Piston Pumps ( <i>see pump manual</i> ) . . . . .	Stainless steel, Buna-N, Polychloroprene, Nitrile, Nylon, and UHMWPE. Certain models have PTFE packings.
12:1 Ratio Piston Pumps ( <i>see pump manual</i> ) . . . . .	Stainless steel, Acetal, Nitrile, PTFE, UHMWPE
Diaphragm Pumps ( <i>see pump manual</i> ) . . . . .	316 Stainless steel, Santoprene®, Buna-N, Fluoroelastomer, EPDM, Weighted CR, Weighted Polychloroprene, and PTFE



## Package Weights

Piston Pump Ram Packages			Diaphragm Pump Ram Packages		
Model	Weight		Model	Weight	
	lb	kg		lb	kg
24D708	413	187	24G542	450	204
24D712	433	196	24F191	464	210
24D714	428	194	24G543	464	210
24D720	417	189	24F192	450	204
24D724	437	198	24F193	464	210
24D726	432	196	24F194	464	210
24D776	353	160	24D922	428	194
24D780	372	169	24D926	443	201
24D782	367	166	24D928	443	201
24D788	356	161	24D932	443	201
24D792	375	170	24D936	442	200
24D794	370	168	24D940	428	194
24D647	440	200	24D944	428	194
24D651	459	208	24D948	443	201
24D653	454	206	24D952	442	200
24F188	440	200	24J364	428	194
24F189	459	208	24J365	443	201
24F190	454	206	24J366	443	201

# 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.

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

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