

# Dura-Flo<sup>®</sup> 1200 Pumps

308360D

Stainless Steel

EN

*For dispensing non-corrosive and non-abrasive oils and lubricants only. For professional use only.*

## 237516 Pump, Series A, 21:1 Ratio, with Bulldog<sup>®</sup> Air Motor

2100 psi (14.5 MPa, 145 bar) Maximum Fluid Working Pressure

100 psi (0.7 MPa, 7 bar) Maximum Air Input Working Pressure

## 237517 Pump, Series A, 13:1 Ratio, with Senator<sup>®</sup> Air Motor

1300 psi (9 MPa, 90 bar) Maximum Fluid Working Pressure

100 psi (0.7 MPa, 7 bar) Maximum Air Inlet Working Pressure

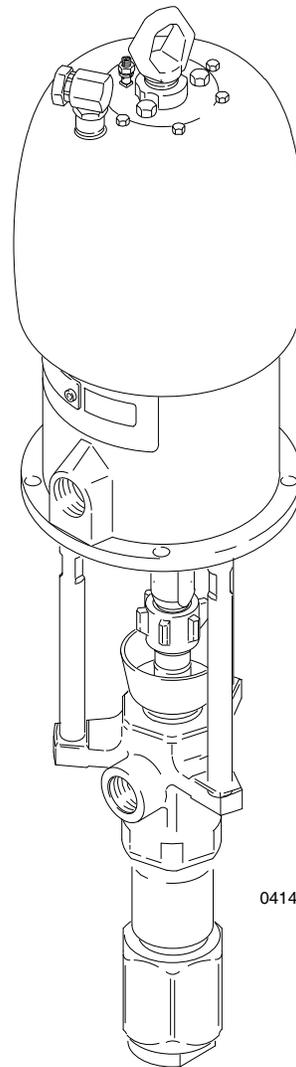
See page 24 for model information, including maximum working pressure and approvals.



### Important Safety Instructions

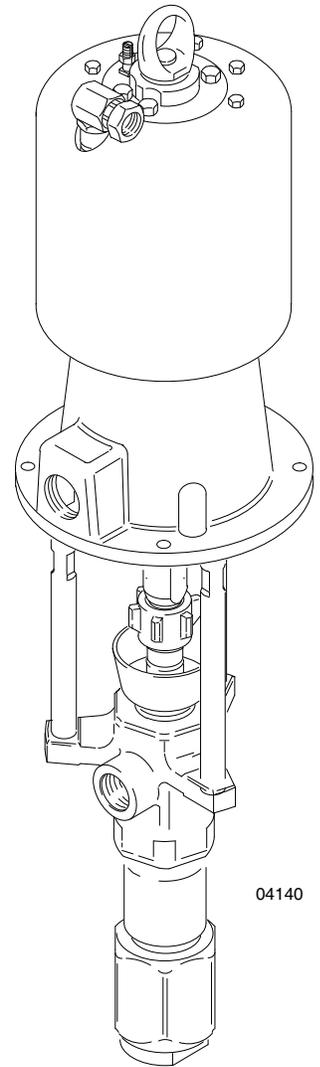
Read all warnings and instructions in this manual before using the equipment. Save these instructions.

Model 237516



04143

Model 237517



04140



# Contents

<b>Related Manuals</b> .....	<b>2</b>	<b>Maintenance</b> .....	<b>12</b>
<b>Warnings</b> .....	<b>3</b>	Required Tools .....	12
<b>Installation</b> .....	<b>5</b>	Disconnect the Displacement Pump .....	12
Grounding .....	5	Connect the Displacement Pump .....	12
Accessories .....	5	Disassemble the Displacement Pump .....	14
Flush Before Using Equipment .....	6	Assemble the Displacement Pump .....	16
Typical Installation .....	7	<b>Parts</b> .....	<b>19</b>
<b>Operation</b> .....	<b>8</b>	Packing Kits .....	21
Pressure Relief Procedure .....	8	<b>Performance Charts</b> .....	<b>22</b>
Flush the Equipment .....	8	Model 237516 Bulldog Pump .....	22
Packing Nut .....	9	Model 237517 Senator Pump .....	22
Start and Adjust the Pump .....	9	<b>Dimensions</b> .....	<b>23</b>
Shutdown and Care for the Pump .....	10	Mounting Hole Layout .....	23
<b>Troubleshooting</b> .....	<b>11</b>	<b>Technical Specifications</b> .....	<b>24</b>
		<b>California Proposition 65</b> .....	<b>25</b>
		<b>Graco Standard Warranty</b> .....	<b>26</b>

## Related Manuals

Manual in English	Description
311827	Dura-Flo Lowers
307049	Bulldog Air Motor
307592	Senator and Quiet Senator Air Motors

# 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><b>EQUIPMENT MISUSE HAZARD</b></p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> <li>Do not operate the unit when fatigued or under the influence of drugs or alcohol.</li> <li>Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See <b>Technical Specifications</b> in all equipment manuals.</li> <li>Use fluids and solvents that are compatible with equipment wetted parts. See <b>Technical Specifications</b> in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheets (SDSs) from distributor or retailer.</li> <li>Do not leave the work area while equipment is energized or under pressure.</li> <li>Turn off all equipment and follow the <b>Pressure Relief Procedure</b> when equipment is not in use.</li> <li>Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.</li> <li>Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.</li> <li>Make sure all equipment is rated and approved for the environment in which you are using it.</li> <li>Use equipment only for its intended purpose. Call your distributor for information.</li> <li>Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.</li> <li>Do not kink or over bend hoses or use hoses to pull equipment.</li> <li>Keep children and animals away from work area.</li> <li>Comply with all applicable safety regulations.</li> </ul>
    	<p><b>SKIN INJECTION HAZARD</b></p> <p>High-pressure fluid from gun, 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 spray without tip guard and trigger guard installed.</li> <li>Engage trigger lock when not spraying.</li> <li>Do not point gun at anyone or at any part of the body.</li> <li>Do not put your hand over the spray tip.</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 spraying 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>



# WARNING



## MOVING PARTS HAZARD

Moving parts can pinch, cut or amputate fingers and other body parts.

- Keep clear of moving parts.
- Do not operate equipment with protective guards or covers removed.
- Equipment can start without warning. Before checking, moving, or servicing equipment, follow the **Pressure Relief Procedure** and disconnect all power sources.



## FIRE AND EXPLOSION HAZARD

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

- Use equipment only in well-ventilated area.
- Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static sparking).
- Ground all equipment in the work area. See **Grounding** instructions.
- Never spray or flush solvent at high pressure.
- 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 hoses.
- Hold gun firmly to side of grounded pail when triggering into pail. Do not use pail liners unless they are anti-static or conductive.
- **Stop operation immediately** if static sparking occurs or you feel a shock. Do not use equipment until you identify and correct the problem.
- Keep a working fire extinguisher in the work area.



## TOXIC FLUID OR FUMES HAZARD

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

- Read Safety Data Sheets (SDSs) to know the specific hazards of the fluids you are using.
- Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.



## PERSONAL PROTECTIVE EQUIPMENT

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

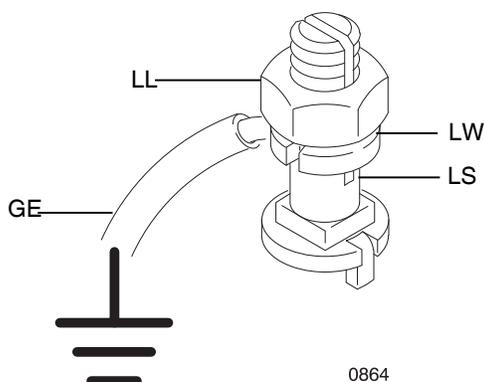
- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.

# Installation

## Grounding



**Pump:** use ground wire and clamp (supplied). Loosen grounding lug locknut (LL) and washer (LW). Insert one end of a 1.5 mm<sup>2</sup> (12 ga) minimum ground wire end (GW) into lug (LS) slot and tighten locknut securely. Connect ground clamp to a true earth ground. Order part 237569 ground wire and clamp.



**Air and fluid hoses:** use only electrically conductive hoses. Check electrical resistance of hoses. If total resistance to ground exceeds 29 megohms, replace hose immediately.

**Air compressor:** follow manufacturer's recommendations.

**Spray gun:** ground through connection to a properly grounded fluid hose and pump.

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

**Object being sprayed:** 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 spray gun/dispense valve firmly to the side of a grounded metal pail, then trigger the gun/valve.

## Accessories

Install the following accessories in the order shown in FIG. 1, page 7, using adapters as necessary. Contact your Graco representative or Graco Technical Assistance for assistance in designing a system to suit your needs.

### Air and Fluid Hoses

Be sure all air hoses (H) and fluid hoses (N and P) are properly sized and pressure-rated for your system. Use only electrically conductive hoses. Fluid hoses must have spring guards on both ends. Use a whip hose (P) and a swivel (R) between the main fluid hose (N) and the gun (S) to allow freer gun movement

### Mounting Accessories

Mount the pump (A) to suit the type of installation planned. FIG. 1, page 7, illustrates a wall mount system. See **Dimensions** and **Mounting Hole Layout**, page 23.

If you are using a floor stand, refer to its separate manual for installation and operation instructions.

## Air Line

- **Air line lubricator (D):** provides automatic air motor lubrication.
- **Bleed-type master air valve (E):** required in your system to relieve air trapped between it and the air motor when the valve is closed.

**NOTE:** Be sure the valve is easily accessible from the pump and located downstream from the air regulator.



Trapped air can cause the pump to cycle unexpectedly, which could result in serious injury from splashing or moving parts.

- **Air regulator (F):** controls pump speed and outlet pressure by adjusting the air pressure to the pump.

**NOTE:** Locate the regulator close to the pump, but upstream from the bleed-type master air valve.

- **Pump runaway valve (C):** senses when the pump is running too fast and automatically shuts off the air to the motor. A pump which runs too fast can be seriously damaged.
- **Air manifold (G):** has a 3/4 npsm(f) swivel air inlet. It mounts to the pump support bracket, and provides ports for connecting lines to air-powered accessories.
- **Air line filter (J):** removes harmful dirt and moisture from the compressed air supply. Also, install a **drain valve (W)** at the bottom of each air line drop, to drain off moisture.
- **Second bleed-type air valve (K):** isolates the air line accessories for servicing.

**NOTE:** Locate upstream from all other air line accessories.

## Fluid Line

- **Fluid filter (L):** with a 60 mesh (250 micron) stainless steel element to filter particles from the fluid as it leaves the pump.
- **Fluid drain valve (M):** required in your system, to relieve fluid pressure in the hose and gun.
- **Gun (S):** to dispense fluid.

**NOTE:** The gun shown in FIG. 1, page 7, is an airless spray gun for light to medium viscosity fluids.

- **Fluid line swivel (R):** for easier gun movement.
- **Suction kit (T):** enables the pump to draw fluid from a container.

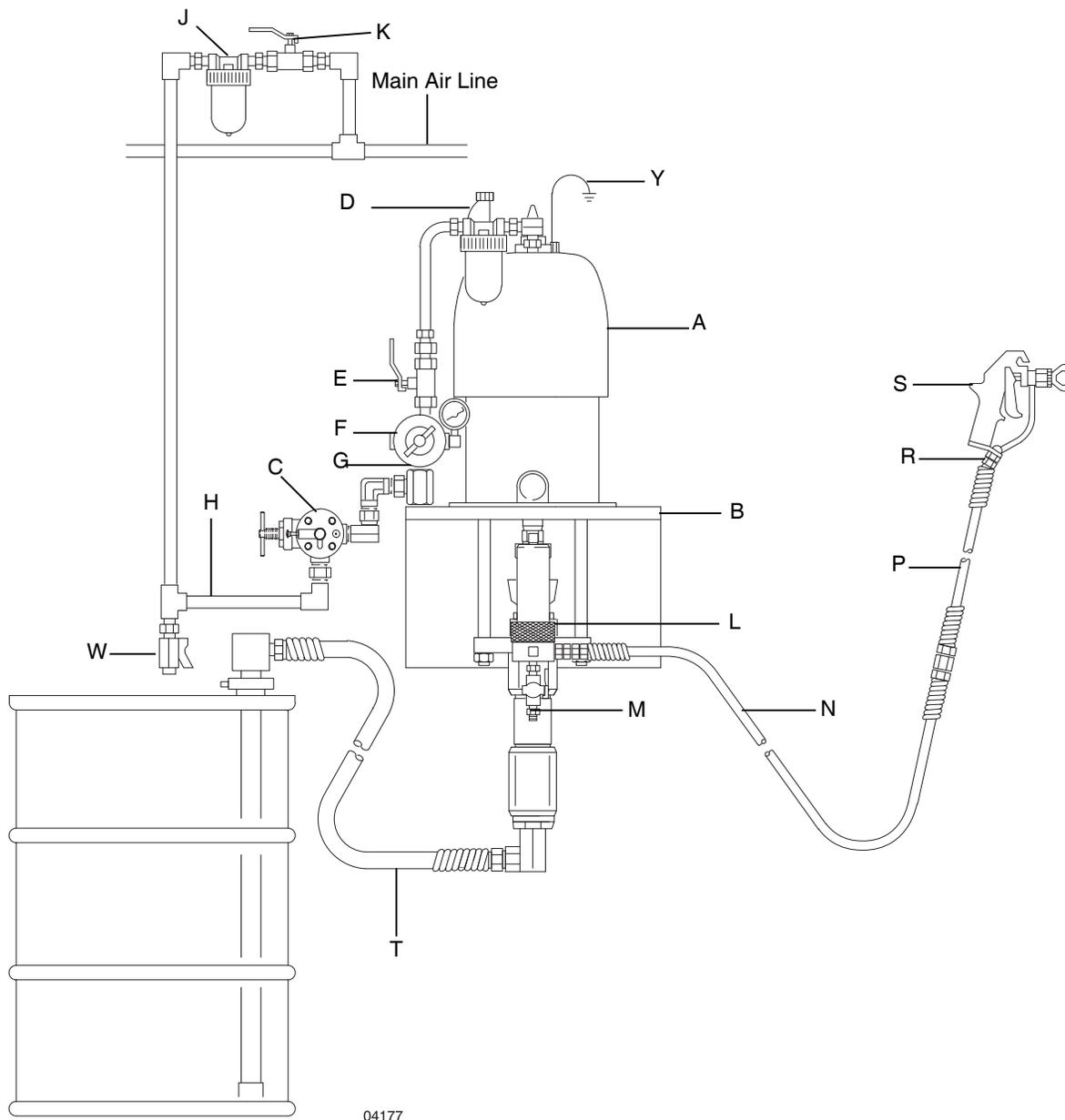
### NOTICE

To prevent intake valve damage, always apply PTFE tape to the female threads of the intake valve before connecting a suction hose or fitting to the intake.

## Flush Before Using Equipment

The equipment was tested with lightweight oil, which is left in the fluid passages to protect parts. To avoid contaminating your fluid with oil, flush the equipment with a compatible solvent before using the equipment. See **Flush the Equipment**, page 8.

# Typical Installation



04177

**FIG. 1: Typical Installation**

**Key:**

- A Pump
- B Wall bracket
- C Pump runaway valve
- D Air line lubricator
- E Bleed-type master air valve (required for pump)
- F Pump air regulator
- G Air manifold
- H Electrically conductive air supply hose
- J Air line filter
- K Bleed-type master air valve (for accessories)

**Key:**

- L Fluid filter
- M Fluid drain valve (required)
- N Electrically conductive fluid supply hose
- P Fluid whip hose
- R Gun swivel
- S Airless spray gun
- T Suction kit
- Y Ground wire and clamp (required, see **Grounding**, page 5, for installation instructions)
- W Air line drain valve

# Operation

## Pressure Relief Procedure

 Follow the Pressure Relief Procedure whenever you see this symbol.

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

1. Engage trigger lock.
2. Shut off the air supply to the pump.
3. Close the bleed-type master air valve.
4. Disengage the trigger lock.
5. Hold a metal part of the gun firmly to a grounded metal pail. Trigger the gun to relieve pressure.
6. Engage the trigger lock.
7. Open all fluid drain valves in the system, having a waste container ready to catch drainage. Leave drain valve(s) open until you are ready to spray again.
8. If you suspect the spray tip or hose is clogged or that pressure has not been fully relieved:
  - a. VERY SLOWLY loosen the tip guard retaining nut or the hose end coupling to relieve pressure gradually.
  - b. Loosen the nut or the coupling completely.
  - c. Clear the obstruction in the hose or tip.

## Flush the Equipment

				
---	--	---	---	---

To avoid fire and explosion, always ground equipment and waste container. To avoid static sparking and injury from splashing, always flush at the lowest possible pressure.

- Flush before fluid can dry in the equipment, at the end of the day, before storing, and before repairing equipment.
  - Flush at the lowest pressure possible. Check connectors for leaks and tighten as necessary.
  - Flush with a fluid that is compatible with the fluid being dispensed and the equipment wetted parts.
1. Perform **Pressure Relief Procedure**, page 8.
  2. Remove spray tip from the gun.
  3. Hold a metal part of the gun firmly to a grounded metal pail.
  4. Start the pump.
  5. Trigger the gun until clean solvent dispenses.
  6. Perform **Pressure Relief Procedure**, page 8.

## Packing Nut

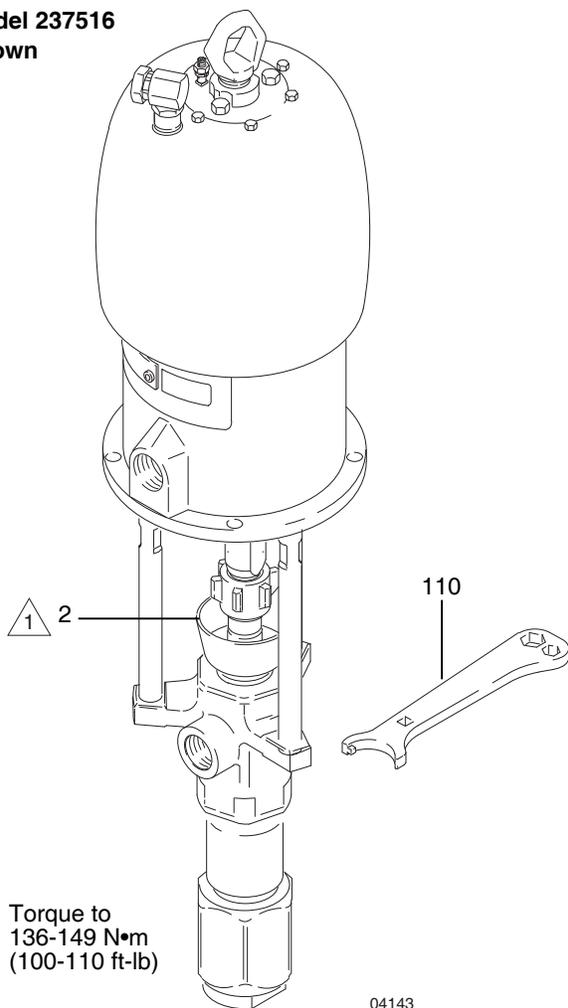
Before starting, fill the packing nut (2) 1/3 full with Graco Throat Seal Liquid (TSL™) or compatible solvent.

The packing nut is torqued at the factory and is ready for operation, If it becomes loose and there is leaking from the throat packings:

1. Perform the **Pressure Relief Procedure**, page 8.
2. Torque the packing nut (2) to 136-149 N•m (100-110 ft-lb) with the supplied wrench (110).

**NOTE:** Do not over-tighten the packing nut.

**Model 237516  
Shown**



## Start and Adjust the Pump

1. Connect the suction kit (T) to the pump fluid inlet. Place the tube into the fluid supply.

### NOTICE

To prevent intake valve damage, always apply PTFE tape to the female threads of the intake valve before connecting a suction hose or fitting to the intake.

2. Close the air regulator (F).
3. Open the pump bleed-type master air valve (E).
4. Hold a metal part of the gun (S) firmly to the side of a grounded metal pail and hold the trigger open.
5. Slowly open the regulator until the pump starts.



To reduce the risk of over-pressurizing your system, which could cause rupture and serious injury, never exceed the specified Maximum Air Input Pressure to the pump (see **Technical Specifications**, pages 24-25).

6. Cycle the pump slowly until all air is pushed out and the pump and hoses are fully primed.
7. Release the gun trigger, engage the trigger safety lock. The pump should stall against pressure.
8. If the pump fails to prime properly, open the drain valve (M). Use the drain valve as a priming valve until the fluid flows from the valve. Close the valve.

**NOTE:** When changing fluid containers with the hose and gun already primed, open the drain valve (M) to help prime the pump and vent air before it enters the hose. Close the drain valve when all air is eliminated.

### NOTICE

Do not allow the pump to run dry. It will quickly accelerate to a high speed, causing damage. If your pump is running too fast, stop it immediately and check the fluid supply. If the container is empty and air has been pumped into the lines, refill the container and prime the pump and the lines, or flush and leave it filled with a compatible solvent. Eliminate all air from the fluid system.

9. With the pump and lines primed, and with adequate air pressure and volume supplied, the pump will start and stop as you open and close the gun. In a

circulating system, the pump will speed up or slow down on demand, until the air supply is shut off.

10. Use the air regulator (F) to control pump speed and fluid pressure.

**NOTICE**

Always use the lowest air pressure necessary to get the desired results. Higher pressures cause premature tip and pump wear.

## Shutdown and Care for the Pump



1. Follow the **Pressure Relief Procedure**, page 8.
2. Follow **Flush the Equipment**, page 8.

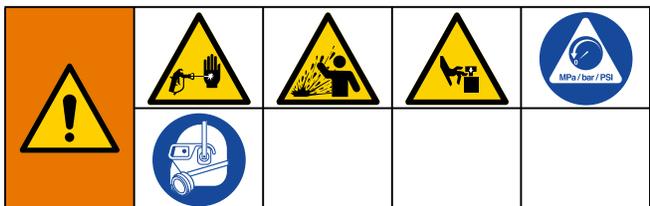
**NOTICE**

Always flush the pump before the fluid dries on the displacement rod and causes damage.

**NOTICE**

For overnight shutdown, stop the pump at the bottom of its stroke to prevent fluid from drying on the exposed displacement rod and damaging the throat packings.

# Troubleshooting



1. Follow **Pressure Relief Procedure**, page 8, before checking or repairing the pump.
2. Check all possible problems and causes before disassembling pump.

**To determine if the fluid hose or gun is obstructed:**

1. Perform the **Pressure Relief Procedure**, page 8.
2. Disconnect the fluid hose and place a container at the pump fluid outlet to catch any fluid.
3. Turn on the air just enough to start the pump. If the pump starts when the air is turned on, the obstruction is in the fluid hose or gun.

**NOTE:** If you experience air motor icing, call Graco Technical Assistance.

Problem	Cause	Solution
The pump fails to operate.	The air line is restricted or the air line is inadequate; valves are closed or clogged.	Clear the line; increase the air supply. Check that the valves are open.
	The fluid hose or gun is obstructed; the fluid hose ID is too small.	Open, clear*; use a hose with a larger ID.
	Fluid has dried on the displacement rod.	Clean the rod; always stop the pump at the bottom of its stroke; keep the wet-cup 1/3 filled with a compatible solvent.
	Motor parts are dirty, worn, or damaged.	Clean or repair; see the separate motor manual.
The pump operates, but the output is low on both strokes.	The air line is restricted or the air line is inadequate; valves are closed or clogged.	Clear the line; increase the air supply. Check that the valves are open.
	The fluid hose or gun is obstructed; the fluid hose ID is too small.	Open, clear*; use a hose with a larger ID.
	The packings in the displacement pump are worn.	Replace the packings.
The pump operates, but the output is low on the downstroke.	The intake valve is held open or worn.	Clear the valve; service.
The pump operates, but the output is low on the upstroke.	The piston valve or packings are held open or worn.	Clear the valve; replace the packings.
Erratic or accelerated pump speed.	The fluid supply is exhausted.	Refill the supply and prime the pump.
	The piston valve or packings are held open or worn.	Clear the valve; replace the packings.
	The intake valve is held open or worn.	Clear the valve; service.

# Maintenance

## Required Tools

- Set of adjustable wrenches
- Large pipe wrench
- Torque wrench
- Rubber mallet
- O-ring pack
- Large vise
- Thread lubricant
- Thread sealant

## Disconnect the Displacement Pump



To prevent injury from crushing or pinching, always use at least two people when lifting, moving, or disconnecting the pump. When disconnecting the pump, be sure to securely brace the pump, or have two people hold it while another person disconnects it.

If the pump is on a cart, slowly tip the cart backward until the handle rests on the ground, then disconnect the displacement pump.

1. Follow **Flush the Equipment**, page 8.
2. Follow the **Pressure Relief Procedure**, page 8.
3. Disconnect the air hose and fluid hose.
4. Disconnect the displacement pump (109) from the motor (101).

**NOTE:** Note the relative position of the pump's fluid outlet (U) to the air inlet (V) of the motor. If the motor does not require servicing, leave it attached to its mounting.

- a. Using an adjustable wrench (or hammer and punch), unscrew the coupling nut (106) from the motor shaft (MS). Do not lose or drop the coupling collars.

- b. Hold the tie rod flats with a wrench to keep the rods from turning. Unscrew the nuts (108) from the tie rods (105). Carefully remove the displacement pump (109) from the motor (101).

## Connect the Displacement Pump



To prevent injury from crushing or pinching, always use at least two people when lifting, moving, or disconnecting the pump. When disconnecting the pump, be sure to securely brace the pump, or have two people hold it while another person disconnects it.

If the pump is on a cart, slowly tip the cart backward until the handle rests on the ground, then disconnect the displacement pump.

1. Make sure the coupling nut (106) and the coupling collars (107) are in place on the displacement rod.
2. Align the pump fluid outlet (U) with the motor air inlet (V). Position the displacement pump (109) on the tie rods.

**NOTE:** Use at least two people to hold the displacement pump while another reconnects it to the motor.

3. Screw the nuts (108) onto the tie rods (105). Torque the nuts to 81-89 N•m (60-66 ft-lb).
4. Screw the coupling nut onto the motor shaft (MS) loosely. Hold the motor shaft flats with a wrench to keep it from turning. Use an adjustable wrench to torque the coupling nut to 196–210 N•m (145–155 ft-lb).
5. Reconnect all hoses. Reconnect the ground wire if it was disconnected. Fill the packing nut (2) 1/3 full of TSL or compatible solvent.
6. Turn on the air supply. Run the pump slowly to ensure proper operation.
7. Before returning the pump to production, relieve the pressure and torque the packing nut to 136–149 N•m (100–110 ft-lb).

Model 237516 Shown

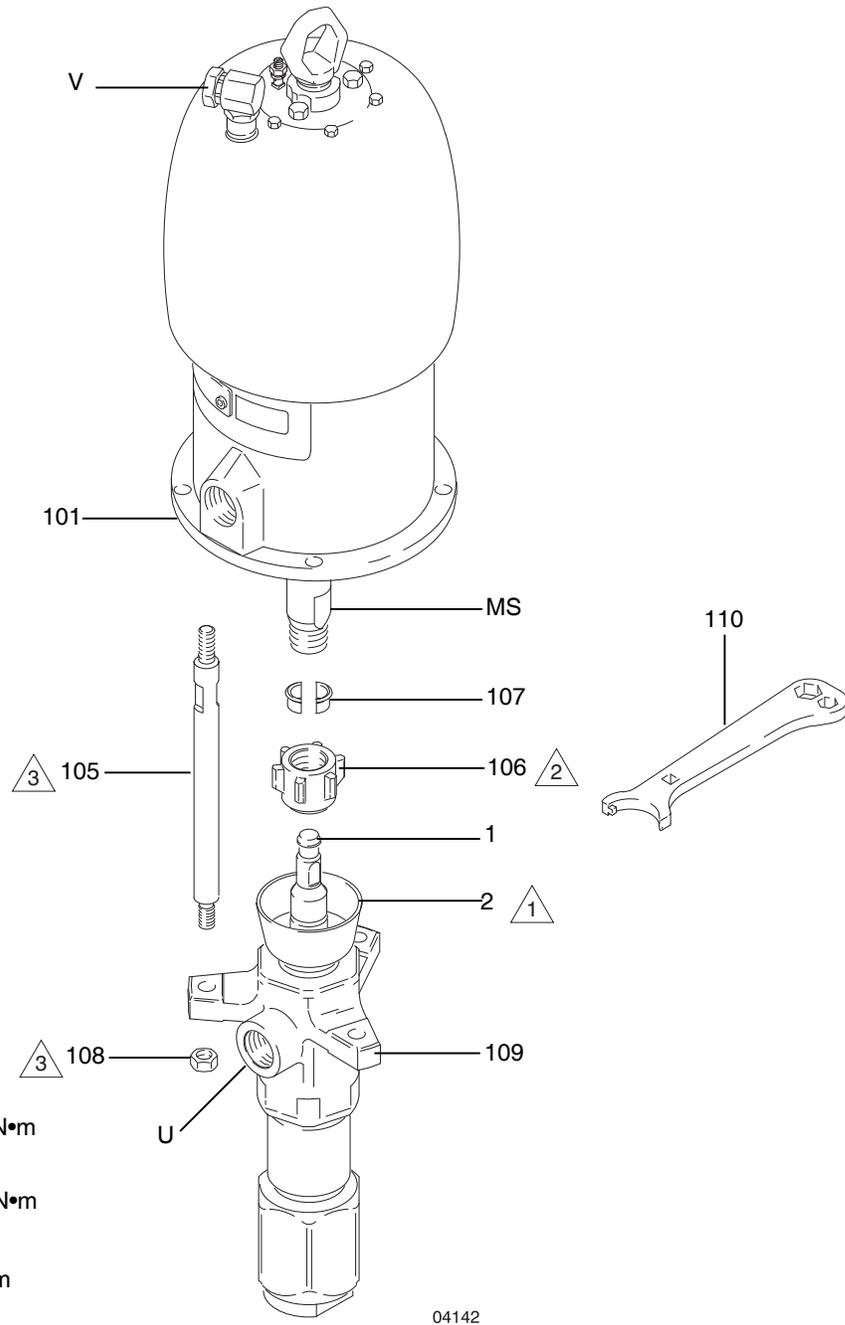


FIG. 2

## Disassemble the Displacement Pump

When disassembling the pump, lay out all the removed parts in sequence, to ease reassembly.

**NOTE:** Packing Repair Kits are available. For the best results, use all the new parts in the kit. Kit parts are marked with \*. You can also convert the pump to different packing materials. See **Packing Kits**, page 21.

1. Place the pump lengthwise in a large vise, with the jaws on the outlet housing (7) as shown in FIG. 3, page 15. Using the supplied wrench (110), loosen, but do not remove, the packing nut (2).
2. Apply a pipe wrench to the flats of the intake valve (19) from the intake housing (18). Be careful to catch the intake ball (17) as you remove the intake valve, so that it does not fall and suffer damage. Remove the seal (8) from the intake valve. Inspect the ball and the seat (BS) of the intake valve for wear or damage.
3. Apply a pipe wrench to the hex of the valve housing (18). The pump assembly may separate at joint A or joint B.

### NOTICE

To reduced the possibility of damage to the rod (1) and cylinder (9), always use a rubber mallet to drive the rod out of the cylinder. Never use a hammer to drive out the rod,

- **If the assembly separates at joint A:**

- a. Unscrew the valve housing (18) from the cylinder.
- b. Using a rubber mallet, drive the displacement rod (1) and piston assembly out of the outlet housing (7) and cylinder (9) until the piston comes free. Pull the rod and piston from the cylinder, being careful not to scratch the parts.
- c. Unscrew the cylinder (9) from the outlet housing (7), using a pipe wrench.
- d. Remove the two seals (8) from the cylinder. Shine a light into the cylinder (9) to inspect the inner surface for scoring or wear.
- e. Proceed to step 6.

- **If the assembly separates at joint B:**

- a. Unscrew the cylinder (9) and valve housing (18) from the outlet housing (7).
  - b. Gently pull the cylinder and valve housing straight out of the outlet housing; the displacement rod (1) and piston assembly will come out with these parts.
  - c. Place the valve housing (18) in the vise and unscrew the cylinder (9) from the housing, using a pipe wrench. The displacement rod (1) and piston assembly will remain in the cylinder.
  - d. Using a rubber mallet, drive the displacement rod (1) and piston assembly out of the cylinder (9) until the piston comes free. Pull the rod and piston from the cylinder, being careful not to scratch the parts.
  - e. Remove the two seals (8) from the cylinder. Shine a light into the cylinder (9) to inspect the inner surface for scoring or wear.
  - f. Proceed to step 6.
4. Place the flats of the piston seat housing (16) in a vise, as shown in FIG. 4, page 15.
  5. Using an adjustable wrench, unscrew the piston ball housing (10) from the piston seat housing. Be careful to catch the piston ball (11) as you separate the piston seat housing and ball housing, so that it does not fall and suffer damage.
  6. Examine the displacement rod (1) for scratches or other damage. Only if the rod needs replacement, unscrew it from the piston ball housing (10), using an adjustable wrench on the flats of the rod.
  7. Remove the glands and v-packings (PV) from the piston seat housing (16). Inspect the ball (11), and the seat (PS) and guides (PG) on the housing for wear or damage. See FIG. 5, page 18.
  8. Unscrew the packing nut (2) from the outlet housing (7). Remove the glands and v-packings (OV). See FIG. 5, page 18.
  9. Clean all parts with a compatible solvent and inspect them for wear or damage.

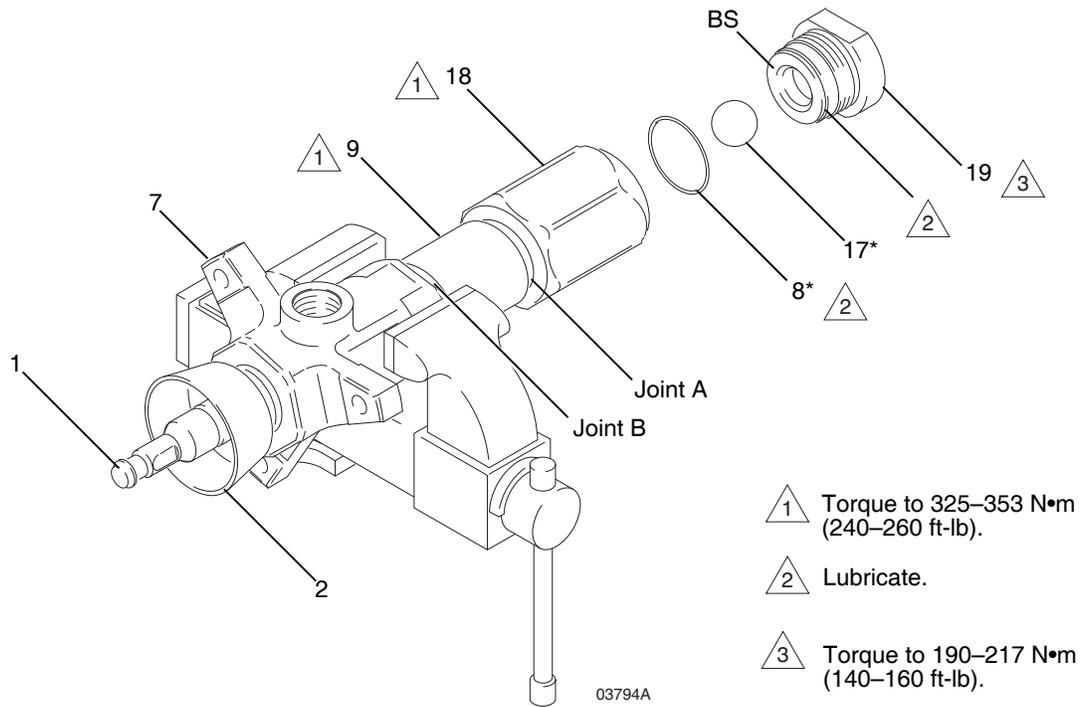


FIG. 3

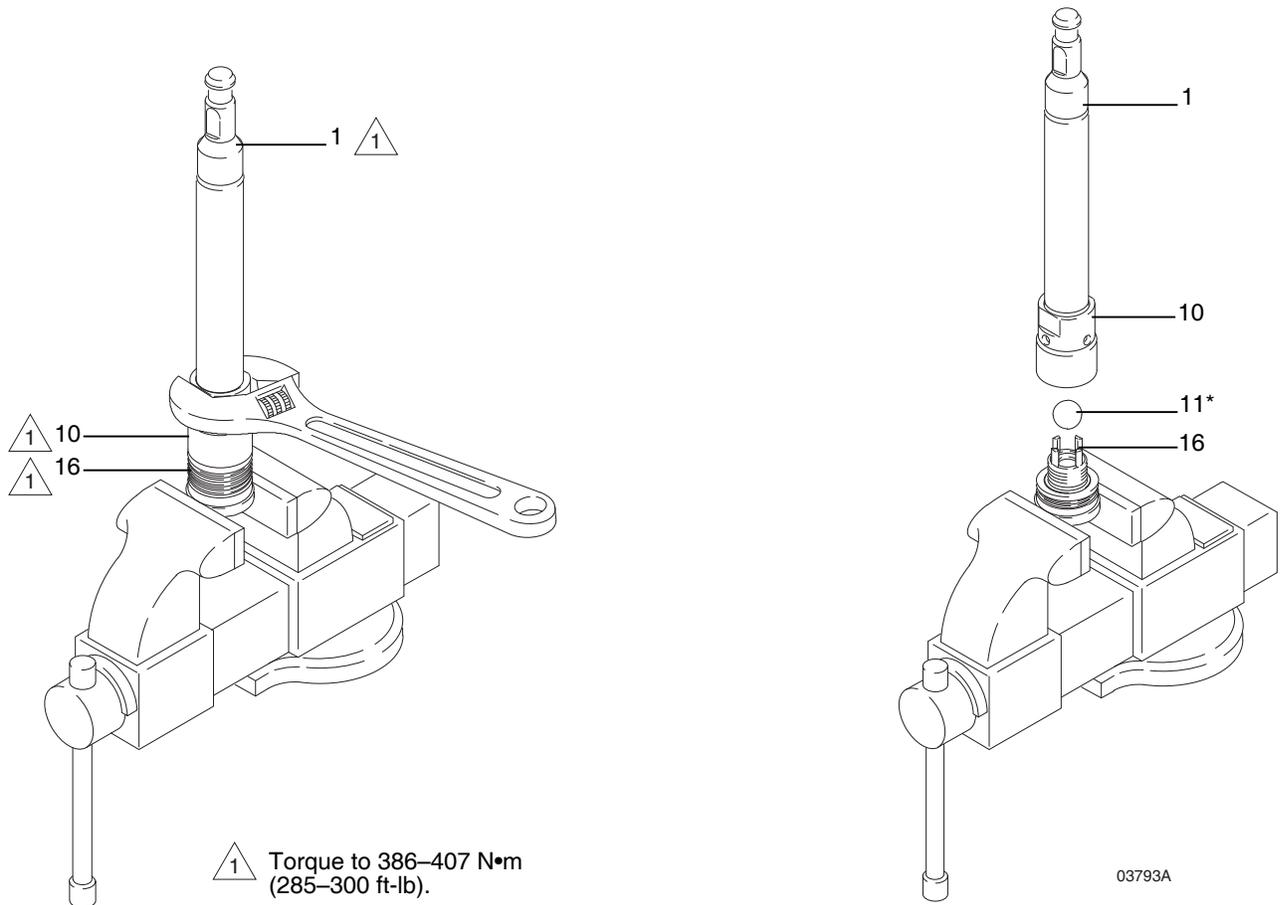


FIG. 4

## Assemble the Displacement Pump

### NOTICE

All rebuild kits are supplied with anti-seize. Failure to apply anti-seize during the reassembly process greatly increases the chances of galling.

1. **If it was necessary to remove the piston ball housing (10) from the displacement rod (1):**
    - a. Clean the threads of the rod and the ball housing apply anti-seize (20\*).
    - b. Screw the ball housing onto the rod, hand tight.
    - c. Place the flats of the piston ball housing in a vise and torque the rod to 386–407 N•m (285–300 ft-lb). See FIG. 5, page 18.
  2. **For standard displacement pump 237514**, place the piston packings on the piston seat housing (16) in the following order, with the lips of the v-packings facing up (see the Piston Packing Stack Detail in FIG. 5, page 18):
    - the female gland (15\*)
    - one PTFE v-packing (14\*)
    - four leather v-packings (12\*)
    - the male gland (13\*)
- NOTE:** If your pump uses an optional packing configuration, or you want to convert the pump to a different packing material, see **Packing Kits**, page 21.
3. Place the flats of the piston seat housing (16) in a vise.
  4. Place the ball (11\*) on the housing and apply anti-seize (20\*) to threads. Screw the piston ball housing (10) onto the piston seat housing hand tight, then torque to 386–407 N•m (285–300 ft-lb). See FIG. 4, page 15.
  5. **For standard displacement pump 237514**, lubricate the throat packings and place them in the outlet housing (7) in the following order with the lips of the v-packings facing down (see the Throat Packing Stack Detail in FIG. 5, page 18):
    - the male gland (6\*)
    - four leather v-packings (3\*)
    - one PTFE v-packing (5\*)
    - the female gland (4\*)

**NOTE:** If your pump uses an optional packing configuration, or you want to convert the pump to a different packing material, see **Packing Kits**, page 21.

6. Apply anti-seize (20\*) and install the packing nut (2) loosely into the outlet housing (7).
7. Lubricate the piston packings. Slide the displacement rod (1) and piston assembly down into the cylinder (9).

**NOTE:** The cylinder is symmetrical, so either end may face up.

8. Use a rubber mallet to drive the rod into the cylinder, until the piston seat housing (16) is near the bottom of the cylinder.
9. Install the seal (8\*) on the top of the cylinder (9). Lubricate the seal and apply anti seize (20\*) to threads of the cylinder.

10. Place the outlet housing (7) in a vise, as shown in FIG. 5, page 18.

11. Slide the displacement rod (1) up into the outlet housing, then screw the cylinder (9) into the outlet housing hand tight.

**NOTE:** The threads will engage easily until the seal (8\*) contacts the sealing surface of the outlet housing. The top of the rod will protrude from the packing nut (2).

12. Install the seal (8\*) on the bottom of the cylinder (9). Lubricate the seal and apply anti seize (20\*) to threads of the cylinder.

13. With the beveled ball stop surfaces (SS) facing down (see FIG. 5, page 18), screw the intake housing (18) onto the cylinder hand tight.

**NOTE:** The threads will engage easily until the seal contacts the sealing surface of the intake housing.

14. Install the seal (8\*) on the intake valve (19). Lubricate the seal and apply anti seize (20\*) to threads of the intake valve.

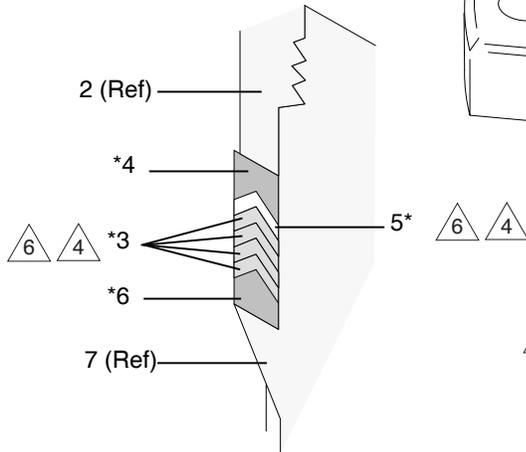
15. Place the intake ball (17\*) in the intake housing (18), then screw the intake valve into the intake housing hand tight.

**NOTE:** The threads will engage easily until the seal contacts the sealing surface of the intake housing.

16. Using a pipe wrench, torque the intake housing (18) to 325–353 N•m (240–260 ft-lb). This will torque both cylinder joints (A and B). See FIG. 3, page 15.
17. Using a pipe wrench, torque the intake valve (19) to 190–217 N•m (140–150 ft-lb). See FIG. 3, page 15.
18. Torque the packing nut (2) to 136–149 N•m (100–110 ft-lb).
19. Follow **Connect the Displacement Pump**, page 12.

- △1 Torque to 136–149 N•m (100–110 ft-lb).
- △2 Torque to 325–353 N•m (240–260 ft-lb).
- △3 Torque to 386–407 N•m (285–300 ft-lb).
- △4 Lubricate.
- △5 Lips face up.
- △6 Lips face down.
- △7 See Throat Packing Detail at left.
- △8 See Piston Packing Detail at left.
- △9 Torque to 190–217 N•m (140–160 ft-lb).
- △10 Apply anti-seize (123174).

**Throat Packing Stack Detail**  
 (Displacement Pump 237515 Shown. See  
**Packing Kits**, page 21 for options.)



**Piston Packing Stack Detail**  
 (Displacement Pump 237515 Shown.  
 See **Packing Kits**, page 21 for options.)

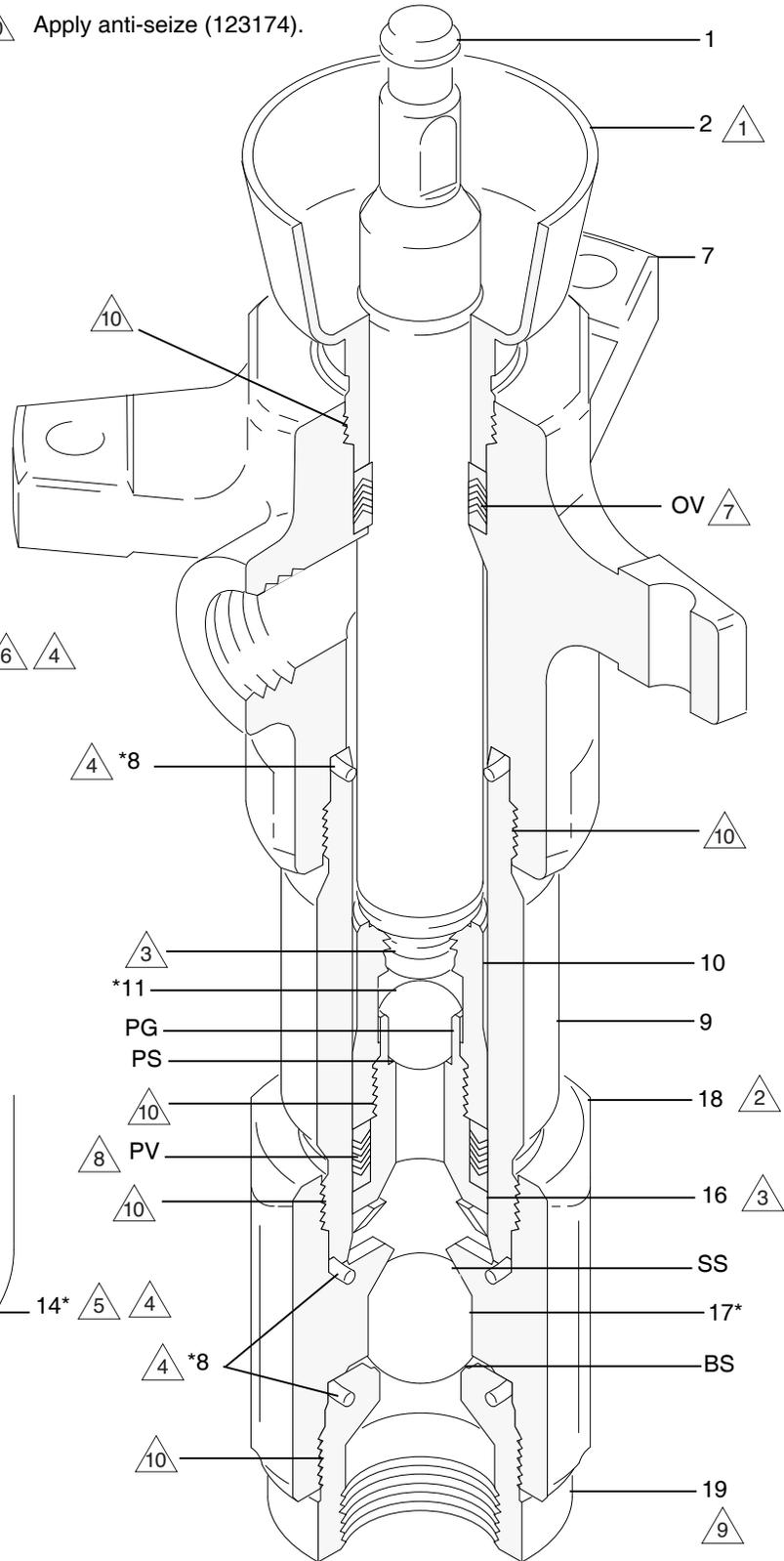
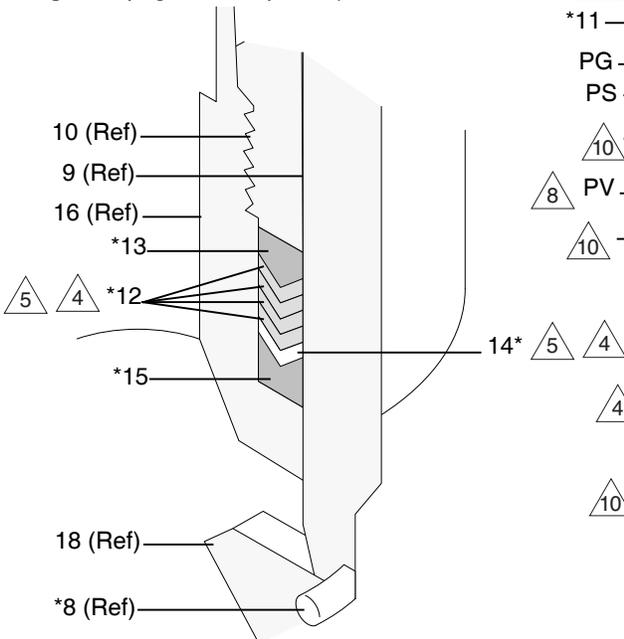
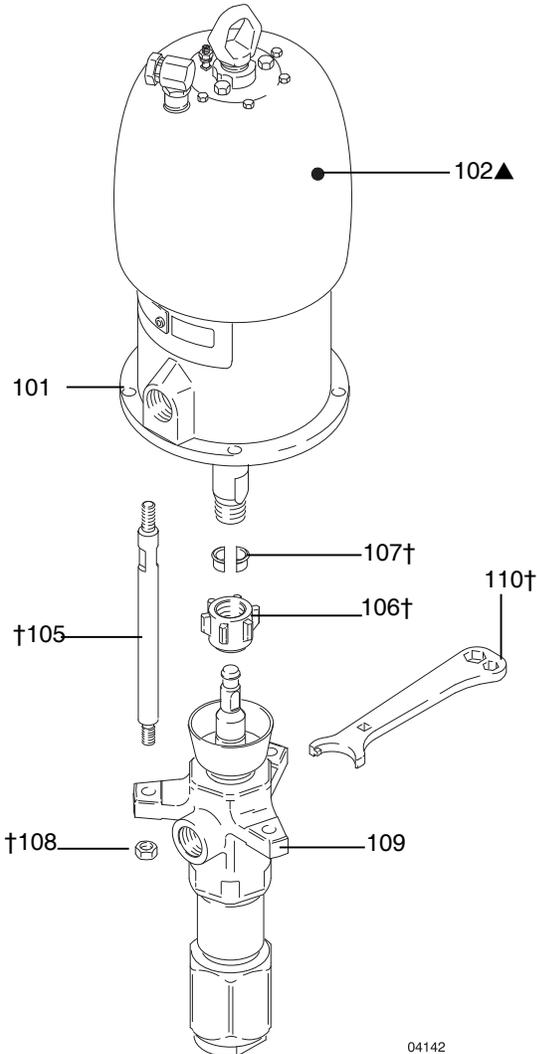


FIG. 5

03634

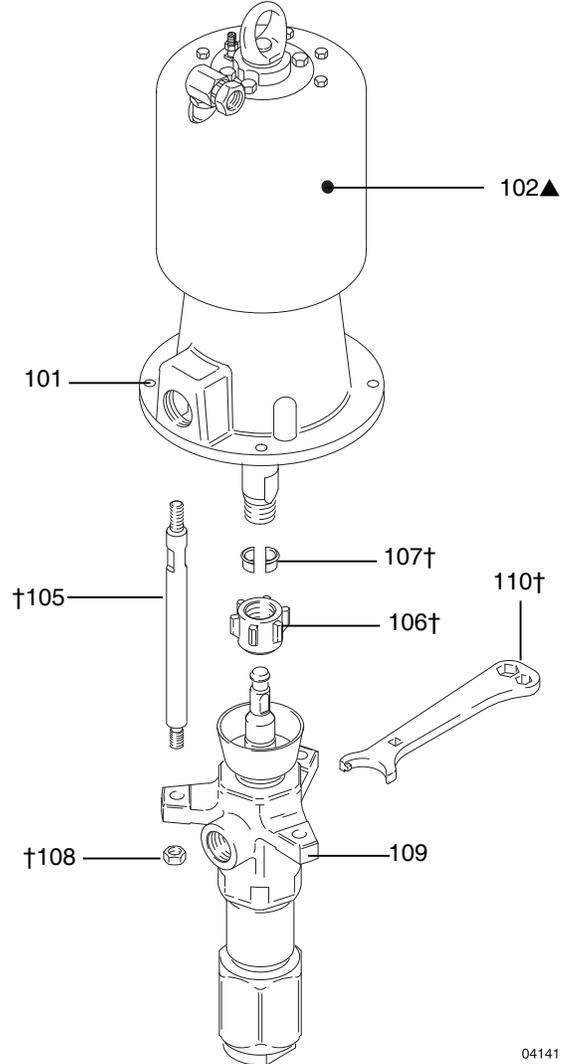
# Parts

**237516 Pump, Series A  
21:1 Ratio, with Bulldog Air Motor**



04142

**237517 Pump, Series A  
13:1 Ratio, with Senator Air Motor**



04141

Ref.	Part	Description	Qty.
101	208356	AIR MOTOR, Bulldog, See 307–049 for parts	1
102▲	176529	LABEL, warning	1
105†	190000	ROD, tie; 224 mm (8.82 in.) shoulder to shoulder	3
106†	186925	NUT, coupling	1
107†	184129	COLLAR, coupling	2
108†	106166	NUT, hex; M16 x 2.0	3
109	237514	PUMP, displacement. See page 19 for parts	1
110†	112887	WRENCH, spanner	1

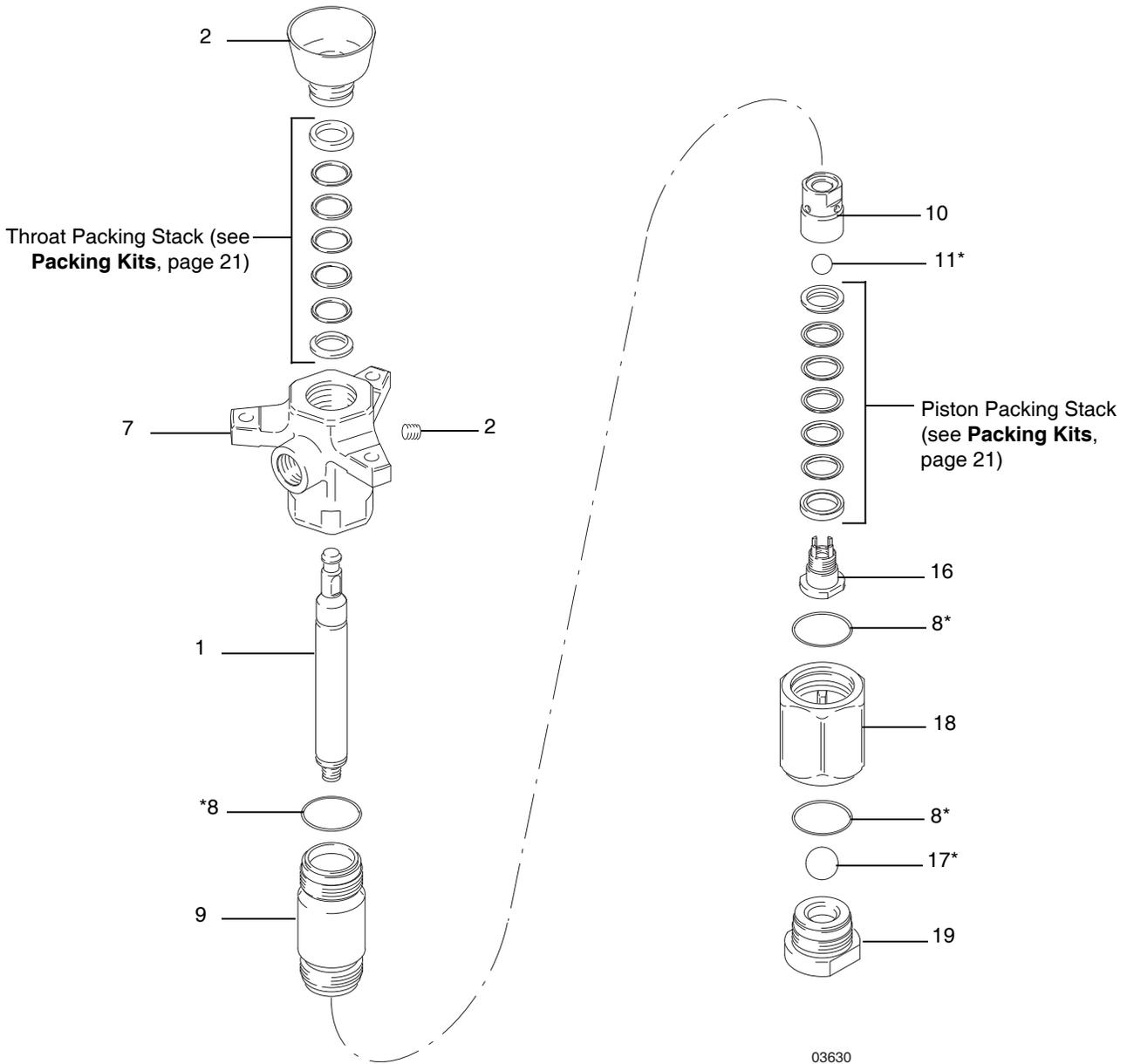
▲ Replacement safety labels, tags, and cards are available at no cost.

† These parts are included in Connection Kit 235417. For applications requiring stainless steel tie rods, order Connection Kit 235418.

Ref.	Part	Description	Qty.
101	217540	AIR MOTOR, Senator, See 307–592 for parts	1
102▲	176529	LABEL, warning	1
105†	190000	ROD, tie; 224 mm (8.82 in.) shoulder to shoulder	3
106†	186925	NUT, coupling	1
107†	184129	COLLAR, coupling	2
108†	106166	NUT, hex; M16 x 2.0	3
109	237514	PUMP, displacement. See page 19 for parts	1
110†	112887	WRENCH, spanner	1

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

† These parts are included in Connection Kit 235417. For applications requiring stainless steel tie rods, order Connection Kit 235418.



03630

**NOTE:** The parts listed on this page are common to all displacement pumps covered in this manual. Refer to page 21 for the different packing configurations available.

Ref.	Part	Description	Qty.
1	184487	ROD, displacement; stainless steel	1
2	236582	PACKING NUT; stainless steel	1
7	237186	HOUSING, outlet; stainless steel	1
8*	109499	SEAL; PTFE	2
9	184540	CYLINDER; stainless steel	1
10	189409	HOUSING, ball, piston; stainless steel	1
11*	102972	BALL, piston; stainless steel; 0.875 in. (22.2 mm) diameter	1

Ref.	Part	Description	Qty.
16	222951	HOUSING, seat, piston valve; stainless steel with tungsten carbide seat	1
17*	108001	BALL, intake; stainless steel; 1.5 in. (38.1 mm) diameter	1
18	189396	HOUSING, intake; stainless steel	1
19	236588	VALVE, intake; stainless steel with tungsten carbide seat	1
22	101748	PLUG, pipe, socket hd; 3/8 npt	1
24▲	172477	TAG, warning (not shown)	1
25▲	172479	TAG, warning (not shown)	1

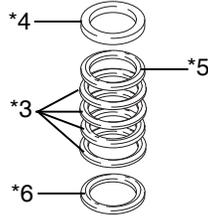
\* Parts included in Repair Kit 237178, which may be purchased separately for standard Displacement Pump 237514. See page 20. They are also included in Optional Kits 237179, 237180, and 237713.  
▲ Replacement safety labels, tags, and cards are available at no cost.

# Packing Kits

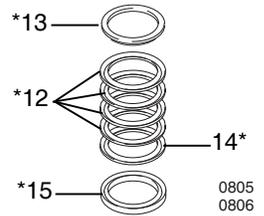
## Leather Packing Kit 237178, for Standard Displacement Pump 237514, Series A

Ref.	Part	Description	Qty.
3*	184309	V-PACKING, throat; leather	4
4*	184179	GLAND, throat, female; stainless steel	1
5*	109309	V-PACKING, throat; PTFE	1
6*	184229	GLAND, throat, male; stainless steel	1
12*	184310	V-PACKING, piston; leather	4
13*	184230	GLAND, piston, male; stainless steel	1
14*	109310	V-PACKING, piston; PTFE	1
15*	184180	GLAND, piston, female; stainless steel	1
20*	123174	ANTI-SEIZE (not shown)	1

**Throat Packings:  
Lips Face Down**



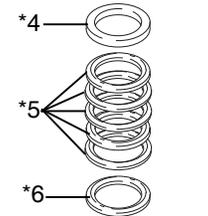
**Piston Packings:  
Lips Face Up**



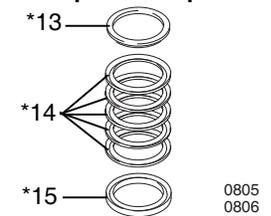
## PTFE Packing Kit 237179, for Optional Displacement Pump 236490, Series A

Ref.	Part	Description	Qty.
4*	184179	GLAND, throat, female; stainless steel	1
5*	109309	V-PACKING, throat; PTFE	5
6*	184229	GLAND, throat, male; stainless steel	1
13*	184230	GLAND, piston, male; stainless steel	1
14*	109310	V-PACKING, piston; PTFE	5
15*	184180	GLAND, piston, female; stainless steel	1
20*	123174	ANTI-SEIZE (not shown)	1

**Throat Packings:  
Lips Face Down**



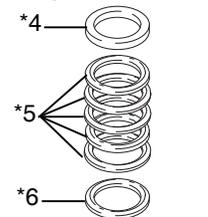
**Piston Packings:  
Lips Face Up**



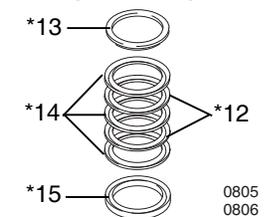
## UHMWPE and Leather Packing Kit 237180, for Optional Displacement Pump 237515, Series A

Ref.	Part	Description	Qty.
3*	184309	V-PACKING, throat; leather	2
4*	184179	GLAND, throat, female; stainless steel	1
5*	109259	V-PACKING, throat; UHMWPE	3
6*	184229	GLAND, throat, male; stainless steel	1
12*	184310	V-PACKING, piston; leather	2
13*	184230	GLAND, piston, male; stainless steel	1
14*	109260	V-PACKING, piston; UHMWPE	3
15*	184180	GLAND, piston, female; stainless steel	1
20*	123174	ANTI-SEIZE (not shown)	1

**Throat Packings:  
Lips Face Down**



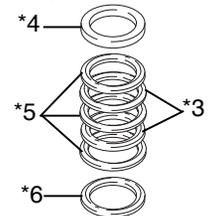
**Piston Packings:  
Lips Face Up**



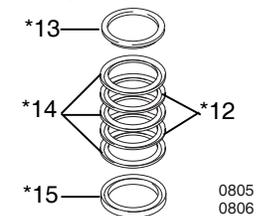
## UHMWPE and PTFE-Packing Kit 237713 (Optional)

Ref.	Part	Description	Qty.
3*	184309	V-PACKING, throat; leather	2
4*	184179	GLAND, throat, female; stainless steel	1
5*	109259	V-PACKING, throat; UHMWPE	3
6*	184229	GLAND, throat, male; stainless steel	1
12*	184310	V-PACKING, piston; leather	2
13*	184230	GLAND, piston, male; stainless steel	1
14*	109260	V-PACKING, piston; UHMWPE	3
15*	184180	GLAND, piston, female; stainless steel	1
20*	123174	ANTI-SEIZE (not shown)	1

**Throat Packings:  
Lips Face Down**



**Piston Packings:  
Lips Face Up**



\* Parts are included in Repair Kits 237178, 237179, 237180, or 237713 (purchase separately). Kits also include parts 8\*, 11\*, and 17\*.

# Performance Charts

**To find Fluid Outlet Pressure (psi/bar) at a specific fluid flow (gpm/lpm):**

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

**To find Pump Air Consumption (m<sup>3</sup>/scfm) at a specific fluid flow (gpm/lpm) and air pressure (psi/bar):**

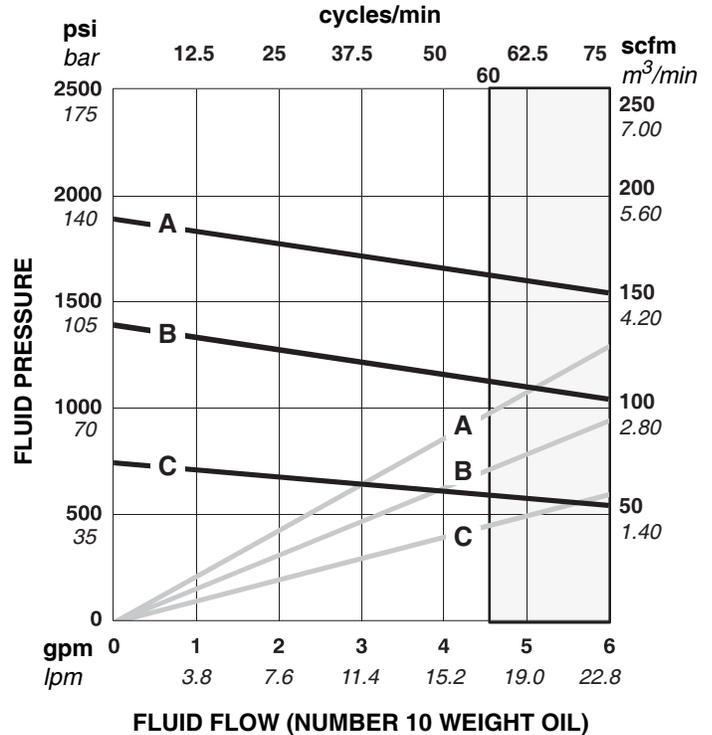
1. Locate desired flow along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve (gray). Follow right to scale to read air consumption.

**Key**

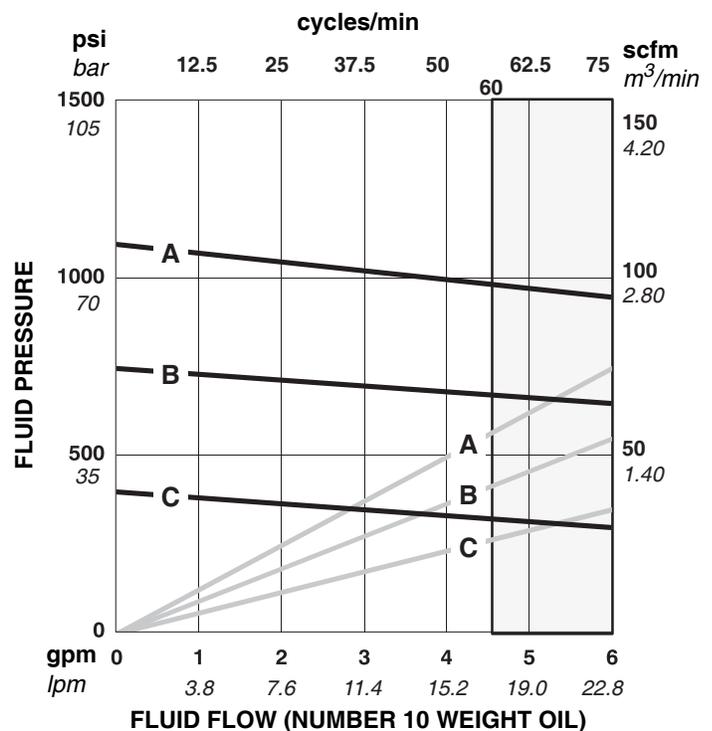
- Black Curve Fluid Outlet Pressure
- Gray Curve Air Consumption
- A 7 bar (100 psi) Air Pressure
- B 4.9 bar (70 psi) Air Pressure
- C 2.8 bar (40 psi) Air Pressure

**NOTE:** Recommended pump speed for continuous operation (to shaded area) is 60 cpm.

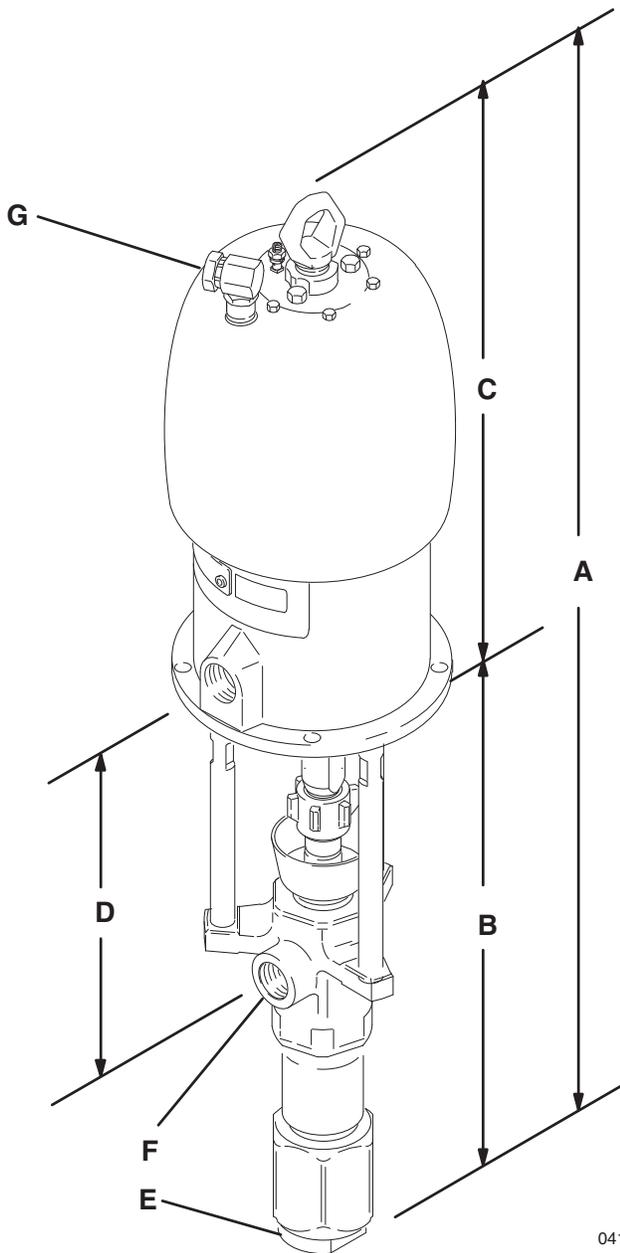
## Model 237516 Bulldog Pump



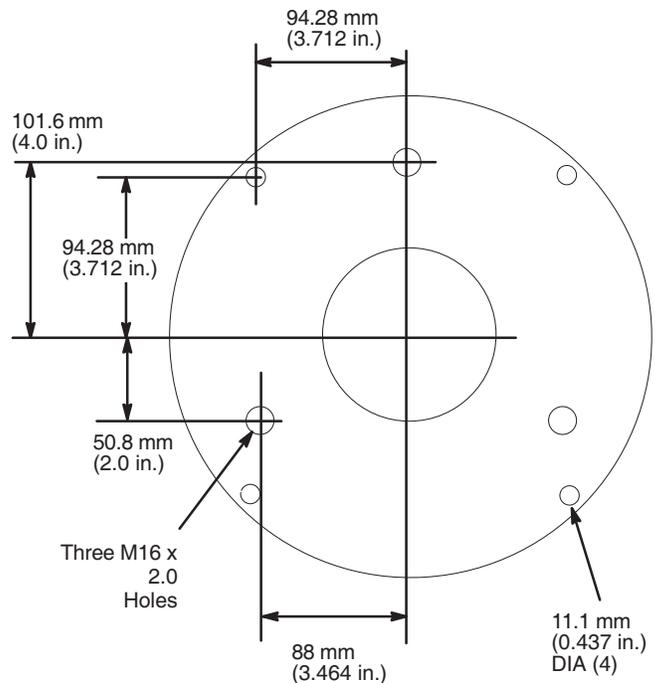
## Model 237517 Senator Pump



# Dimensions



# Mounting Hole Layout



Pump Model	A	B	C	D	E	F	G
237516	1134 mm (44.65 in.)	590 mm (23.23 in.)	544 mm (21.42 in.)	257 mm (10.12 in.)	2 in. np(f)	1 in. np(f)	3/4 npsm(f)
237517	1138 mm (44.80 in.)	590 mm (23.23 in.)	548 mm (21.57 in.)	257 mm (10.12 in.)	2 in. np(f)	1 in. np(f)	3/4 npsm(f)

# Technical Specifications

<b>Model 237516 Bulldog Pump</b>		
	<b>US</b>	<b>Metric</b>
Ratio		21:1
Maximum fluid working pressure	2100 psi	145 bar
Maximum air input pressure	100 psi	7 bar
Pump cycles per 3.8 liters (1 gal.)		12.5
Fluid flow at 60 cycles/min	4.6 gpm	17.4 lpm
Air motor piston effective area	38 in. <sup>2</sup>	248 cm <sup>2</sup>
Stroke length	4.75 in.	120 mm
Displacement pump effective area	1.86 in. <sup>2</sup>	12 cm <sup>2</sup>
Maximum pump operating temperature	180 °F	82 °C
Air inlet size		3/4 npsm(f)
Fluid inlet size		2 in. npt(f)
Fluid outlet size		1 in. npt(f)
Weight	240 lb	109 kg
Wetted parts	316, 440 and 17-4 PH Grades of Stainless Steel; Tungsten Carbide; PTFE; Glass-Filled PTFE; Leather	
<b>Noise (dBa)</b>		
Maximum sound pressure <i>Sound pressure measured 3.3 feet (1 meter) from equipment.</i> <i>Sound power measured per ISO-3744.</i>	94 dBa @ 100 psi (0.7MPa, 7 bar)	
<b>Notes</b>		
All trademarks or registered trademarks are the property of their respective owners.		

<b>Model 237517 Senator Pump</b>		
	<b>US</b>	<b>Metric</b>
Ratio		13:1
Maximum fluid working pressure	1300 psi	90 bar
Maximum air input pressure	100 psi	7 bar
Pump cycles per 3.8 liters (1 gal.)		12.5
Fluid flow at 60 cycles/min	4.6 gpm	17.4 lpm
Air motor piston effective area	24 in. <sup>2</sup>	154 cm <sup>2</sup>
Stroke length	4.75 in.	120 mm
Displacement pump effective area	1.86 in. <sup>2</sup>	12 cm <sup>2</sup>
Maximum pump operating temperature	180 °F	82 °C
Air inlet size		3/4 npsm(f)
Fluid inlet size		2 in. npt(f)
Fluid outlet size		1 in. npt(f)
Weight	240 lb	109 kg
Wetted parts	316, 440 and 17-4 PH Grades of Stainless Steel; Tungsten Carbide; PTFE; Glass-Filled PTFE; Leather	
<b>Noise (dBa)</b>		
Maximum sound pressure <i>Sound pressure measured 3.3 feet (1 meter) from equipment.</i> <i>Sound power measured per ISO-3744.</i>	93 dBa at 100 psi (0.7MPa, 7 bar)	
<b>Notes</b>		
All trademarks or registered trademarks are the property of their respective owners.		

## California Proposition 65

### CALIFORNIA RESIDENTS

 **WARNING:** Cancer and reproductive harm – [www.P65warnings.ca.gov](http://www.P65warnings.ca.gov).

# Graco Standard Warranty

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

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

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

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

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.

## **FOR GRACO CANADA CUSTOMERS**

The Parties acknowledge that they have required that the present document, as well as all documents, notices and legal proceedings entered into, given or instituted pursuant hereto or relating directly or indirectly hereto, be drawn up in English. Les parties reconnaissent avoir convenu que la rédaction du présente document sera en Anglais, ainsi que tous documents, avis et procédures judiciaires exécutés, donnés ou intentés, à la suite de ou en rapport, directement ou indirectement, avec les procédures concernées.

# Graco Information

**For the latest information about Graco products, visit [www.graco.com](http://www.graco.com).**

**For patent information, see [www.graco.com/patents](http://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**

*All written and visual data contained in this document reflects the latest product information available at the time of publication. Graco reserves the right to make changes at any time without notice.*

Original instructions. This manual contains English. MM 308360

**Graco Headquarters: Minneapolis**

**International Offices: Belgium, China, Japan, Korea**

**GRACO INC. AND SUBSIDIARIES • P.O. BOX 1441 • MINNEAPOLIS MN 55440-1441 • USA  
Copyright 2021, Graco Inc. All Graco manufacturing locations are registered to ISO 9001.**

[www.graco.com](http://www.graco.com)  
Revision D, March 2021