INSTRUCTIONS–PARTS LIST 308–107

Rev D
Supersedes B
and PCN C

INSTRUCTIONS

This manual contains important warnings and information.
READ AND RETAIN FOR REFERENCE

SEVERE-DUTY
Stainless Steel Pumps

Model 223–887, Series A,
45:1 Ratio King™ Pump, with Standard Motor
4050 psi (283 bar) Maximum Fluid Working Pressure
90 psi (6.3 bar) Maximum Air Input Pressure

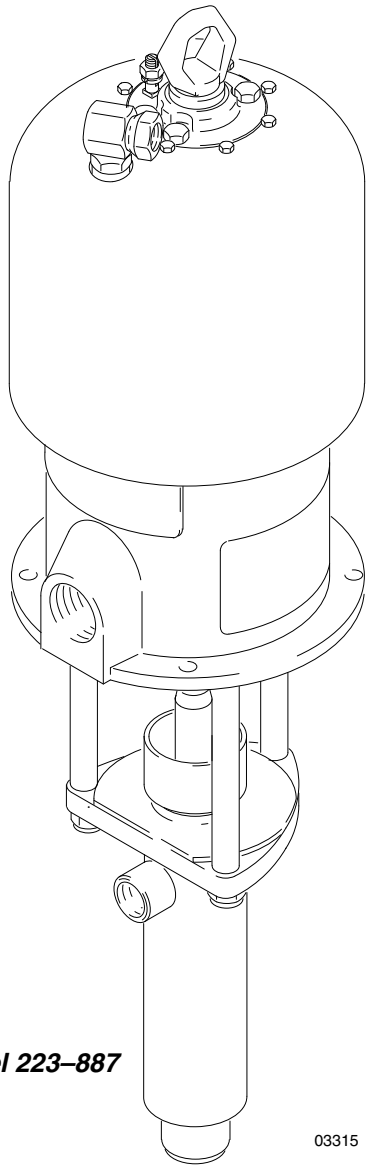
Model 224–387, Series A,
45:1 Ratio King™ Pump, with Quiet Motor
4050 psi (283 bar) Maximum Fluid Working Pressure
90 psi (6.3 bar) Maximum Air Input Pressure

Model 223–581, Series A,
20:1 Ratio Bulldog® Pump
2000 psi (140 bar) Maximum Fluid Working Pressure
100 psi (7 bar) Maximum Air Input Pressure

Model 231–110, Series A,
13:1 Ratio Senator® Pump
1300 psi (90 bar) Maximum Fluid Working Pressure
100 psi (7 bar) Maximum Air Input Pressure

Severe-Duty Displacement Pumps have an abrasion and corrosion-resistant displacement rod and sleeve. Refer to **Technical Data** on pages 21–23 for Wetted Parts information.

Refer to page 2 for Table of Contents.



Model 223–887

03315

GRACO INC. P.O. BOX 1441 MINNEAPOLIS, MN 55440–1441

Table of Contents

Symbols

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the instructions.

⚠ WARNING

INSTRUCTIONS

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are not sure, call Graco Technical Assistance at 1–800–543–0339.
- Do not alter or modify this equipment.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure of the lowest rated system component. Refer to the **Technical Data** on pages 21–23 for the maximum working pressure of this equipment.
- Use fluids and solvents which are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Do not use hoses to pull equipment.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 82°C (180°F) or below –40°C (–40°F).
- Do not lift pressurized equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

⚠ WARNING

FLUID INJECTION HAZARD

Spray from the gun, leaks or ruptured components can inject fluid into your body and cause extremely serious injury, including the need for amputation. Fluid splashed in the eyes or on the skin can also cause serious injury.

- If a fluid injection injury occurs, get **emergency medical care at once. Do not treat as a simple cut.** Tell the doctor exactly what fluid was injected.

  NOTE TO PHYSICIAN: Injection into the skin is a traumatic injury. **It is important to treat the injury surgically as soon as possible.** Do not delay treatment to research toxicity. Toxicity is a concern with some exotic coatings injected directly into the blood stream. Consultation with a plastic surgeon or reconstructive hand surgeon may be advisable.

- Do not point the gun at anyone or at any part of the body.
- Do not put your hand or fingers over the spray tip.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Do not “blow back” fluid; this is not an air spray system.
- Always have the tip guard and the trigger guard on the gun when spraying.
- Check the gun diffuser operation weekly. Refer to the gun manual.
- Be sure the gun trigger safety operates before spraying.
- Lock the gun trigger safety when you stop spraying.
- Follow the **Pressure Relief Procedure** on page 8 if the spray tip clogs and before cleaning, checking or servicing the equipment.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn or damaged parts immediately. Do not repair high pressure couplings; you must replace the entire hose.
- Fluid hoses must have spring guards on both ends, to help protect them from rupture caused by kinks or bends near the couplings.

MOVING PARTS HAZARD

Moving parts, such as the air motor piston, can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Before servicing the equipment, follow the **Pressure Relief Procedure** on page 8 to prevent the equipment from starting unexpectedly.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground the equipment and the object being sprayed. Refer to **Grounding** on page 5.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop spraying immediately.** Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being sprayed.
- Keep the spray area free of debris, including solvent, rags, and gasoline.
- Electrically disconnect all equipment in the spray area.
- Extinguish all open flames or pilot lights in the spray area.
- Do not smoke in the spray area.
- Do not turn on or off any light switch in the spray area while operating or if fumes are present.
- Do not operate a gasoline engine in the spray area.

TOXIC FLUID HAZARD

Hazardous fluid or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

Installation

Grounding

⚠ WARNING

FIRE AND EXPLOSION HAZARD
Before operating the pump, ground the system as explained below. Also read the section **FIRE OR EXPLOSION HAZARD** on page 4.

1. *Pump:* use a ground wire and clamp. See Fig. 1. Loosen the grounding lug locknut (W) and washer (X). Insert one end of a 1.5 mm^2 (12 ga) minimum ground wire (Y) into the slot in lug (Z) and tighten the locknut securely. Connect the other end of the wire to a true earth ground. Order Part No. 222–011 Ground Wire and Clamp.

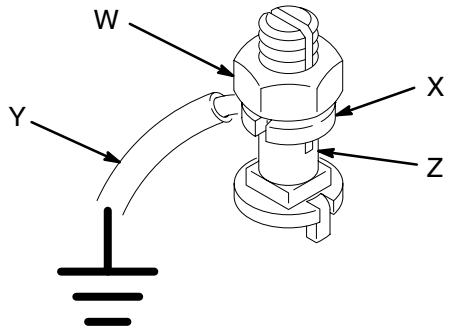


Fig. 1

2. *Air and fluid hoses:* use only grounded hoses.

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

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

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

6. *Object being sprayed:* follow your local code.

7. *Solvent pails used when flushing:* follow your local code. Use only metal pails, which are conductive, placed on a grounded surface. Do not place the pail on a nonconductive surface, such as paper or cardboard, which interrupts the grounding continuity.

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

Installation

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

NOTE: Accessories are available from your Graco representative. If you supply your own accessories, be sure they are adequately sized and pressure-rated to meet the system's requirements.

Fig. 2 is only a guide for selecting and installing system components and accessories. Contact your Graco representative or Graco Technical Assistance (1–800–543–0339) for assistance in designing a system to suit your particular needs.

System Accessories

⚠ WARNING

A bleed-type master air valve (D) and a fluid drain valve (J) are required in your system. These accessories help reduce the risk of serious injury, including fluid injection and splashing of fluid in the eyes or on the skin, and injury from moving parts if you are adjusting or repairing the pump.

The bleed-type master air valve relieves air trapped between this valve and the pump after the air is shut off. Trapped air can cause the pump to cycle unexpectedly. Locate the valve close to the pump. Order Part No. 107–141.

The fluid drain valve assists in relieving fluid pressure in the displacement pump, hose, and gun. Triggering the gun to relieve pressure may not be sufficient. Order Part No. 210–658.

Air and Fluid Hoses

Be sure all air and fluid hoses are properly sized and pressure-rated for your system. Use only grounded hoses. Fluid hoses must have spring guards on both ends.

Connect a grounded fluid hose (K) to the pump's fluid outlet, using a suitable adapter.

Connect a fluid suction hose and tube (M) to the pump's fluid intake.

Use a grounded 3/4 in. I.D. (minimum) air hose (H) to supply air to the pump.

Mounting Accessories

Mount the pump (A) to suit the type of installation planned. Pump dimensions and the mounting hole layout are shown on page 20. Use 3/8 in. bolts, lockwashers and nuts to attach the pump firmly to the mounting.

Air Line Accessories

Install the following accessories in the locations shown in Fig. 2, using adapters as necessary:

- **An air line lubricator (C)** provides automatic air motor lubrication.
- **A bleed-type master air valve (D)** is required in your system to relieve air trapped between it and the air motor when the valve is closed (see the **WARNING** at left). Be sure the bleed valve is easily accessible from the pump, and is located **downstream** from the air regulator.
- **An air regulator (E)** controls pump speed and outlet pressure by adjusting the air pressure to the pump. Locate the regulator close to the pump, but **upstream** from the bleed-type master air valve.
- **A pump runaway valve (B**) 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.
- **An air line filter (F)** removes harmful dirt and moisture from the compressed air supply.
- **A second bleed-type air valve (G)** isolates the air line accessories for servicing. Locate upstream from all other air line accessories.

Fluid Line Accessories

Install the following accessories in the locations shown in Fig. 2, using adapters as necessary:

- **A fluid drain valve (J)** is required in your system to relieve fluid pressure in the hose and gun (see the **WARNING** at left). Install the drain valve pointing down, but so the handle points up when opened.
- **A spray gun (L)** dispenses the fluid. The gun shown in Fig. 2 is an airless spray gun.

Installation

TYPICAL INSTALLATION

KEY

- **A** Pump
- **B** Pump Runaway Valve
- **C** Air Line Lubricator
- **D** Bleed-Type Master Air Valve (required, for pump)
- **E** Pump Air Regulator
- **F** Air Line Filter
- **G** Bleed-Type Master Air Valve (for accessories)
- **H** Air Supply Hose
- **J** Fluid Drain Valve (required)
- **K** Fluid Supply Hose
- **L** Spray Gun
- **M** Fluid Suction Hose
- **N** Exhaust Port for Muffler (1–1/4" npt)
- **P** 16 Exhaust Holes
- **R** Wall Bracket
- **S** Packing Nut/Wet-Cup
- **Y** Ground Wire (required)

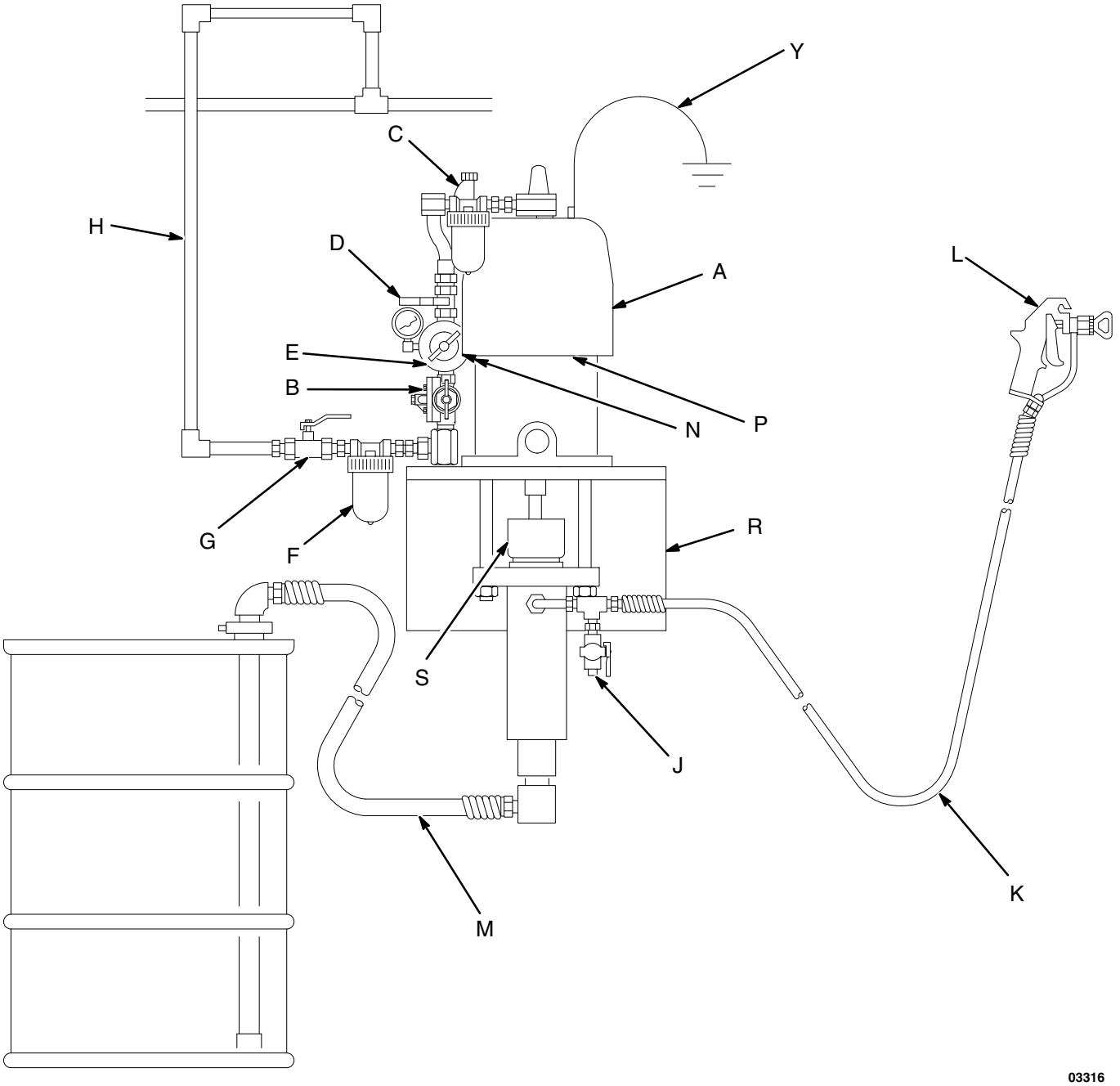


Fig. 2

Operation/Maintenance

Pressure Relief Procedure

⚠ WARNING

PRESSURIZED EQUIPMENT HAZARD
The equipment stays pressurized until pressure is manually relieved. To reduce the risk of serious injury from pressurized fluid, accidental spray from the gun or splashing fluid, follow this procedure whenever you:

- Are instructed to relieve pressure
- Stop spraying
- Check, clean or service any system equipment
- Install or clean spray tips.

1. Engage the gun safety latch.
2. Shut off the air supply to the pump.
3. Close the bleed-type master air valve (required in your system).
4. Disengage the gun safety latch.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
6. Engage the gun safety latch.
7. Open the drain valve (required in your system), having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, very slowly loosen the tip guard retaining nut or hose end coupling and relieve pressure gradually, then loosen completely. Now clear the tip or hose.

Flush the Pump Before First Use

The pump is tested with lightweight oil, which is left in to protect the pump parts. If the fluid you are using may be contaminated by the oil, flush it out with a compatible solvent. See **Flushing** on page 9.

Starting and Adjusting the Pump

1. See Fig. 2. Connect the suction kit (M) to the pump's fluid inlet. Place the tube into the fluid supply.
2. Close the air regulator (E) and bleed-type master air valve (D). Do not install the spray tip yet.
3. Open the pump's bleed-type master air valve (D). Hold a metal part of the gun (L) firmly to the side of a grounded metal pail and hold the trigger open. Slowly open the regulator (E) until the pump starts.
4. Cycle the pump slowly until all air is pushed out and the pump and hoses are fully primed. Release the gun trigger and engage the safety latch. The pump should stall against pressure.
5. Follow the **Pressure Relief Procedure** at left, then install the spray tip in the gun.
6. If the pump fails to prime properly, open the drain valve (J). 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 (J) to help prime the pump and vent air before it enters the hose. Close the drain valve when all air is eliminated.

⚠ CAUTION

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.

7. 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.

⚠ WARNING

COMPONENT RUPTURE HAZARD
To reduce the risk of overpressurizing your system, which could cause component rupture and serious injury, *never exceed the specified Maximum Incoming Air Pressure to the pump* (see the **Technical Data** on pages 21–23).

8. Use the air regulator (E) to control pump speed and fluid pressure. Always use the lowest air pressure necessary to get the desired results. Higher pressures cause premature tip and pump wear.

9. Keep the packing nut/wet-cup (S) half filled with Graco Throat Seal Liquid (TSL) or compatible solvent, to help prolong the packing life. Adjust the packing nut weekly with the wrench (supplied) so it is just tight enough to prevent leakage; do not overtighten. Always follow the **Pressure Relief Procedure** on page 8 before adjusting the packing nut.

Shutdown and Care of the Pump

For overnight shutdown, follow the **Pressure Relief Procedure** on page 8. Stop the pump at the bottom of its stroke to prevent fluid from drying on the exposed displacement rod and damaging the throat packings.

Always flush the pump before the fluid dries on the displacement rod. See **Flushing** at right.

Flushing

⚠ WARNING

FIRE AND EXPLOSION HAZARD
Before flushing, read the section **FIRE OR EXPLOSION HAZARD** on page 4. Be sure the entire system and flushing pails are properly grounded. Refer to **Grounding** on page 5.

1. Follow the **Pressure Relief Procedure** on page 8.
2. Remove the spray tip from the gun.
3. Hold a metal part of the gun firmly to the side of a grounded *metal* pail.
4. Start the pump. Always use the lowest possible fluid pressure when flushing.
5. Trigger the gun.
6. Flush the system until clear solvent flows from the gun. If the pump is being used to supply a circulating system, allow the solvent to circulate until the pump is thoroughly flushed.
7. Follow the **Pressure Relief Procedure** on page 8.

Troubleshooting Chart

1. Follow the **Pressure Relief Procedure** on page 8 before checking or servicing the equipment.

2. Check all possible causes and problems before disassembling the pump.

PROBLEM	CAUSE	SOLUTION
The pump fails to operate.	Restricted air line or an inadequate air supply; closed or clogged valves.	Clear the line; increase the air supply. Check that the valves are open.
	Obstructed fluid hose or gun; the fluid hose ID is too small.	Open, clear*; use a hose with a larger ID.
	Exhausted fluid supply	Refill; purge all air from pump and fluid lines.
	Fluid has dried on the displacement rod.	Clean the rod; always stop the pump at the bottom of its stroke; keep the wet-cup 1/2 filled with a compatible solvent.
	Dirty, worn, or damaged motor parts.	Clean or repair; see the separate motor manual.
The pump operates, but the output is low on both strokes.	Restricted air line or an inadequate air supply; closed or clogged valves.	Clear the line; increase the air supply. Check that the valves are open.
	Obstructed fluid hose or gun; the fluid hose ID is too small.	Open, clear*; use a hose with a larger ID.
	Exhausted fluid supply	Refill; purge all air from pump and fluid lines
	Air in displacement pump and hose	Reprime.
	Intake valve needs adjustment	Adjust. See page 14.
	Packing nut too tight or too loose	Adjust. See page 11.
	Worn packings in the displacement pump.	Replace the packings. See page 13.
The pump operates, but the output is low on the downstroke.	Held open or worn intake valve.	Clear the valve; service. See page 13.
The pump operates, but the output is low on the upstroke.	Held open or worn piston valve or packings.	Clear the valve; replace the packings. See page 13.
Erratic or accelerated pump speed.	Exhausted fluid supply.	Refill the supply and prime the pump.
	Packing nut too tight.	Adjust. See page 11.
	Intake valve needs adjustment.	Adjust. See page 14.
	Held open or worn piston valve or packings.	Clear the valve; replace the packings. See page 13.
	Held open or worn intake valve.	Clear the valve; service. See page 13.

* To determine if the fluid hose or gun is obstructed, follow the **Pressure Relief Procedure** on page 8. Disconnect the fluid hose and place a container at the pump fluid outlet to catch any fluid. 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 **(1-800-543-0339).**

Service

REQUIRED TOOLS

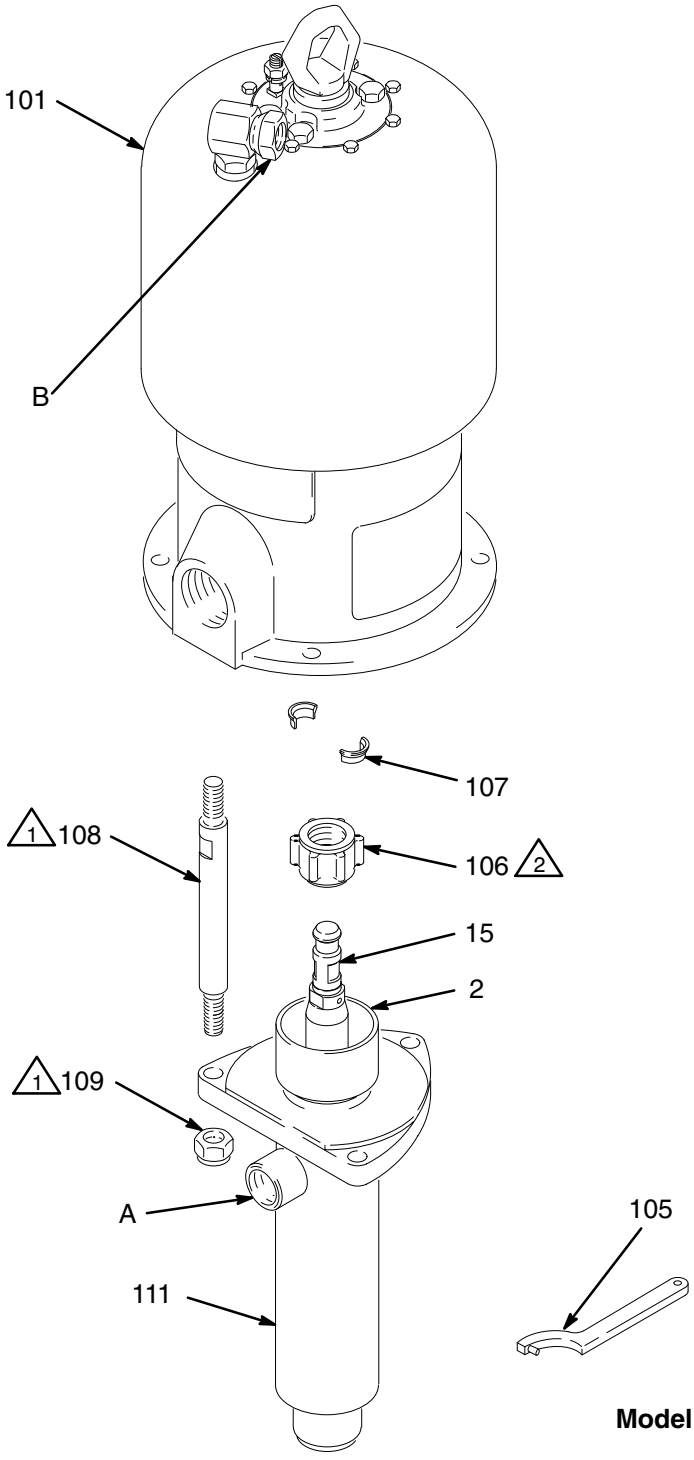
- Set of adjustable wrenches
- Torque wrench
- Rubber mallet
- O-ring pick
- Large vise
- Thread lubricant
- Thread sealant

DISCONNECTING THE DISPLACEMENT PUMP

1. Flush the pump, if possible. Stop the pump at the bottom of its stroke.
2. Follow the **Pressure Relief Procedure** on page 8.
3. Disconnect the air hose and the fluid hose.
4. Disconnect the displacement pump (111) from the motor (101) as follows. Note the relative position of the pump's fluid outlet (A) to the air inlet (B) of the motor. See Fig. 3. If the motor does not require servicing, leave it attached to its mounting.
5. Using an adjustable wrench, unscrew the coupling nut (106) from the motor shaft. Do not lose or drop the coupling collars (107). See Fig. 3.
6. Hold the tie rod flats with a wrench to keep the rods from turning. Unscrew the nuts (109) from the tie rods (108). Carefully remove the displacement pump (111) from the motor (101).
7. Refer to page 13 for displacement pump service.
8. To service the air motor, refer to the separate motor manual supplied (306–968 for Standard King Motors, 307–741 for Quiet King Motors, 307–049 for Bulldog Motors, and 307–592 for Senator Motors).

RECONNECTING THE DISPLACEMENT PUMP

1. Make sure the coupling nut (106) and the coupling collars (107) are in place on the displacement rod (15). See Fig. 3.
2. Orient the pump's fluid outlet (A) to the air inlet (B) as was noted in step 4 under **Disconnecting the Displacement Pump.** Position the displacement pump (111) on the tie rods (108).
3. Screw the coupling nut (106) onto the air motor piston rod. Screw the locknuts (109) onto the tie rods (108) loosely.
4. Mount the pump and reconnect all hoses. Reconnect the ground wire if it was disconnected during repair.
5. Torque the coupling nut (106) to 145–155 ft-lb (195–210 N.m). Tighten the tie rod locknuts (109) evenly, and torque to 40–50 ft-lb (54–68 N.m).
6. Tighten the packing nut/wet-cup (2) with the wrench (105) supplied, so it is snug – no tighter. Fill the wet-cup half full with Graco Throat Seal Liquid or compatible solvent. Start the pump and run it slowly, at about 20 psi (1.4 bar) air pressure, to check that it is operating properly.



1 Torque to 40–50 ft-lb (54–68 N.m)

2 Torque to 145–155 ft-lb (195–210 N.m)

Fig. 3

Service

DISPLACEMENT PUMP SERVICE

Disassembly

NOTES: Packing Repair Kit 223–643 is available. See the parts list on page 19. The kit includes two packing stacks which are preassembled. For the best results, use all the new parts in the kit.

An asterisk behind a reference number, for example (6*), indicates that this part is included in the repair kit.

1. Remove the displacement pump from the air motor as explained on page 9.

2. Screw the intake valve housing (4) out of the pump housing (1). See Fig. 4. Note which set of holes the ball stop pin (10) is in. Remove the pin, retainer (11), ball guide (12), ball (7), and o-ring (8) from the intake valve housing (4). Check that the ball seat of the intake housing is not chipped or nicked.

3. Loosen the packing nut (2). Push down on the displacement rod (15) until the piston (3) flats clear the pump housing (1). Pull the piston and displacement rod assembly out of the pump housing.

4. Unscrew the piston (3) from the displacement rod (15). Remove the ball (6), washer (14), and gland/packing stack (18). Check that the ball seat of the piston is not chipped or nicked.

5. Remove the packing nut/wet-cup (2). Remove the gland/packing stack from the throat of the pump housing (1).

6. Clean all parts thoroughly, and check for wear, scratches or other damage. Scoring or irregular surfaces on the displacement rod (15) or polished inner wall of the sleeve (13) can cause premature packing wear and leaking. Check these parts by rubbing a finger on the surfaces or by holding the parts up to the light at an angle. If either is worn or scratched, replace it.

NOTE: If the sleeve (13) needs replacement and is hard to remove, contact Graco Technical Assistance (see back page).

Service

Reassembly

1. Lubricate the throat gland/packing stack (18*). Install the stack in the throat of the pump housing (1). Remove the shims from the packing stack. *Be sure the lips of the v-packings face down in the throat.* See Fig. 5. Loosely install the packing nut/wet-cup (2).

2. Reinstall the sleeve (13) if it was removed, making sure to replace the gasket (19*). *Be sure the tapered end of the sleeve faces down, toward the pump intake.*

3. Lubricate the other packing stack (18*) and install it on the piston (3). Do not disassemble the stack. The shims must remain in place to ensure the correct stack height. *Be sure the lips of the v-packings face up on the piston.* See Fig. 5.

4. Place the washer (14) and ball (6*) on the piston (3), and screw the piston assembly into the displacement rod (15). Torque to 150–175 ft-lb (203–237 N.m).

NOTE: Do not use thread sealant on the piston.

5. Lubricate the displacement rod, and guide it through the bottom of the pump housing (1). Carefully push it up through the throat packings.

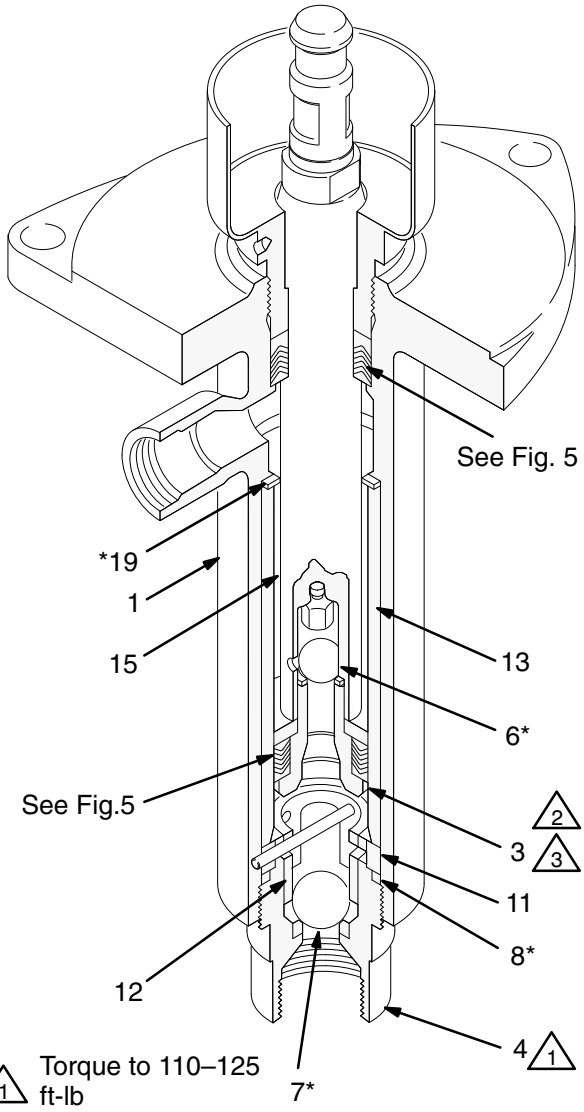
6. Install the o-ring (8*) and retainer (11) on the intake valve housing (4). Install the ball (7*) and ball guide (12) in the intake valve housing. Align the holes in the housing, retainer and guide, then install the ball stop pin (10) in the desired set of holes, as was noted in step 2 under **Disassembly.** (To change the pin location, see **Check Valve Adjustment**, below.) Screw the assembly into the pump housing (1). Torque to 110–125 ft-lb (149–169 N.m). See Fig. 4.

7. Reconnect the displacement pump to the air motor as explained on page 9.

Check Valve Adjustment

The intake check valve is set for high flow rates or high viscosity fluids. To set the valve for lighter viscosity fluids or a lower flow rate, to minimize surging at pump stroke changeover, move the ball stop pin (10) to the lower set of holes, decreasing the check ball travel. The piston check valve in this pump is not adjustable.

Service



1 Torque to 110–125 ft-lb (149–169 N.m)

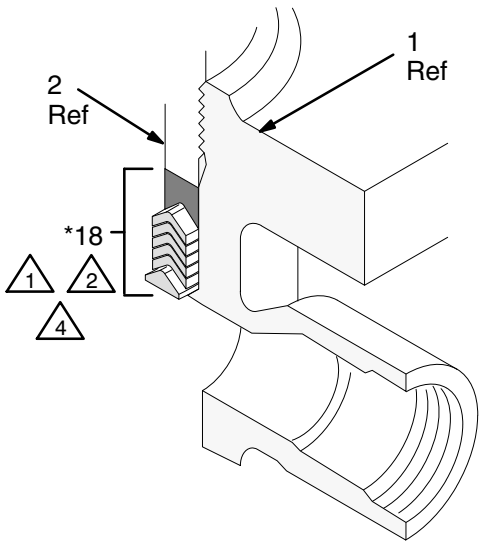
2 Torque to 150–175 ft-lb (203–237 N.m)

3 Do not use thread sealant on the piston.

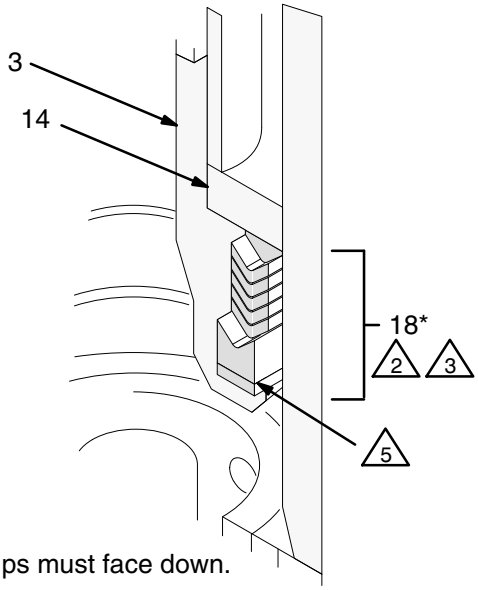
03318

Fig. 4

Detail of throat gland/packing stack.



Detail of piston gland/packing stack.



1 Lips must face down.

2 Do not disassemble stack.

3 Lips must face up.

4 Remove shims from throat packing stack.

5 Leave shims in place in piston packing stack.

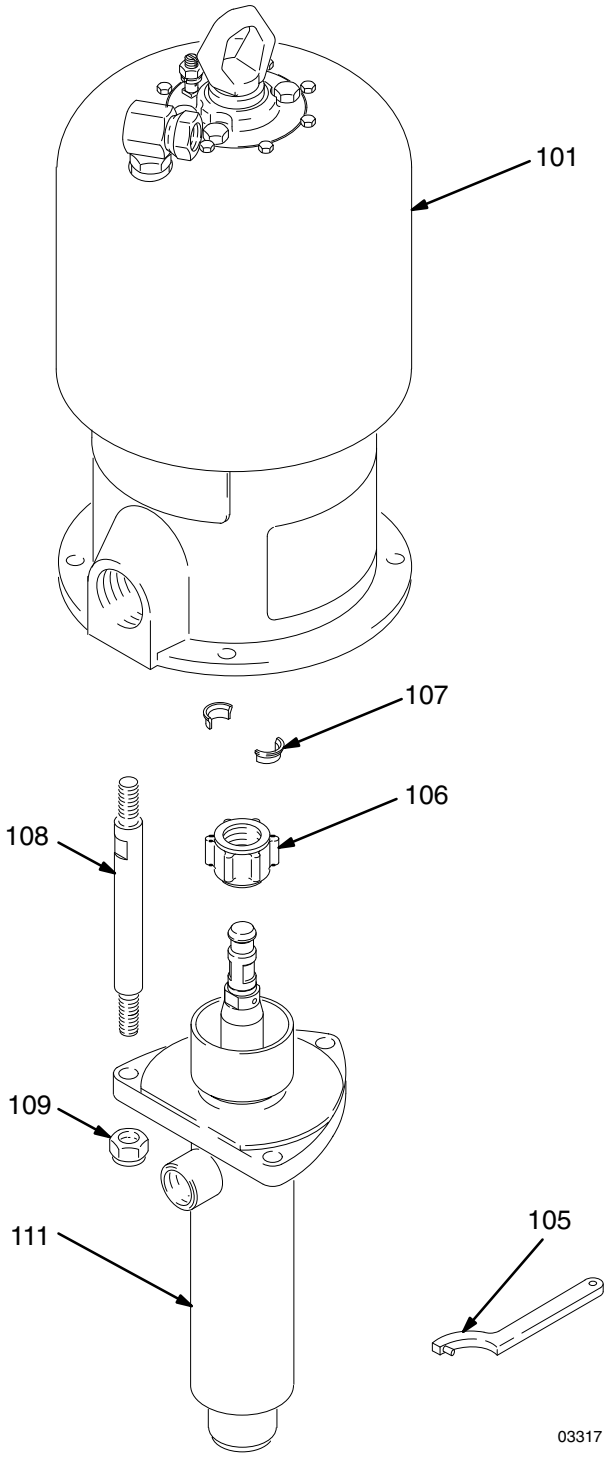
03319

Fig. 5

Parts

Model 223–887, Series A
45:1 Ratio King Pump, with Standard Air Motor
Includes items 101–111

Model 224–387, Series A
45:1 Ratio King Pump, with Quiet Air Motor
Includes items 101–111



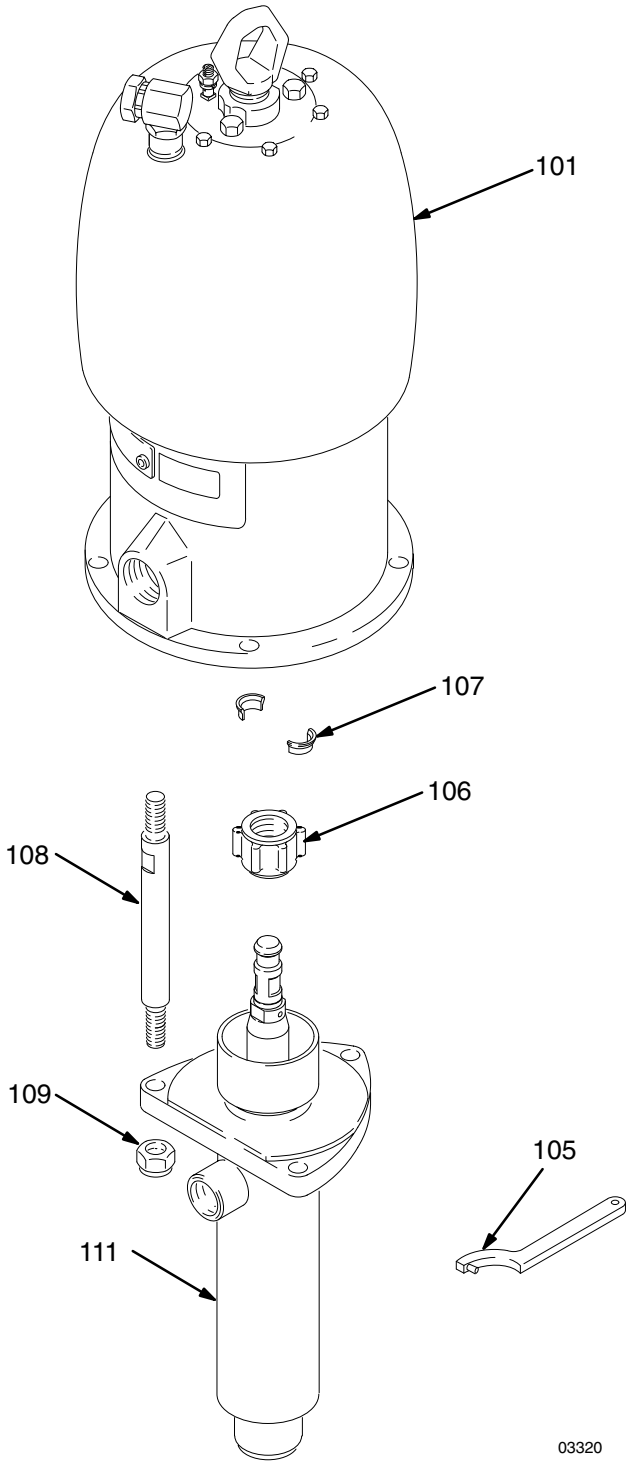
Ref. No.	Part No.	Description	Qty.
101	207–647	KING AIR MOTOR, standard Used on Model 223–887 See 306–968 for parts	1
	220–106	KING AIR MOTOR, quiet Used on Model 224–387 See 307–741 for parts	1
102▲	172–447	LABEL, warning (not shown)	1
105	102–176	WRENCH	1
106	186–925	NUT, coupling	1
107	184–129	COUPLING	2
108	167–911	ROD, TIE; 7” (178 mm), shoulder-to-shoulder	3
109	101–712	NUT, lock; 5/8–11	3
111	223–841	DISPLACEMENT PUMP ASSY See page 19 for parts	1

▲ Extra warning tags and labels available at no extra charge.

306 and 307 numbers in descriptions refer to separate instruction manuals, supplied.

Parts

Model 223–581, Series A
20:1 Ratio Bulldog Pump
Includes items 101–111



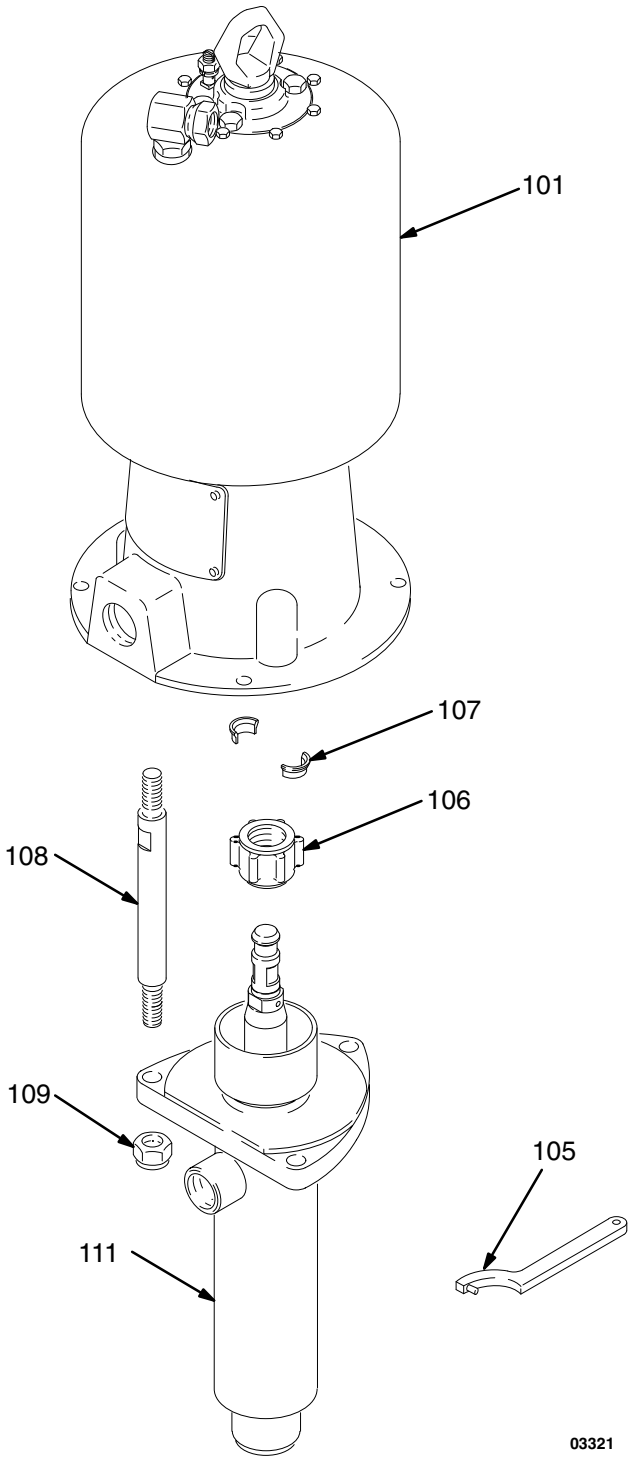
Ref. No.	Part No.	Description	Qty.
101	208–356	AIR MOTOR See 307–049 for parts	1
102▲	172–447	LABEL, warning (not shown)	1
105	102–176	WRENCH	1
106	186–925	NUT, coupling	1
107	184–129	COUPLING	2
108	167–911	ROD, tie; 7” (178 mm), shoulder-to-shoulder	3
109	101–712	NUT, lock; 5/8–11	3
111	223–841	DISPLACEMENT PUMP ASSY See page 19 for parts	1

▲ Extra warning tags and labels available at no extra charge.

306 and 307 numbers in descriptions refer to separate instruction manuals, supplied.

Parts

Model 231–110, Series A
13:1 Ratio Senator Pump
Includes items 101–111



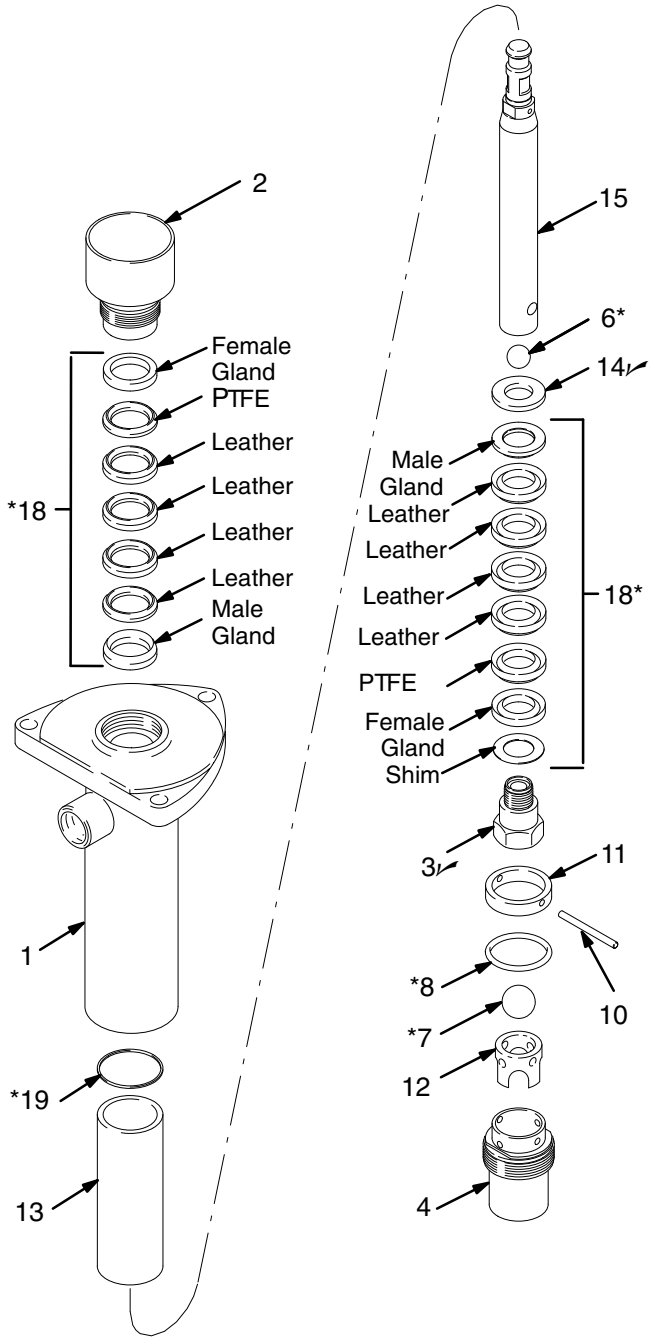
Ref. No.	Part No.	Description	Qty.
101	217–540	AIR MOTOR See 307–592 for parts	1
102▲	172–447	LABEL, warning (not shown)	1
105	102–176	WRENCH	1
106	186–925	NUT, coupling	1
107	184–129	COUPLING	2
108	167–911	ROD, tie; 7” (178 mm), shoulder-to-shoulder	3
109	101–712	NUT, lock; 5/8–11	3
111	223–841	DISPLACEMENT PUMP ASSY See page 19 for parts	1

▲ Extra warning tags and labels available at no extra charge.

306 and 307 numbers in descriptions refer to separate instruction manuals, supplied.

Parts

Model 223–841, Series C
Includes items 1–20



Ref. No.	Part No.	Description	Qty.
1	223–582	HOUSING, pump; stainless steel	1
2	223–583	PACKING NUT/WET-CUP; stainless steel	1
3✓	223–560	PISTON; stainless steel with tungsten carbide seat	1
4	223–561	HOUSING, intake valve; stainless steel with tungsten carbide seat	1
6*	109–217	BALL, stainless steel; 7/8" dia.	1
7*	109–219	BALL, stainless steel; 2–1/4: dia.	1
8*	106–260	O-RING; PTFE	1
10	186–160	PIN, ball stop, intake valve; stainless steel	1
11	186–165	RETAINER; stainless steel	1
12	186–161	GUIDE, ball; stainless steel	1
13	178–894	SLEEVE; stainless steel	1
14✓	186–159	WASHER, flat; stainless stel	1
15	236–278	ROD, displacement; stainless steel	1
18*	223–642	GLAND/PACKING STACK	2
19*	167–894	GASKET; PTFE	1
20▲	172–479	TAG, warning (not shown)	1

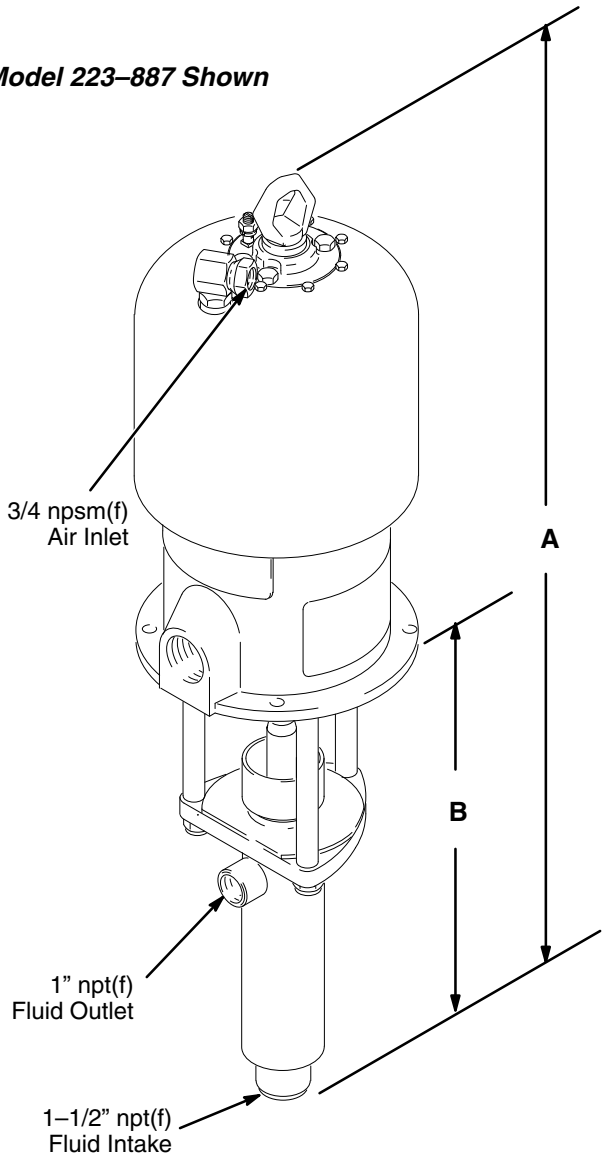
* Supplied in Repair Kit 223–643.

✓ Recommended "tool box" spare parts. Keep on hand to reduce downtime.

▲ Extra warnings and tags are supplied at no charge.

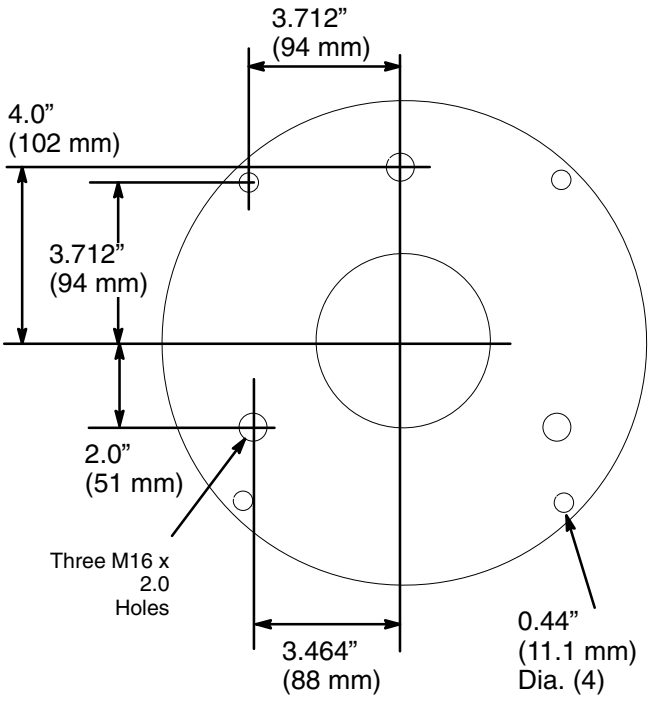
Dimensions

Model 223–887 Shown



Pump Model	A	B
223–887	42.5 in. (1080 mm)	21.0 in. (534 mm)
224–387	42.5 in. (1080 mm)	21.0 in. (534 mm)
223–581	42.2 in. (1071 mm)	20.9 in. (531 mm)
231–110	42.5 in. (1080 mm)	21.0 in. (534 mm)

Mounting Hole Layout



0653

Manual Change Summary

Assembly Changed	Part Status	Ref No.	Part No.	Name
223–841 Displacement Pump	Old New	15 15	178–888 236–278	Rod Rod
	Deleted	21	186–575	Connecting Rod

Other changes:

Series Change: Model 223–841 to Series C.

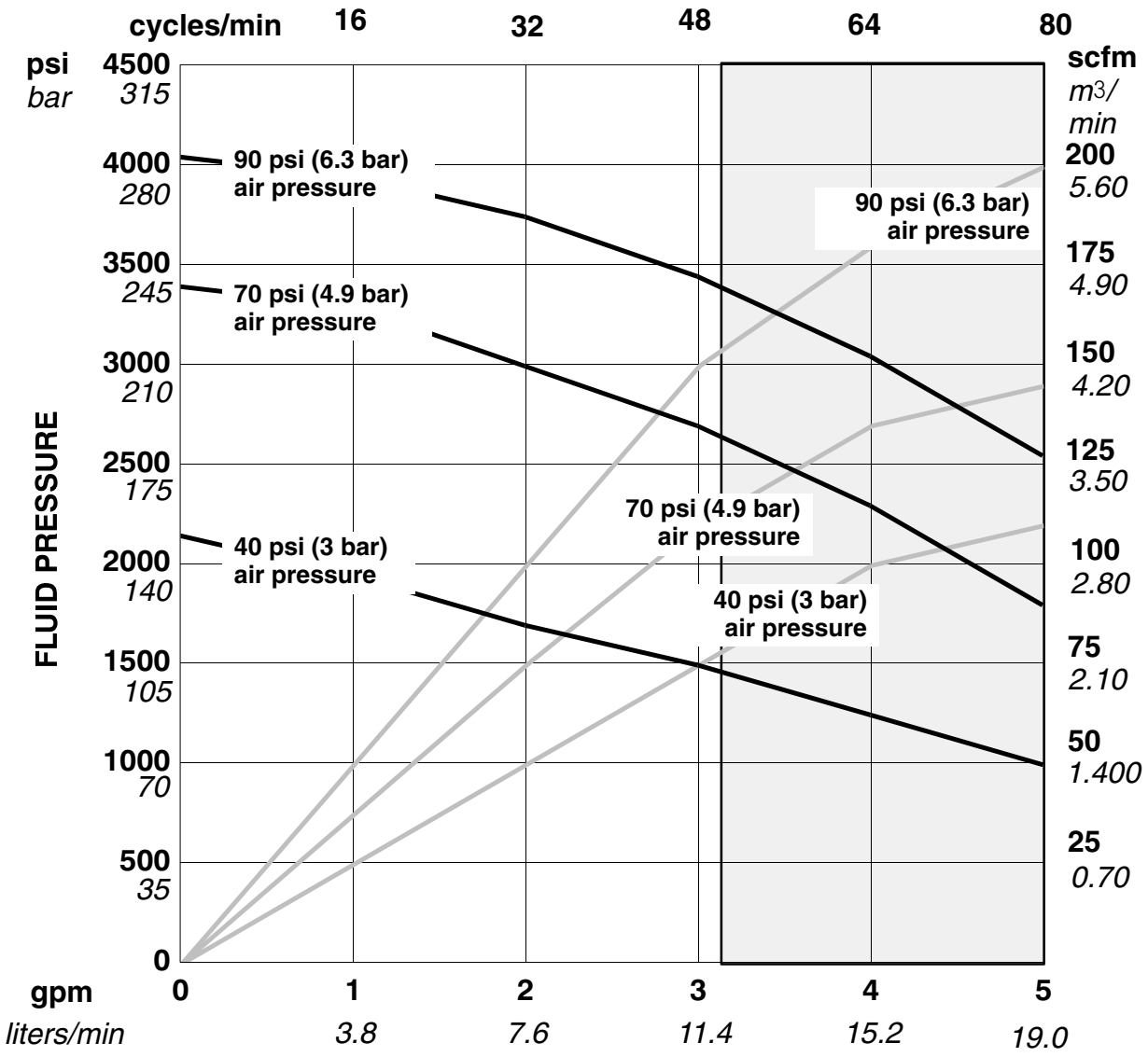
Displacement pump v-packings were changed to leather, with PTFE backup.

Technical Data (King Pump)

Maximum fluid working pressure	4050 psi (283 bar)
Air input pressure operating range	20–90 psi (1.4–6.3 bar)
Ratio	45:1
Pump cycles per 1 gallon (3.8 liters)	16
Maximum recommended pump speed for continuous operation	50 cycles per min
Air consumption	approx. 38 scfm (1.0 m3/min) at 1 gpm (3.8 liters/min) at 70 psi (4.9 bar) air pressure
Wetted parts	304, 316, 329 and 17–4 PH Grades of Stainless Steel, Tungsten Carbide, Chrome Plating, PTFE, Leather

KEY: Fluid Outlet Pressure – Black Curves
Air Consumption – Gray Curves

NOTE: Pump may be operated continuously to shaded area.



FLUID FLOW (TEST FLUID: NO. 10 WEIGHT OIL)

To find Fluid Outlet Pressure (bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (bar/psi):

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 (m3/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (bar/psi):

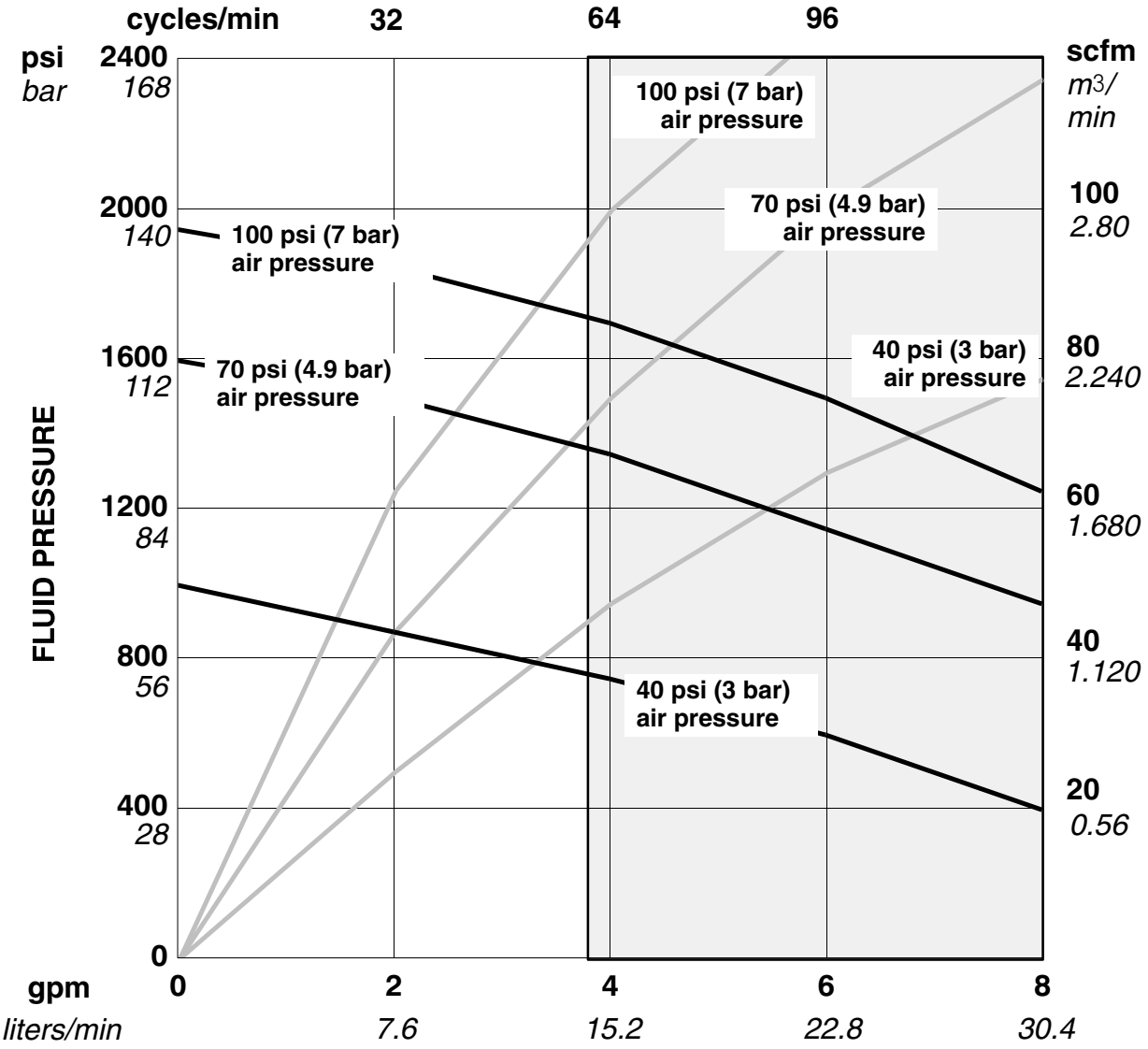
1. Locate desired flow along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve (gray). Follow right to scale to read air consumption.

Technical Data (Bulldog Pump)

Maximum fluid working pressure	2000 psi (140 bar)
Air input pressure operating range	40–100 psi (2.8–7 bar)
Ratio	20:1
Pump cycles per 1 gallon (3.8 liters)	16
Maximum recommended pump speed for continuous operation	60 cycles per min
Air consumption	approx. 20 scfm (0.56 m3/min) at 1 gpm (3.8 liters/min) at 70 psi (4.9 bar) air pressure
Wetted parts	304, 316, 329 and 17–4 PH Grades of Stainless Steel, Tungsten Carbide, Chrome Plating, PTFE, Leather

KEY: Fluid Outlet Pressure – Black Curves
Air Consumption – Gray Curves

NOTE: Pump may be operated continuously to shaded area.



FLUID FLOW (TEST FLUID: NO. 10 WEIGHT OIL)

To find Fluid Outlet Pressure (bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (bar/psi):
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.

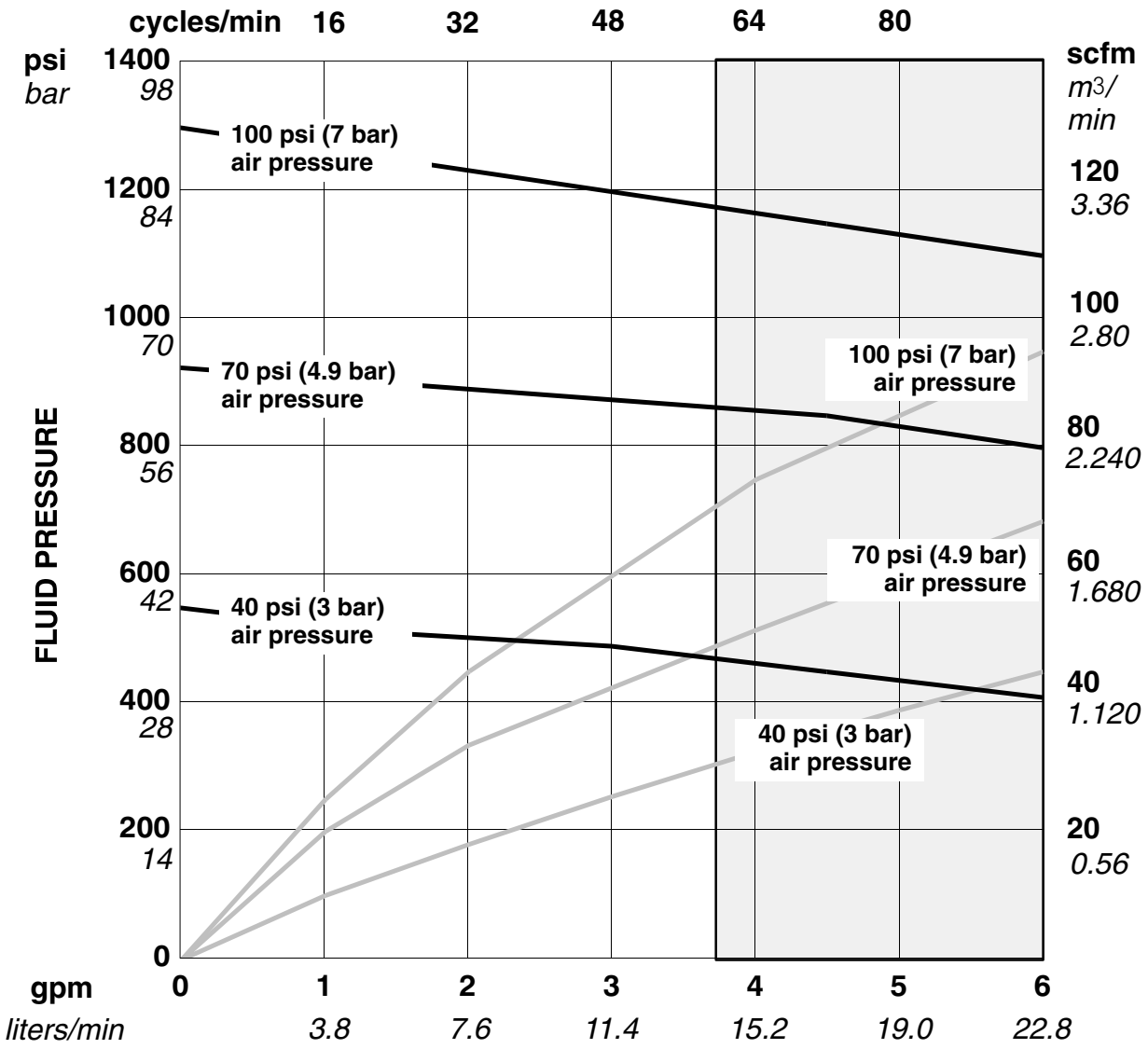
To find Pump Air Consumption (m3/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (bar/psi):
1. Locate desired flow along bottom of chart.
2. Read vertical line up to intersection with selected air consumption curve (gray). Follow right to scale to read air consumption.

Technical Data (Senator Pump)

Maximum fluid working pressure	1300 psi (90 bar)
Air input pressure operating range	40–100 psi (2.8–7 bar)
Ratio	13:1
Pump cycles per 1 gallon (3.8 liters)	16
Maximum recommended pump speed for continuous operation	60 cycles per min
Air consumption	approx. 20 scfm (0.56 m3/min) at 1 gpm (3.8 liters/min) at 70 psi (4.9 bar) air pressure
Wetted parts	304, 316, 329 and 17–4 PH Grades of Stainless Steel, Tungsten Carbide, Chrome Plating, PTFE, Leather

KEY: Fluid Outlet Pressure – Black Curves
Air Consumption – Gray Curves

NOTE: Pump may be operated continuously to shaded area.



FLUID FLOW (TEST FLUID: NO. 10 WEIGHT OIL)

To find Fluid Outlet Pressure (bar/psi) at a specific fluid flow (lpm/gpm) and operating air pressure (bar/psi):

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 (m3/min or scfm) at a specific fluid flow (lpm/gpm) and air pressure (bar/psi):

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.

Warranty

WARRANTY

Graco warrants all equipment manufactured by it and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. As purchaser's sole remedy for breach of this warranty, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment proven 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, 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 with Graco equipment of 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 claim. 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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