



INSTRUCTIONS

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

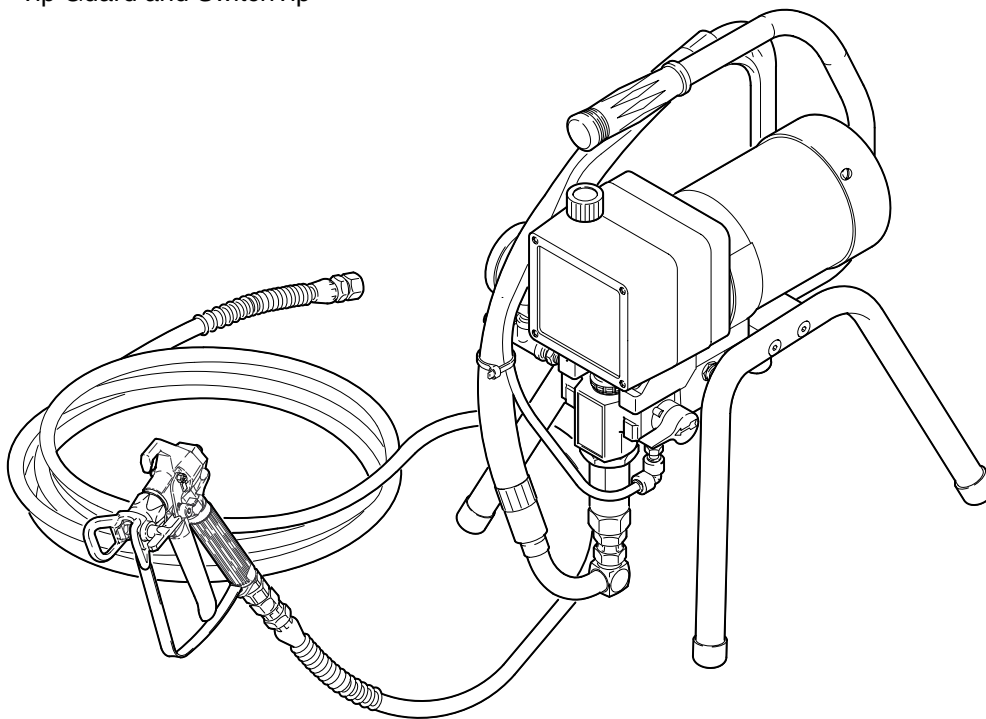
ELECTRIC, 230 Vac, 50 Hz

## 290 Easy Airless Paint Sprayer

*190 bar (19 MPa, 2750 psi) Maximum Working Pressure*

**Model 231-409, Series A**

Standard mount; complete sprayer with hose, gun,  
RAC IV® DripLess™ Tip Guard and SwitchTip™



7410B

**GRACO INC. P.O. BOX 1441 MINNEAPOLIS, MN 55440-1441**

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## Symbols

### Warning Symbol



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

### Caution Symbol



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

## ! 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.



- 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.
- Use only with a grounded outlet that matches the grounded plug of this equipment.

# WARNING



## 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.

- Fluid injected into the skin is a serious injury. The injury may look like just a cut, but it is a serious injury. Get immediate medical attention.
- 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 10 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.



## 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.



## MOVING PARTS HAZARD

Moving parts 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 10 to prevent the equipment from starting unexpectedly.

# ! WARNING



INSTRUCTIONS

## EQUIPMENT MISUSE HAZARD

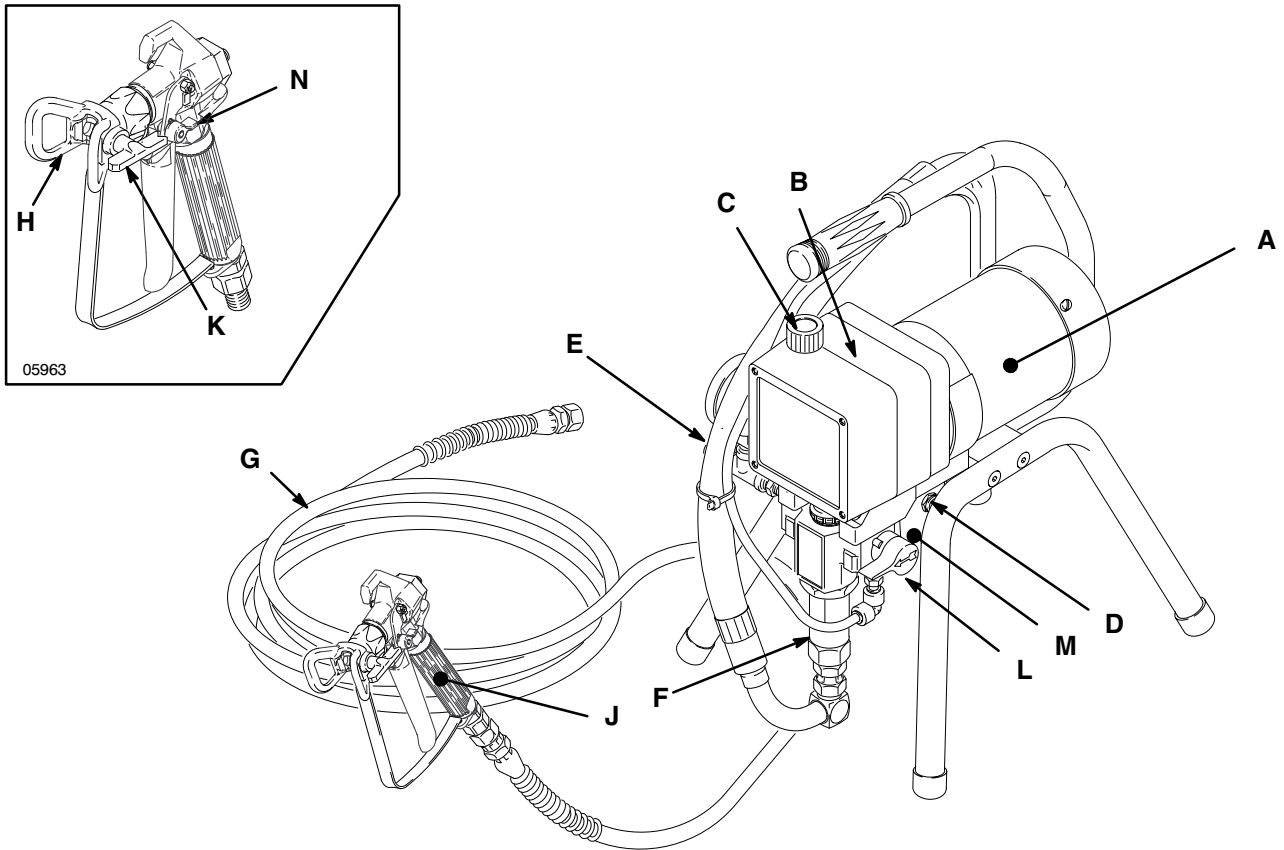
Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- 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 your distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts.
- 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 page 32 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 1,1,1-trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents in pressurized aluminum equipment. Such use could result in a chemical reaction, with the possibility of explosion.
- 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.

**NOTE:** This is an example of the DANGER label on your sprayer. This label is available in other languages, free of charge. See page 29 to order.

! DANGER !	
<b>FIRE AND EXPLOSION HAZARD</b>	<b>SKIN INJECTION HAZARD</b>
<p>Spray painting, flushing or cleaning equipment with flammable liquids in confined areas can result in fire or explosion.</p> <p>Use outdoors or in extremely well ventilated areas. Ground equipment, hoses, containers and objects being sprayed.</p> <p>Avoid all ignition sources such as static electricity from plastic drop cloths, open flames such as pilot lights, hot objects such as cigarettes, arcs from connecting or disconnecting power cords or turning light switches on and off.</p> <p>Failure to follow this warning can result in death or serious injury.</p>	<p>Liquids can be injected into the body by high pressure airless spray or leaks – especially hose leaks.</p> <p>Keep body clear of the nozzle. Never stop leaks with any part of the body. Drain all pressure before removing parts. Avoid accidental triggering of gun by always setting safety latch when not spraying.</p> <p>Never spray without a tip guard.</p> <p>In case of accidental skin injection, seek immediate "Surgical Treatment".</p> <p>Failure to follow this warning can result in amputation or serious injury.</p>
<p><b>READ AND UNDERSTAND ALL LABELS AND INSTRUCTION MANUALS BEFORE USE</b></p>	

# Component Identification and Function



Model 231-409 Shown

Fig. 1

7150D

<b>A</b>	Motor	DC motor, 230 Vac, 50 Hz, 3.8A, 1 phase
<b>B</b>	Drive Assembly	Transfers power from DC motor to the displacement pump
<b>C</b>	Pressure Adjusting Knob	Controls fluid outlet pressure
<b>D</b>	ON/OFF Switch	Power switch that controls 230 Vac power to sprayer
<b>E</b>	Fluid Outlet	Hose and spray gun is connected here
<b>F</b>	Displacement Pump	Pressurizes fluid to be sprayed through spray gun
<b>G</b>	15 m Main Hose	1/4 in. ID, grounded, nylon hose with spring guards on both ends
<b>H</b>	RAC IV Tip Guard	Reverse-A-Clean (RAC) tip guard reduces the risk of fluid injection injury
<b>J</b>	FTx-E Gun	High pressure spray gun with gun safety latch
<b>K</b>	RAC IV Switch Tip	RAC switch tip atomizes fluid and removes clogs from spray tip without removing tip from spray gun
<b>L</b>	Pressure Drain Valve	Relieves fluid pressure when open
<b>M</b>	Pressure Control	Controls motor to maintain fluid pressure. Works with pressure adjusting knob.
<b>N</b>	Spray Gun Safety Latch	Inhibits accidental triggering of spray gun

# Setup

## ⚠ WARNING

If you supply your own hoses and spray gun, be sure the hoses are electrically conductive, that the gun has a tip guard, and that each part is rated for at least *190 bar (19 MPa, 2750 psi) Working Pressure*. This is to reduce the risk of serious injury caused by static sparking, fluid injection or over-pressurization and rupture of the hose or gun.

## ⚠ CAUTION

To avoid damaging the pressure control, which may result in poor equipment performance and component damage, follow these precautions:

1. Always use a nylon spray hose at least 15 m long.
2. Never use a wire braid hose as it is too rigid to act as a pulsation dampener.
3. Never install any shutoff device between the filter and the hose. See Fig. 4.

1. **Plug the power cord (57)** into the inlet receptacle located below the motor. Tighten the screw (A) of the cord clamp (65) securely. See Fig 2. If the power cord you are using does not have a male plug attached, have a qualified electrician install an appropriate plug.

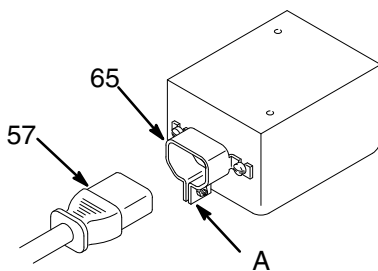


Fig. 2

2. **Connect the hose (74) and gun (67)** and screw it onto the outlet nipple (28). Don't use thread sealant, and don't install the spray tip yet!
3. **Fill the wet-cup (102).** Pry off the wet-cup seal. Fill the cup 1/3 full with Graco Throat Seal Liquid (TSL), supplied. Install the wet-cup seal.
4. **Check the electrical service.** It must be 230 Vac, 50 Hz, 6A (minimum) and protected by a fuse or circuit breaker with a rating of not more than 16A.

You may use a 3-wire, 1.0 mm<sup>2</sup> (16 AWG) (minimum) extension cord up to 45 m long.

## ⚠ WARNING



### FIRE AND EXPLOSION HAZARD

Proper electrical grounding is essential to reduce the risk of fire or explosion which can result in serious injury and property damage. Also read **FIRE OR EXPLOSION HAZARD** on page 2

5. **Plug in the sprayer.** Be sure the ON/OFF switch (52) is OFF. Plug the cord into a grounded outlet at least 6 m away from the spray area.

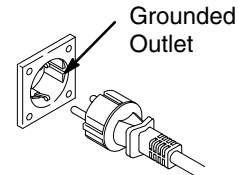
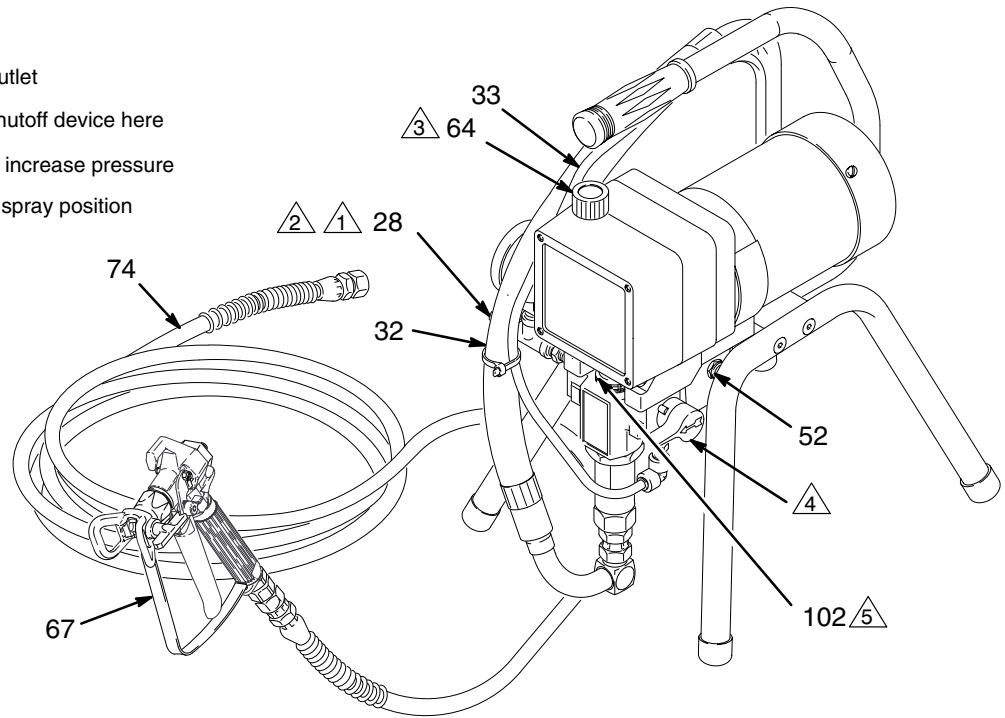


Fig. 3

6. **Flush the pump** to remove the lightweight oil which was left in to protect pump parts after factory testing. See page 13.
7. **Prepare the paint** according to the manufacturer's recommendations. Remove any paint skin. Strain the paint through a fine nylon mesh bag (available at most paint dealers) to remove particles that could clog the spray tip. This is an important step toward trouble-free paint spraying.

# Setup

- △1 1/4 npsm(m) fluid outlet
- △2 Do not install any shutoff device here
- △3 Rotate clockwise to increase pressure
- △4 Shown in closed or spray position
- △5 Fill 1/3 full with TSL



**Model 231-409 Shown**

7150D

**Fig. 4**

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# Operation

## How to use the gun trigger safety

When engaged, the gun safety latch prevents the gun from accidental triggering. See Fig. 5.

**⚠ WARNING**

**INJECTION HAZARD**  
If the gun still sprays when the gun trigger safety is locked, repair the gun. See manual 308-748, supplied.

- 1 Gun safety latch shown engaged
- 2 Gun safety latch shown disengaged

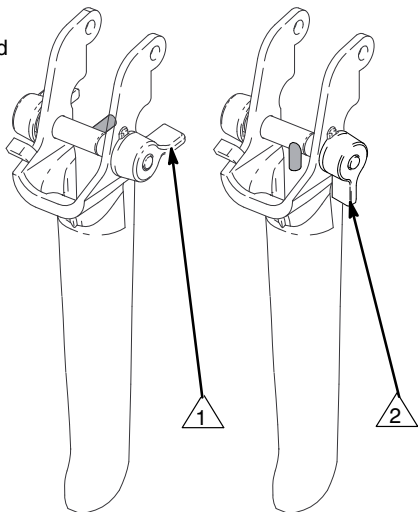


Fig. 5 7186A

## How to use the pressure drain valve.

Use the pressure drain valve to relieve fluid pressure from the pump and to help prime the pump. If the valve senses an over pressure condition, it opens automatically to relieve fluid pressure. If this happens, stop spraying immediately, shut off and unplug the sprayer. Determine the cause of the problem and correct it before operating the sprayer again. Refer also to the **Troubleshooting**, page 14. See Fig. 6.

- 1 Open or drain, position
- 2 Closed, or spray position

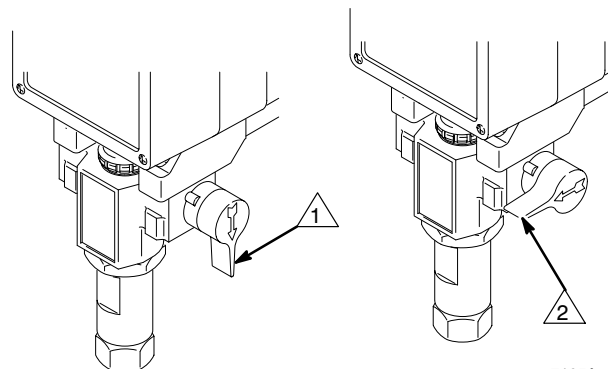


Fig. 6 7105A

## How to use the pressure control.

The pressure control controls the motor operation so the sprayer maintains constant fluid pressure at the pump outlet. Turn the pressure control knob fully counterclockwise to obtain the minimum setting. Turn the knob clockwise to increase pressure. See Fig. 7.

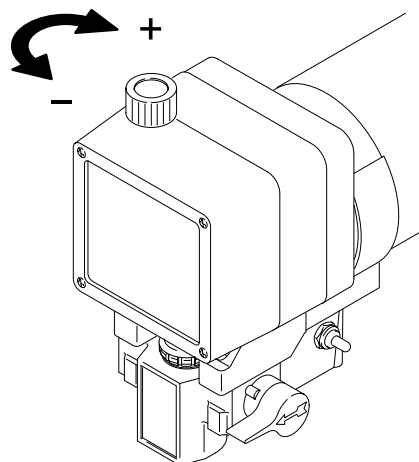


Fig. 7 7105A



# Operation

## How to use the RAC IV tip guard.

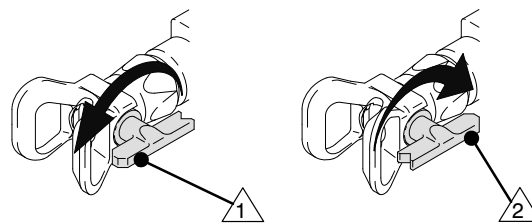
**⚠ WARNING**

**INJECTION HAZARD**

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

The tip guard alerts you to the risk and helps prevent placing any part of the body close to the spray tip. The tip guard also adjusts the vertical or horizontal spray pattern. See Fig. 10. The tip guard holds a reversing spray tip. The tip is in the spraying position when the tip handle points forward. See Fig. 8.

Clean the front of the tip frequently during the day's operation. First, follow the **Pressure Relief Procedure** on page 10.



1 Tip handle shown in spraying position.

2 Turn handle 180°, trigger gun to clear clog

04647

**Fig. 8**

### How to remove a tip clog.

1. Release the gun trigger. Lock the safety latch. Rotate the RAC IV tip handle 180°. See Fig. 8.
2. Unlock the safety latch. Trigger the gun into a pail or onto the ground to remove the clog.
3. Lock the safety latch. Rotate the tip handle to the spraying position.
4. If the tip is still clogged, lock the safety latch, shut off and unplug the sprayer, and open the pressure drain valve to relieve pressure. Clean the spray tip as shown in manual 308-644, supplied.

# Startup

## **⚠ WARNING**



### **INJECTION HAZARD**

The system pressure must be manually relieved to prevent the system from starting or spraying accidentally. Fluid under high pressure can be injected through the skin and cause serious injury. To reduce the risk of an injury from injection, splashing fluid, or moving parts, follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure,
- stop spraying,
- check or service any of the system equipment,
- or install or clean the spray tip.

## **Pressure Relief Procedure**

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the power supply cord.
4. Disengage the gun safety latch. Hold a metal part of the gun firmly to a grounded metal pail. Trigger the gun to relieve pressure.
5. Engage the gun safety latch.
6. Open the pressure drain valve. Leave the pressure 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 to relieve pressure gradually, then loosen completely. Now clear the tip or hose obstruction.*

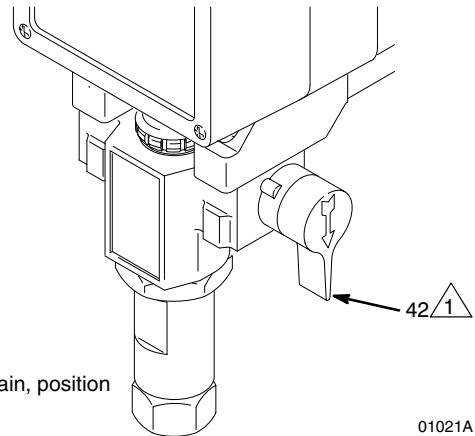
## **Startup Procedure**

Use this procedure each time you start the sprayer to help ensure the sprayer is ready to operate and that you start it safely.

**NOTE:** If this is a first-time startup, flush the sprayer. See page 13.

**NOTE:** Refer to Fig. 4 and the other figures referenced in the text as you start the sprayer.

1. **Open the pressure drain valve (42).** See Fig. 9.
2. **Don't install the spray tip until the pump is primed!**
3. **Put the suction hose (32) into the paint.** If you are pumping from a pail, push the drain hose (33) down below the top of the pail to avoid splashing paint when the drain valve is opened.



**Fig. 9**

01021A

4. **Turn the pressure knob (64) to the minimum setting.**
5. **Disengage the gun trigger safety.** See Fig. 5, page 8.

## **⚠ CAUTION**

Do not run the sprayer dry for more than 30 seconds to avoid damaging the pump packings.

6. **To prime the pump,** turn the sprayer switch (52) on. Slowly increase the pressure until the sprayer starts. When fluid comes from the pressure drain valve, close the valve.

# Startup

## ⚠ WARNING



### FIRE AND EXPLOSION HAZARD

To reduce the risk of static sparking and splashing when priming or flushing the system, hold a metal part of the gun firmly to the side of a grounded metal pail before triggering the gun.

7. **To prime the hose**, lower the pressure to reduce splashing. Hold a metal part of the gun firmly against and aimed into a grounded metal pail. See the preceding WARNING. Hold the gun trigger open and slowly increase the pressure until the pump starts. Keep the gun triggered until all air is forced out of the system and the fluid flows freely from the gun. Release the trigger and engage the gun safety latch.
8. **Check all fluid connections for leaks.** Relieve pressure before tightening the connections.
9. Engage the gun safety latch.
10. **Install the spray tip and tip guard.** Install the spray tip. If you are using the RAC IV tip guard, refer to manual 308–644 for installation instructions.
11. **Adjust the spray pattern**
  - a. Increase the pressure until spray from the gun is completely atomized. To avoid excessive overspray and fogging, and to extend tip and sprayer life, always use the lowest pressure needed to get the desired results.
  - b. If more coverage is needed, use a larger tip rather than increasing the pressure.
  - c. Adjust the direction of the spray pattern. See Fig. 10. Engage the gun safety latch. Loosen the retaining nut (A). Position the tip guard for a horizontal or vertical pattern. Hold the tip guard in place and tighten the retaining nut.

**NOTE:** Spray patterns will change as tips wear. Change the spray tip if adjusting the pressure will not improve the spray pattern.

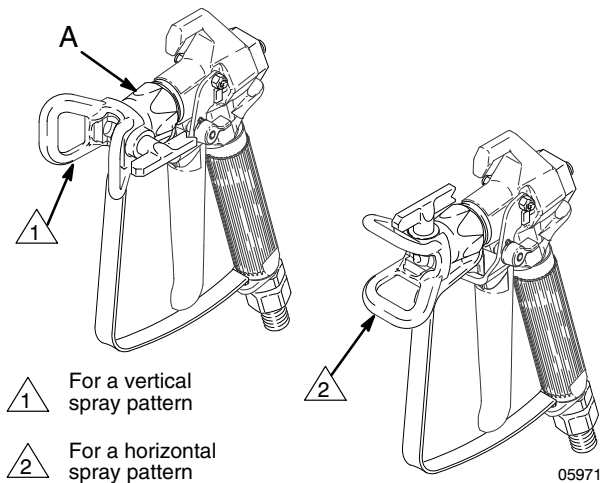


Fig. 10

# Shutdown and Care

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

8. **Coil the hose and hang it on a hose rack** when storing it, even for overnight, to help protect the hose from kinking, abrasion, coupling damage, etc.

## Shutdown and Care

1. **Check the packing nut/wet-cup daily (102).** Relieve pressure first. Keep the wet-cup 1/3 full of TSL at all times to help prevent fluid buildup on the piston rod and premature wear of packings.
2. **Tighten the packing nut/wet-cup (102) just enough to stop leakage.** Over-tightening causes binding and excessive packing wear. Use a round punch or brass rod and a light hammer to adjust the nut. See Fig. 11.
3. **Clean the gun's fluid filter often** and whenever the gun is stored. Relieve pressure first. Refer to manual 307-821.
4. **Periodically clean paint residue from the pressure transducer (29) vent hole area.** See Fig. 12. Replace the transducer when leakage is excessive. See page 28.
5. **Lubricate the bearing housing** after every 100 hours of operation. Remove the front cover. Fill the bearing housing cavity (A) with SAE 10 non-detergent oil. See Fig. 12.
6. **Flush the sprayer at the end of each work day** and fill it with mineral spirits to help prevent pump corrosion and freezing. See page 13.

## ⚠ CAUTION

To prevent pump corrosion, and to reduce the chance of fluid freezing in the pump in cold weather, never leave water or any type of paint in the sprayer when it is not in use. Freezing can seriously damage the sprayer or result in a loss of pressure or stalling.

7. **For very short shutoff periods,** leave the suction tube in the paint, relieve pressure, and clean the spray tip.

## ⚠ WARNING



### INJECTION HAZARD

See the warning section **INJECTION HAZARD** on page 3 for information on the hazard of using damaged hoses.

- 1 Turn packing nut clockwise to tighten

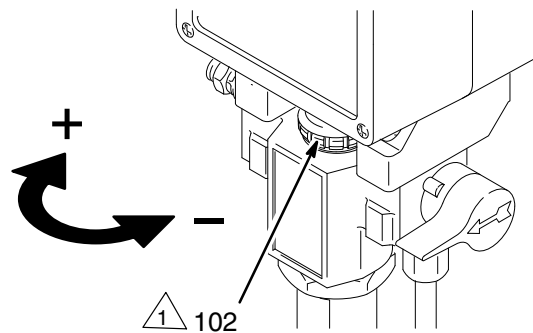


Fig. 11

05117

- 1 Vent hole

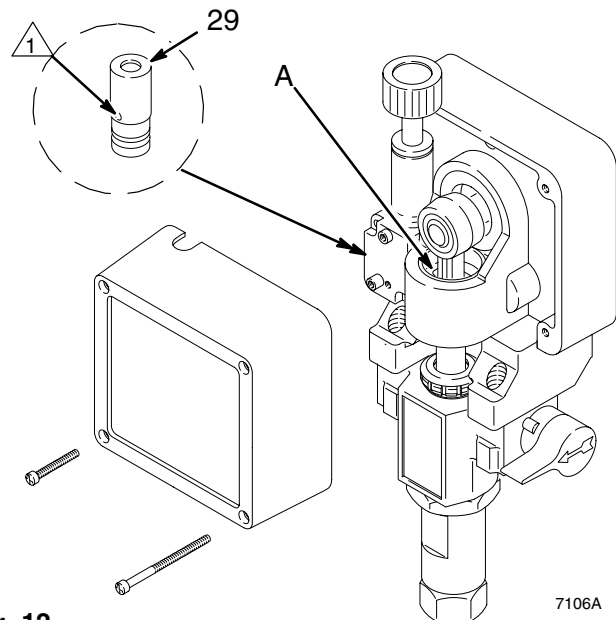


Fig. 12

7106A

# Flushing

## When to Flush

1. **Before using a new sprayer:** flush out the oil which was left in to protect pump parts.  
  
**Before using water-base paint:** flush with mineral spirits followed by soapy water, and then a clean water flush.  
  
**Before using oil-base paint:** flush with mineral spirits only.
2. **Changing colors:** flush with a compatible solvent such as mineral spirits or water.
3. **Changing from water-base to oil-base paint:** flush with warm, soapy water, and then mineral spirits.
4. **Changing from oil-base to water-base paint:** flush with mineral spirits, then warm, soapy water, and then a clean water flush.
5. **Storage after using water-base paint:** flush with water and then mineral spirits. Leave the system filled with mineral spirits. Relieve pressure. Leave the drain valve open.

**Storage after using oil-base paint:** flush with mineral spirits. Relieve pressure. Leave the drain valve open.

## ⚠ CAUTION

Never allow water to freeze in the pressure control. Doing so prevents the sprayer from being started and may cause serious damage. Push the water out with mineral spirits.

6. **Startup after storage.** Before using water-base paint, flush out the mineral spirits with soapy water and then clean water. When using oil-base paint, flush out the mineral spirits with the paint.

## How to Flush

1. Follow the **Pressure Relief Procedure** on page 10.
2. Remove the spray tip and clean it separately. Remove the filter screen and then reinstall the bowl, hand tight, without the screen. Clean the screen separately. (See instruction manual 308–249.)
3. Pour one-half gallon (2 liters) of compatible solvent into a grounded metal flushing pail. Put the suction hose in the pail.
4. Open the pressure drain valve. See Fig. 6, page 8.
5. **To save the paint still in the pump and hose,** follow Step 6, except put the drain tube in the paint pail. When solvent appears, close the drain valve. Put the drain tube in the flushing pail. Trigger the gun into the paint pail. When solvent appears, release the trigger. Continue with Step 6.
6. Lower the pressure setting. Turn on the sprayer. Maintaining metal-to-metal contact, trigger the gun into the flushing pail. Slowly increase the sprayer pressure until the pump starts. Keep the gun triggered until the solvent flows freely from the gun. Circulate the solvent to thoroughly clean the sprayer. Release the gun trigger. Engage the gun trigger safety.
7. Open the drain valve and circulate the solvent through the drain tube to thoroughly clean it. Close the drain valve.
8. Remove the suction hose from the pail. Disengage the gun trigger safety. Trigger the gun and run the pump a few seconds to push air into the hose. Do not run the pump dry for more than 30 seconds to avoid damaging the pump packings! Relieve pressure.
9. Remove and clean the inlet strainer. Wipe paint off the suction hose and drain tube.
10. Refer to **When To Flush**, Step 1 again. Relieve pressure.
11. Leave the drain valve open until you use the sprayer again.

## ⚠ WARNING



### FIRE AND EXPLOSION HAZARD

To reduce static sparking and splashing, always remove the spray tip from the gun, and hold a metal part of the gun firmly to the side of a grounded metal pail when flushing.

# Troubleshooting

## WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

## Basic Problem Solving

Check everything in the troubleshooting table before disassembling the sprayer.

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK, refer to this column</i>
Fluid pressure	1. Check pressure control knob setting. The pump won't develop much pressure if it is at minimum setting (fully counterclockwise).	1. Slowly increase pressure setting to see if motor starts.
	2. Check for a clogged spray tip or fluid filter, if used. See page 9.	2. If tip is still clogged, relieve pressure; refer to separate gun or tip instruction manual for tip cleaning. Clean or replace filter element. See manual 308–249.
Mechanical	1. Check for frozen or hardened paint in pump (20). Using a screwdriver, carefully try to rotate fan at back of motor by hand. See page 18.	1. Thaw. Plug in sprayer and turn on. Slowly increase pressure setting to see if motor starts. If it doesn't, see NOTE, below.
	2. Check pump connecting rod pin (17). It must be completely pushed into connecting rod (15), and retaining spring (18) must be firmly in connecting rod groove. See Fig. 19, page 22.	2. Push pin into place and secure with spring retainer.
	3. Check for motor damage. Remove drive housing assembly (11). See page 25. Try to rotate motor fan by hand.	3. Replace motor (4) if fan won't turn. See page 23.
Electrical	1. Check electrical supply with volt meter. Meter should read 210–250 Vac.	1. Reset building circuit breaker; replace building fuse. Try another outlet.
	2. Check extension cord for visible damage. Use a volt meter or test lamp at extension cord outlet to check.	2. Replace extension cord.
	3. Check sprayer power supply cord (57) for visible damage such as broken insulation or wires.	3. Replace power supply cord. See page 24.
	4. Check motor brushes for the following: <ul style="list-style-type: none"> <li>a. Loose terminal screws.</li> <li>b. Broken or misaligned brush springs.</li> <li>c. Brushes binding in holders.</li> <li>d. Broken leads.</li> <li>e. Worn brushes.</li> </ul> <b>NOTE:</b> The brushes do not wear at same rate on both sides of motor. Check both brushes.	4. Refer to page 20. <ul style="list-style-type: none"> <li>a. Tighten.</li> <li>b. Replace broken spring and/or align spring with brush</li> <li>c. Clean brush holders. Remove carbon with small cleaning brush. Align brush leads with slot in brush holder to assure free vertical brush movement.</li> <li>d. Replace brushes</li> <li>e. Replace brushes if less than 12.5 mm (0.5 in.) long.</li> </ul>

**NOTE:** Thaw sprayer if water or water-based paint has frozen in it, due to exposure to low temperatures, by placing in a warm area. Do not try to start sprayer until completely thawed or damage to motor and/or start board may occur. If paint hardened (dried) in sprayer, the pump packings (page 22) and/or pressure transducer (page 28) must be replaced.

# Basic Problem Solving

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK, refer to this column</i>
Electrical <i>(continued)</i>	5. Check motor armature commutator for burn spots, gouges and extreme roughness. Remove motor cover and brush inspection plates to check. See page 20.	5. Remove motor and have motor shop resurface commutator if possible. See page 23.
	6. Check motor armature for shorts using armature tester (growler) or perform motor test. See page 18.	6. Replace motor. See page 23.
	7. Check leads from pressure control and motor to motor start board (47) to be sure they are securely fastened and properly mated.	7. Replace loose terminals; crimp to leads. Be sure male terminal blades are straight and firmly connected to mating part.
	8. Check motor start board (47) by substituting with a good board. See page 24.  <b>CAUTION:</b> Do not perform this check until motor armature is determined to be good. A bad motor armature can burn out a good board.	8. Replace board. See page 24.
	9. Check power supply cord (57). Disconnect black and white power cord terminals; connect volt meter to these leads. Plug in sprayer. Meter should read 210–250 Vac. Unplug sprayer.	9. Replace power supply cord. See page 24.
	10. Check ON/OFF switch (52). Disconnect the motor start board (47) and switch and connect volt meter between exposed terminal on switch and power cord's white wire. Plug in sprayer and turn <b>ON</b> . Meter should read 210–250 Vac Turn off and unplug sprayer.	10. Replace ON/OFF switch. See page 24.
	11. Check motor thermal cutout switch. Connect ohmmeter between motor's red leads. Meter should read 1 ohm maximum.	11. Allow motor to cool. Correct cause of overheating. If switch remains open after motor cools, replace motor.
	12. Remove pressure control (64) and check microswitch operation with ohmmeter:  (1) With pressure knob at lowest setting and stem pushed into control, readings should be: white & black = 1 ohm max. white & red = open.  (2) With pressure knob at highest setting, readings should be: white & black = open; white & red = 1 ohm max.	12. Replace pressure control. See page 27.
13. Check pressure transducer (29) for hardened paint or damaged or worn components. See page 28.	13. Replace transducer. See page 28. Thorough system flushing will help extend life of transducer.	

## Intermediate Problem Solving

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK refer to this column</i>
Low output	1. Check for worn spray tip.	1. Follow <b>Pressure Relief Procedure</b> then replace tip. See your separate gun or tip manual.
	2. Be sure pump does not continue to stroke when gun trigger is released. Plug in and turn on sprayer. Prime with paint. Trigger gun momentarily, then release and lock safety latch. Relieve pressure, turn off and unplug sprayer.	2. Service pump. See page 22.

# Intermediate Problem Solving

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK, refer to this column</i>
Low output ( <i>continued</i> )	3. Release gun trigger. Observe resting position of pump rod (107).	3. If pump consistently comes to rest with rod (107) fully extended, the piston packings and/or piston valve may be worn. Service the pump. See page 22.
	4. Check electrical supply with volt meter. Meter should read 210–250 Vac.	4. Reset building circuit breaker; replace building fuse. Repair electrical outlet or try another outlet.
	5. Check extension cord size and length; must be at least 12 gauge wire and less than 150 ft (45 m) long.	5. Replace with a correct, grounded extension cord.
	6. Check motor brushes. See Electrical – What To Check, item 4, on page 14.	6. See page 20.
	7. Check motor start board (47) by substituting with a good board.  <b>CAUTION:</b> Do not perform this check until motor armature is determined to be good. A bad motor armature can burn out a good board.	7. Replace board. See page 24.
	8. Check motor armature for shorts by using an armature tester (growler) or perform motor test. See page 18.	8. Replace motor. See page 23.
Drain valve leaks	1. Check drain valve for correct torque and/or worn parts. Check for debris trapped on seat.	9. Tighten to 185 in–lb (21 N.m). Clean valve and replace with new gasket (42a) and sealant (42e). See page 29.
Transducer leaks	1. Slight leakage from transducer is normal.	1. Periodically remove residue from its cylinder port. See page 28.
No output: motor runs and pump strokes	1. Check paint supply.	1. Refill and reprime pump.
	2. Check for clogged intake strainer.	2. Remove and clean, then reinstall.
	3. Check for loose suction tube or fittings. See page 28.	3. Tighten; use thread sealant on npt threads of adapter (38).
	4. Check to see if intake valve ball and piston ball are seating properly. See page 22.	4. Remove intake valve and clean. Check ball and seat for nicks; replace as needed. See page 22. Strain paint before using to remove particles that could clog pump.
	5. Check for leaking around throat packing nut which may indicate worn or damaged packings. See page 22.	5. Replace packings. See page 22. Also check piston valve seat for hardened paint or nicks and replace if necessary. Tighten packing nut/wet-cup.
	6. Release gun trigger. Observe resting position of pump rod (107).	6. If pump consistently comes to rest with rod (107) fully extended, the piston packings and/or piston valve may be worn. Service the pump. See page 22.
No output: motor runs but pump does not stroke	1. Check displacement pump connecting rod pin (17). See Fig. 19, page 22.	1. Replace pin if missing. Be sure retainer spring (18) is fully in groove all around connecting rod.
	7. Check connecting rod assembly (15) for damage. See page 25.	7. Replace connecting rod assembly. See page 25.
	8. Be sure crank in drive housing rotates; plug in sprayer and turn on briefly to check. Turn off and unplug sprayer. See page 25.	8. Check drive housing assembly for damage and replace if necessary. See page 25.



# Intermediate Problem Solving

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK, refer to this column</i>
Spray Pattern Variations	1. Spray tip worn beyond sprayer pressure capability.	1. Replace spray tip. <b>NOTE:</b> A smaller size tip will provide longer life.
	2. Check transducer (29) for wear or damage.	2. Replace transducer. See page 28.
	3. Check pressure control (64) for smooth operation.	3. Replace pressure control. See page 27.
	4. Check Low output section, page 16.	
Motor Is Hot and Runs Intermittently	1. Determine if sprayer was operated at high pressure with small tips, which causes excessive heat build up.	1. Decrease pressure setting or increase tip size.
	2. Be sure ambient temperature where sprayer is located is no more than 90°F (32°C) and sprayer is not located in direct sun.	2. Move sprayer to shaded, cooler area if possible.
	3. Check motor.	3. Replace motor. See page 23.
Building Circuit Breaker Opens As Soon As Sprayer Switch Is Turned On.	1. Check all electrical wiring for damaged insulation, and all terminals for loose fit or damage. Also check wires between pressure control and motor. See page 23.	1. Repair or replace any damaged wiring or terminals. Securely reconnect all wires.
	2. Check for missing motor brush inspection plate gasket (see page 18), bent terminal forks or other metal to metal contact points which could cause a short.	2. Correct faulty conditions.
	3. Check motor armature for shorts. Use an armature tester (growler) or perform motor test. See page 18. Inspect windings for burns.	3. Replace motor. See page 23.
	4. Check motor start board (47) by substituting with a good board.  <b>CAUTION:</b> Do not perform this check until motor armature is determined to be good. A bad motor armature can burn out a good board.	4. Replace board. See page 24.
Circuit breaker opens after sprayer operates for 5 to 10 minutes.	1. Check 'Basic Problems – Electrical' on page 14.	
Building circuit breaker opens as soon as sprayer is plugged into outlet and sprayer is NOT turned on.	1. Check ON/OFF switch (52). <i>Be sure sprayer is unplugged!</i> Disconnect wires from switch. Check switch with ohmmeter. The reading should be infinity with ON/OFF switch OFF, and zero with switch ON.  <b>CAUTION:</b> A short in motor circuit can damage switch and or motor start board (47).	1. Replace ON/OFF switch. See page 24.
	2. Check electrical supply with volt meter. Meter should read 210–250 Vac.	2. If voltage is too high, do not operate sprayer until corrected.
Unit will not run on generator but does run on AC power	Check the generator's peak voltage. This sprayer will not run if the peak voltage is above 250V.	Use AC power or a different generator

# Motor Test

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

**Procedure** on page 10.

For checking armature, motor winding and brush electrical continuity.

## Setup

Remove the drive housing. See page 25. This is to ensure that any resistance you notice in the armature test is due to the motor and not to worn gears in the drive housing.

Remove the motor brush inspection covers (A). See Fig. 13.

Remove the junction box screws (56). Lower the junction box. Disconnect the two leads (C) from the motor to the board (47). See Fig. 14.

## Armature Short Circuit Test

Remove the fan cover (B). See Fig. 13.

Spin the motor fan by hand. If there are no shorts, the motor will coast two or three revolutions before coming to a complete stop. If the motor does not spin freely, the armature is shorted and the motor must be replaced. See page 23.

## Armature, Brushes, and Motor Wiring Open Circuit Test (Continuity)

Connect the two black motor leads together with a test lead. Turn the motor fan by hand at about two revolutions per second.

When turning the fan on a DC motor, normally you sense an even, pulsing resistance. If there is irregular turning resistance, or no turning resistance, check and repair the following as needed: broken brush springs, brush leads, motor leads; loose brush terminal screws or motor lead terminals; worn brushes. See page 20.

If there is still uneven or no turning resistance, replace the motor. See page 23.

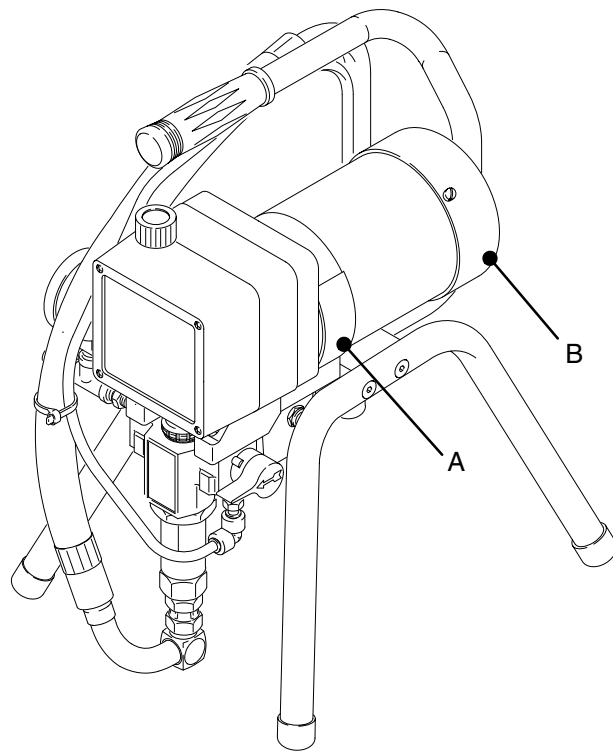


Fig. 13

7156B

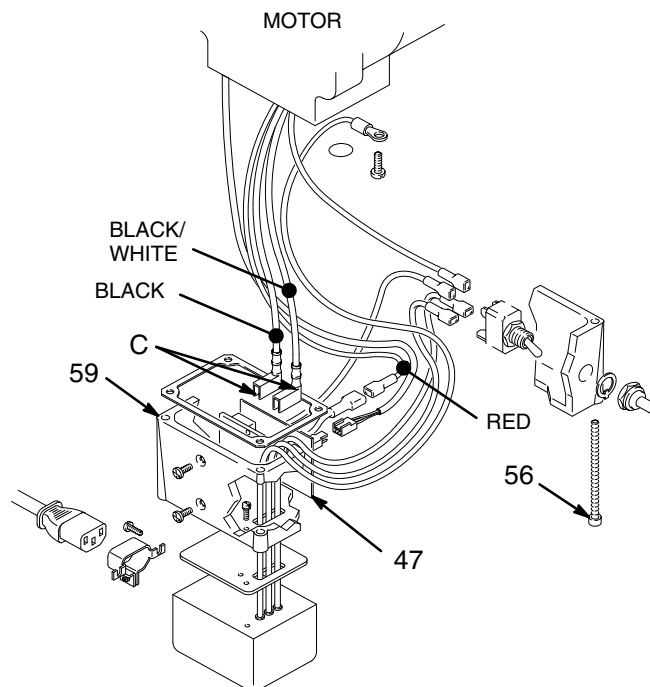


Fig. 14

05563

# General Repair Information

## WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief**

**Procedure** on page 10.

## Tool List

These are the tools required to service all parts of the sprayer.

3/16" Allen® wrench: *gear housing, legs, handle*

3/8" Allen® wrench: *pump manifold*

#1 Phillips® screwdriver: *junction box, pressure control, front cover*

3/8" socket wrench: *motor mount*

5/8" socket wrench: *drain valve, outlet fittings, on/off switch boot, piston*

13/16" socket wrench: *drain valve*

1-1/4" socket wrench: *pump inlet valve*

1/2" open end wrench: *pump rod*

11/16" open end wrench: *piston jam nut*

15/16" open end wrench: *flats of inlet tube*

1-3/4" open end wrench: *pump jam nut*

5/64" drive pin: *drain valve pin*

3" needle nose pliers: *wiring, on/off switch*

Hammer & punch: *packing nut*

Torque wrenches: *various fasteners*

## WARNING



### MOVING PARTS HAZARD

To reduce the risk of serious injury, including electric shock, **DO NOT** touch any moving parts or electrical parts with your fingers or a tool while inspecting the repair.

Shut off the sprayer and unplug it as soon as you complete the inspection.

Reinstall all covers, gaskets, screws and washers before operating the sprayer.

## WARNING



### HOT SURFACE HAZARD

During operation, the motor and drive housing become very hot and could burn your skin if touched. Flammable materials spilled on the hot, bare motor could cause a fire or explosion

## CAUTION

To reduce the risk of a pressure control malfunction, be sure to properly mate connectors, and never pull on a wire to disconnect it. Pulling on a wire could loosen the connector from the wire.

1. **When disconnecting wires** in the junction box assembly, use needle nose pliers to separate mating connectors.
2. **When reconnecting the wires**, be sure the flat blade of the insulated male connector is centered in the wrap-around blade of the female connector.

## CAUTION

Improper wire routing can result in poor sprayer performance or damage to the pressure control.

3. **Route wires carefully** through the drive housing and motor. Avoid pinching the wires between the junction box and the motor or pressure control.
4. **Keep all screws, nuts, washers, gaskets, and electrical fittings** removed during repair procedures. These parts are not normally provided with replacement assemblies.
5. **Test your repair before regular operation** to be sure the problem is corrected.
6. **If the sprayer does not operate properly**, verify that everything was done correctly. Also refer to the Troubleshooting Guide, pages 14–17, to help identify other possible problems and solutions.

# Motor Brushes

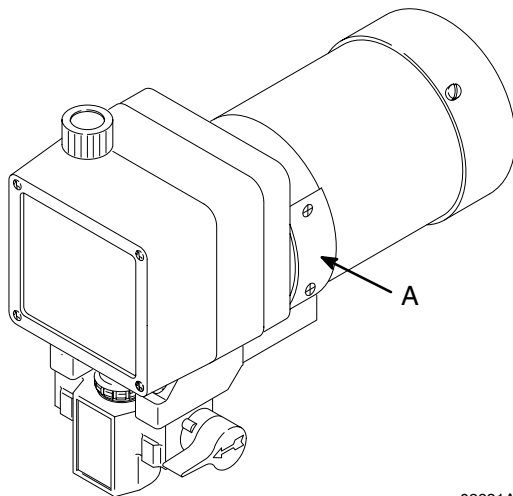
**NOTE:** Replace brushes when worn to about 0.5 in. (12.5 mm). Always check both brushes. Brush Repair Kit 236-967, which includes spring clip 112-766, is available for motors manufactured by Pacific Scientific.

**NOTE:** Replacement brushes may last only half as long as the original ones. To maximize brush life, break in new brushes by operating the sprayer for at least one hour with no load (remove the pump connecting rod pin).

**⚠ WARNING**

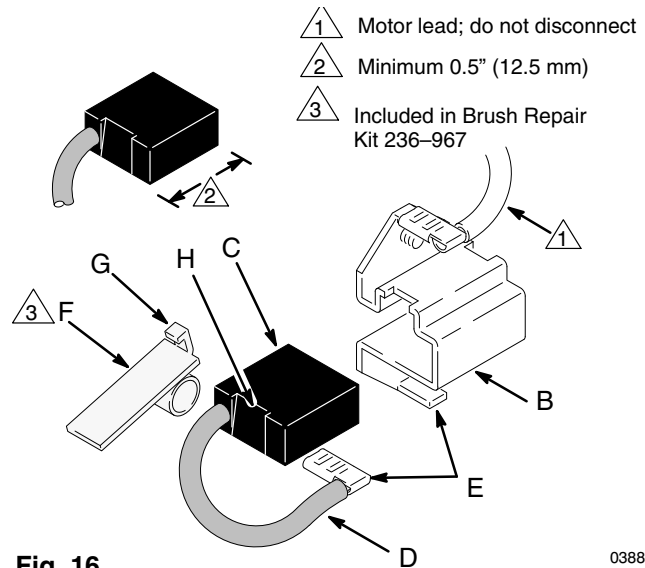
**INJECTION HAZARD**  
 To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

1. Remove both inspection covers (A) and their gaskets. See Fig 15.



**Fig. 15** 02831A

2. Push in the spring clip (F) and release its hook (G) from the brush holder (B). Pull out the spring clip. See Fig 16.
3. Slide off the brush lead terminal (E) off the blade connector. Remove the old brush (C). See Fig 16.



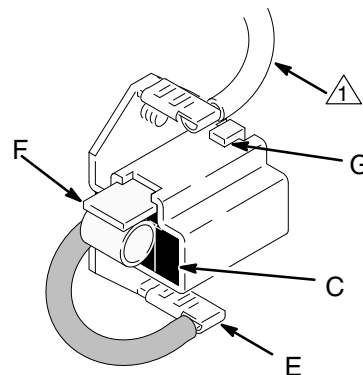
**Fig. 16** 03881

4. Inspect the commutator for excessive pitting, burning or gouging. A black color on the commutator is normal. Have the commutator resurfaced by a qualified motor repair shop if the brushes seem to wear too fast or arc excessively. See Step 9.d., also.

5. Repeat for the other side.

**NOTE:** The motor brushes on the other side are upside down.

6. Place a new brush (C) in the holder (B) so the ramp (H) faces the spring. See Fig. 16.



**Fig. 17** 03881

7. Holding the spring clip (F) at a slight angle, slide the spring clip into the brush holder and hook it over the end of the holder. See Fig. 17. Pull on the spring clip to be sure it stays in place. Connect the brush lead to the blade connector (E).
8. Repeat for the other side.

# Motor Brushes

## 9. Test the brushes.

- a. Remove the pump connecting rod pin (17). See Fig. 19, page 22.
- b. With the sprayer OFF, turn the pressure control knob fully counterclockwise to minimum pressure. Plug in the sprayer.
- c. Turn the sprayer ON. Slowly increase the pressure until the motor is at full speed.
- d. Inspect the brush and commutator contact area for excessive arcing. Arcs should not trail or circle around the commutator surface.

## **WARNING**



### **MOVING PARTS HAZARD**

Do not touch the brushes, leads, springs or brush holders while the sprayer is plugged in to reduce the risk of electric shock and serious injury.

10. Install the brush inspection covers and gaskets.
11. **Break in the brushes.** Operate the sprayer for at least one hour with no load. Install the pump connecting rod pin. See Fig. 19, page 22.

# Displacement Pump Repair

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

**NOTE:** Packing Repair Kit 235–703 is available. Reference numbers of parts included in the kit are marked with an asterisk, i.e., (121\*). For the best results, use all the new parts in the kit, even if the old ones still look good.

**NOTE:** To minimize down time, and for the best sprayer performance, check the motor brushes (see page 20) and clean the transducer (see page 28) whenever you repack the pump. Replace these parts as needed.

### Removing the pump (See Fig. 18.)

1. Flush the pump, if possible. Relieve pressure. Stop the pump with the piston rod (107) in its lowest position, if possible. To lower the piston rod manually, rotate the motor fan blades.
2. Push downward on the inner face of elbow (78) and while pushing upward on the elbow, pull the elbow from the displacement pump stem adapter (36).
3. Use a screwdriver to push the retaining spring (18) up and push out the pin (17).
4. Loosen the screws (21). Remove the pump (20).

### Repairing the pump

See manual 308–190 for pump repair instructions.

### Installing the pump (See Fig. 18 and 19.)

1. Mount the pump on the drive housing. Tap it into the alignment pins with a soft hammer. Tighten the screws (21) to 50 ft-lb (68 N.m).

2. Align the hole in the rod (107) with the connecting rod assembly (15). Use a screwdriver to push the retaining spring (18) up and push in the pin (17). Push the retaining spring (18) into place around the connecting rod.
3. Replace the o-ring (27) if it is worn or damaged. Reconnect the suction and drain hoses (32,33). Install the front cover (13).
4. Tighten the packing nut (102) just enough to stop leakage, but no tighter. Fill the packing nut/wet-cup 1/3 full with Graco TSL. Push the plug (123) into the wet-cup.

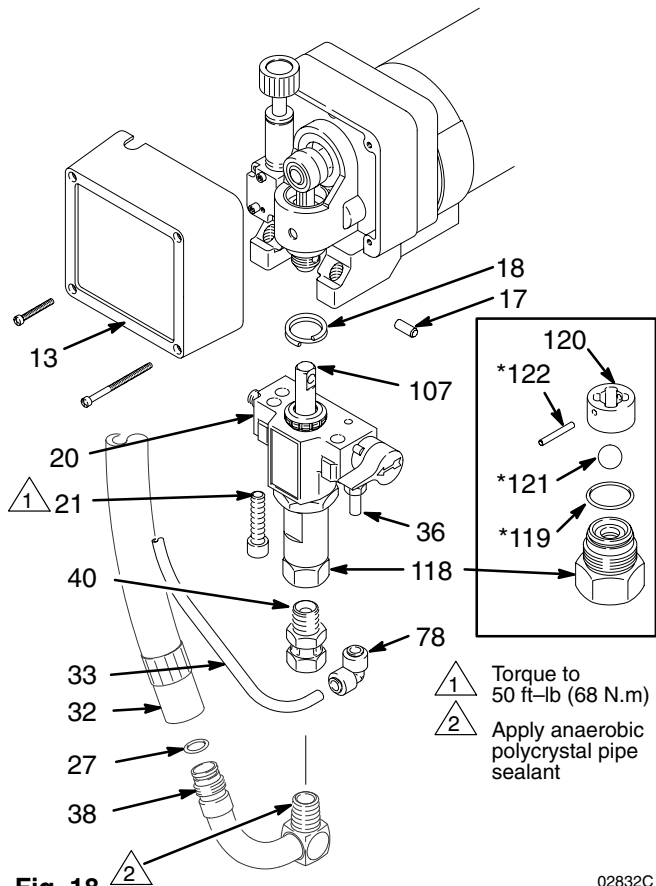


Fig. 18

02832C

## ⚠ WARNING



### MOVING PARTS HAZARD

Be sure the retaining spring (18) is firmly in the groove all the way around, to prevent the pin (17) from working loose due to vibration. See Fig. 19.

If the pin works loose, it or other parts could break off due to the force of the pump action. These parts could be projected into the air and result in serious injury or property damage, including the pump connecting rod or drive housing.

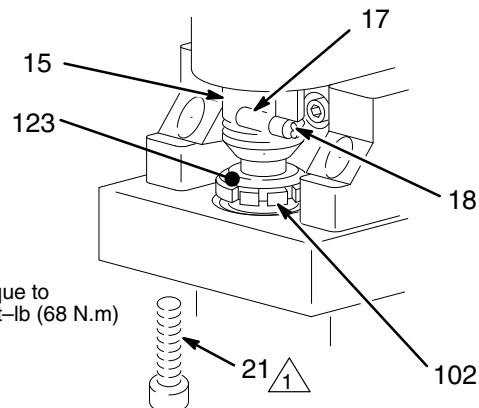



Fig. 19

04655

# Motor

! **WARNING**



**INJECTION HAZARD**  
To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

**NOTE:** See Fig. 22 except where noted.

1. Relieve pressure.
2. Try to stop the pump with the piston rod (107) in its lowest position. To lower the piston rod manually, rotate the motor fan blades. Use a screwdriver to push the retaining spring (18) up and push out the pin (17). See Fig. 20.
3. Remove the screws (56) and lower the junction box (59). Disconnect the motor wires and the pressure control wire (A) from the motor start board. Refer to Fig. 23 on page 24.
4. Remove the front cover (13).
5. Turn the displacement pump rod (107) so the pin hole aligns with the bottom drive housing screw (19). See Fig. 21. Remove the three drive housing screws and lockwashers (19,6). Also see Fig. 22.
6. Remove the two motor screws (5) and the lock washers (6).
7. Tap the lower rear of the drive housing (11) with a plastic mallet to loosen the motor. Pull the drive housing straight off the motor while guiding the harness (A) from the motor. Do not allow the gear (16) to fall. Read the CAUTION on page 25.
8. Remove the two screws (46) and lift the motor off the base (66).
9. Align the new motor with the base and reinstall the screws (46).
10. Assemble the drive housing to the motor. Follow steps 8 to 10 on page 25.
11. Connect the wires in the junction box. Refer to Fig. 23 on page 24. Install the junction box.
12. Connect the piston rod (107) to the drive housing; see page 22, **Installing the Pump**, Step 2 and the WARNING following it.

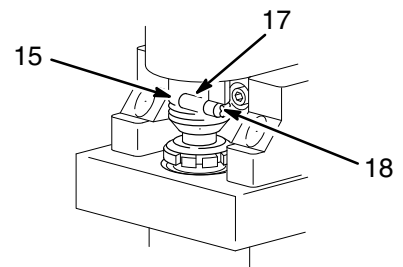


Fig. 20

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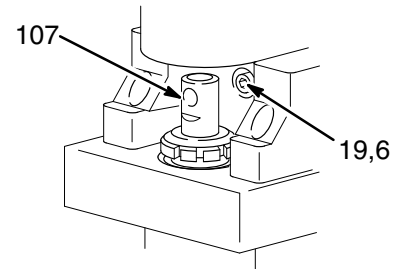


Fig. 21

01074

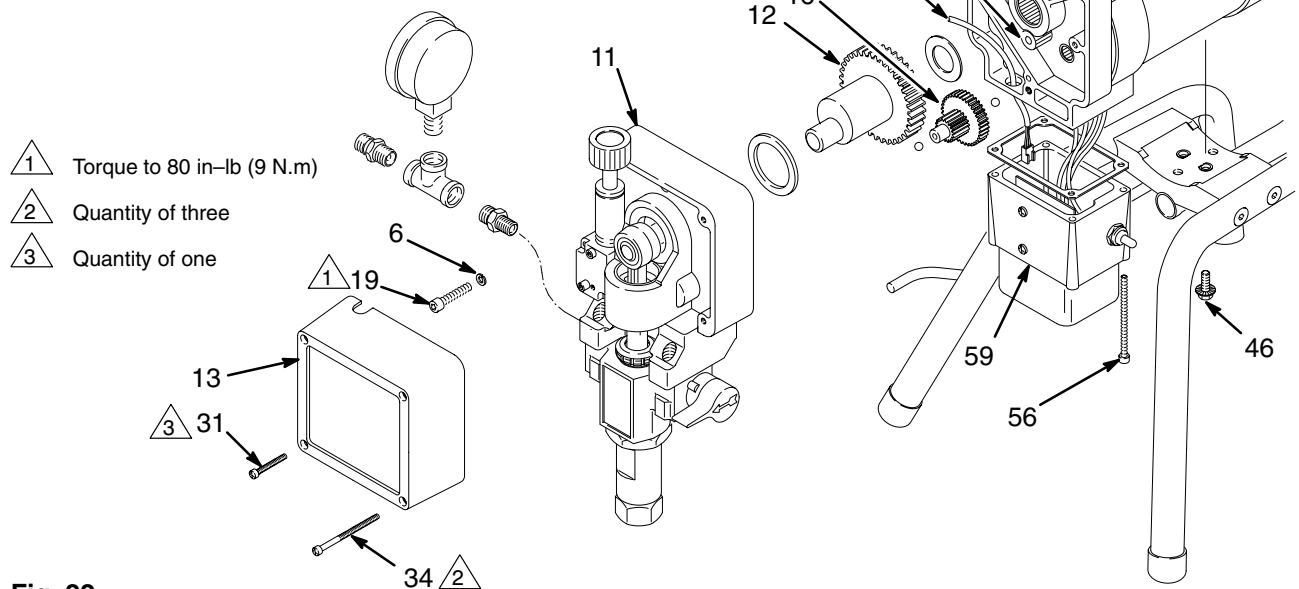


Fig. 22

7151B





# Drive Housing, Connecting Rod, Crankshaft

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief**

**Procedure** on page 10.

## Removal

**NOTE:** Inspect parts as they are removed. Replace parts that are worn or damaged.

1. Remove the displacement pump. See page 22.
2. Remove the pressure control (64). See page 27.
3. Turn the displacement pump rod (107) so the pin hole aligns with the bottom drive housing screw (19). See Fig. 24. Remove the three drive housing screws and lockwashers (19,6). Also see Fig. 25 on page 26.

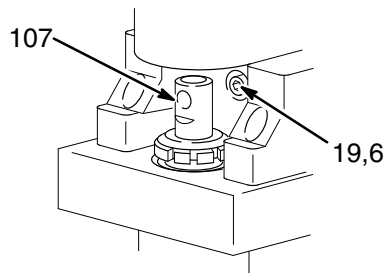


Fig. 24

01074

4. Remove the two motor screws (5) and lock washers (6). See Fig. 25 on page 26.
5. Tap the lower rear of the drive housing (11) with a plastic mallet to loosen the motor. Pull the drive housing straight off the motor.

## ⚠ CAUTION

Do not allow the gear (16) to fall; it may stay attached to the drive housing or to the motor.

Do not lose the thrust balls (11a or 4a) or let them fall between the gears, which will damage the drive housing if not removed. The balls, which are heavily covered with grease, usually stay in the gear recesses, but could be dislodged. If the balls are not in place, the bearings will wear prematurely.

6. Remove and inspect the crankshaft (12) and the connecting rod (15).

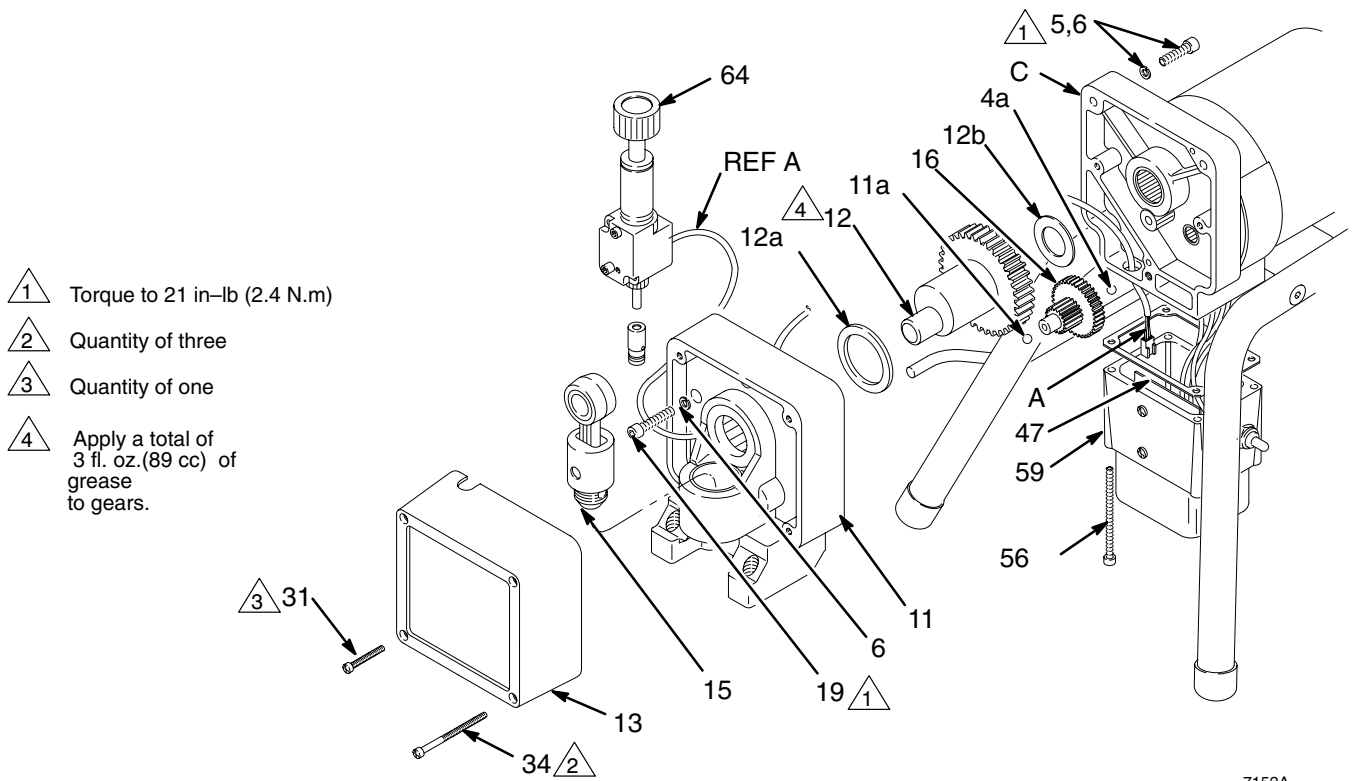
## Installation

7. Install the connecting rod.
8. Lubricate the inside of the drive housing bearing with SAE non-detergent oil. Pack the roller bearing and gears with the grease supplied.

**NOTE:** The gears and bearings between the drive housing (11) and motor front end bell (C) should contain a total of 3 fl. oz. (89 cc) of grease.

9. Place the large washer (12a) and then the small washer (12b) on the crankshaft (12).
10. Lift the crank to the top of the stroke and insert crankshaft (12). Align the gears and push the drive housing (11) straight onto the motor and the locating pins. Install the screws (19, 5) and their lockwashers (6). Torque to 80 in-lb (9 N.m).
11. Install the displacement pump. See page 22.
12. Install the pressure control (64). See page 27. Install the front cover (13).

# Drive Housing, Connecting Rod, Crankshaft



7152A

Fig. 25

# Pressure Control

## WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

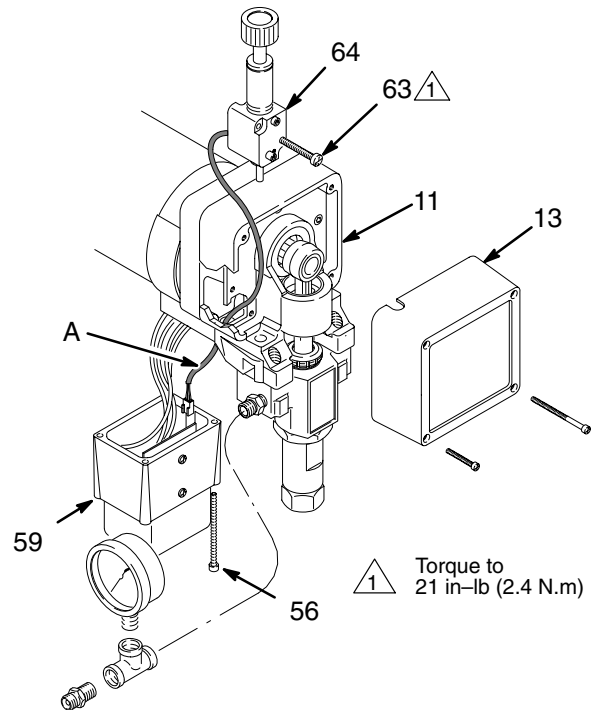
**Procedure** on page 10.

**NOTE:** See Fig. 26 for this procedure.

**NOTE:** The pressure control (64) cannot be repaired or adjusted. If it has malfunctioned, replace it.

1. Remove the front cover (13). Remove the screws (56). Lower the junction box (59).
2. Disconnect the harness connector (A) from the motor start board (47).
3. Remove the screws (63). Pull forward on the pressure adjusting knob and tip the pressure control (64) forward and up to detach it from the drive housing (11).
4. Guide the harness (A) through the motor and drive housing and remove the pressure control.
5. Guide the harness of the new pressure control through the drive housing and motor passages.
6. Install the new pressure control. Tip the pressure control down and back into the drive housing (11). Do not pinch or damage the harness (A).

7. Loosely install the screws (63) and then torque them to 21 in-lb (2.4 N.m).
8. Install the front cover (13). Connect the harness (A) to the motor start board (47).
9. Install the junction box. Be sure no leads are pinched against the motor or by the motor start board.



**Fig. 26**

7154B

# Pressure Transducer

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

- Align the holes in the transducer as shown by the arrows in Fig. 27.
- Install the displacement pump. See page 22.

**NOTE:** See Fig. 27 for this procedure.

- Remove the displacement pump. See page 22.
- Use a pull-twist motion to remove the transducer (29) from the pump manifold (101).
- Clean paint residue from the hole in the manifold; do not scratch the surface of the hole.
- Lightly apply oil to the o-ring of the new transducer.
- Install the transducer in the pump manifold, while guiding the o-ring and backup ring into place.

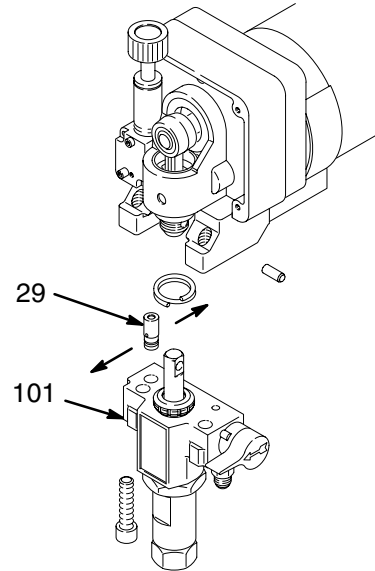


Fig. 27

02817A

# Suction Hose

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.

## ⚠ CAUTION

Misalignment or cross-threading will damage the parts and/or create shavings which can cause the o-ring (27) to leak.

- Remove the drain hose (33) from the stem adapter (36). Remove the front cover (13).
- Pull upward on the hose (32) while unscrewing it from the inlet tube (38). The hose coupling (A) threads will engage and the hose will separate from the tube.
- Replace the o-ring (27) if it is worn or damaged.
- Lubricate the o-ring (27) and the inlet tube (38) threads with light grease.
- Align the suction hose coupling with the threads of the inlet tube (38). Tighten the hose onto the tube at least 4 turns to ensure that the threads have disengaged and can function as a swivel joint.

1 Lubricate

**Note:** Filter not shown

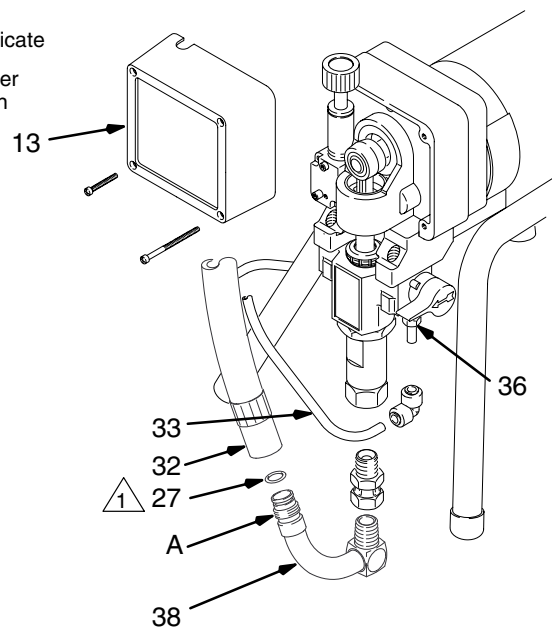



Fig. 28

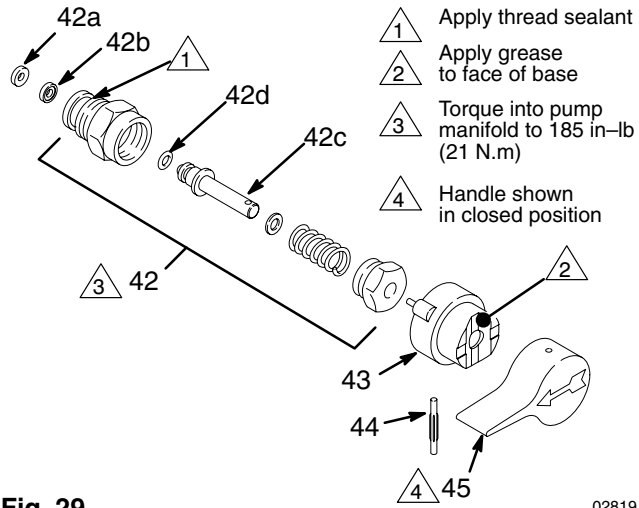
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# Drain Valve

**⚠ WARNING**

**INJECTION HAZARD**  
To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 10.





**Fig. 29** 02819

1. Turn the handle (45) to the closed position. Drive out the pin (44). Remove the handle.
2. Remove the base (43).
3. Unscrew the drain valve (42). The gasket (42a) and seat (42b) will stay in the valve.

## Repair

1. Unscrew the spring retainer from the valve body. Remove the spring, washers and stem/ball. Clean any debris from the ball or seat area.
2. If replacing the gasket (42a) or seat (42b), pry out the gasket.

**NOTE:** Whenever the gasket (42a) is removed, replace it with a new one.

3. Coat the o-ring (42d) with grease. Press the stem into the valve body. Install the spring, washers and spring retainer into the valve body.
4. Place the seat (42b) in the valve body so the lapped side is toward the ball. Apply a small amount of grease to the new gasket (42a) and install it in the valve body.

**NOTE:** The gasket will protrude from the end of the valve until the valve is tightened into pump, which correctly seats the gasket.

## Replacement

1. Apply a small amount of thread sealant (42e) onto the valve (42) threads. Tighten the valve into the pump manifold to 185 in-lb (21 N.m).
2. Lightly grease the face of the base (43) and install the base. Turn the stem so the pin hole is vertical.
3. Securely install the handle (45) and drive pin (44).

# Accessories

## FLUID HOPPER

Must order a hopper installation kit separately.

- 188-337** 2.5 liter hopper & cover
- 188-338** 5 liter hopper & cover

## FLUID HOPPER INSTALLATION KIT 235-576

Includes fittings and mounting hardware to replace the suction hose assembly with a 2 or 5 liter hopper, purchased separately. Instructions included.

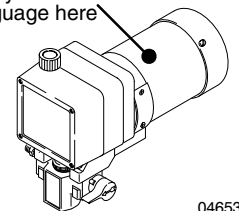
## DANGER LABELS

The English language DANGER label shown on page 1 is also on your sprayer. If you have painters who do not read English, order one of the following labels to apply to your sprayer. The drawing below shows the best placement of these labels for good visibility.

Order the labels directly from Graco, free of charge:  
1-800-328-0211

- French** 185-956
- Spanish** 185-961
- German** 186-041
- Greek** 186-045
- Korean** 186-049
- English** 185-953

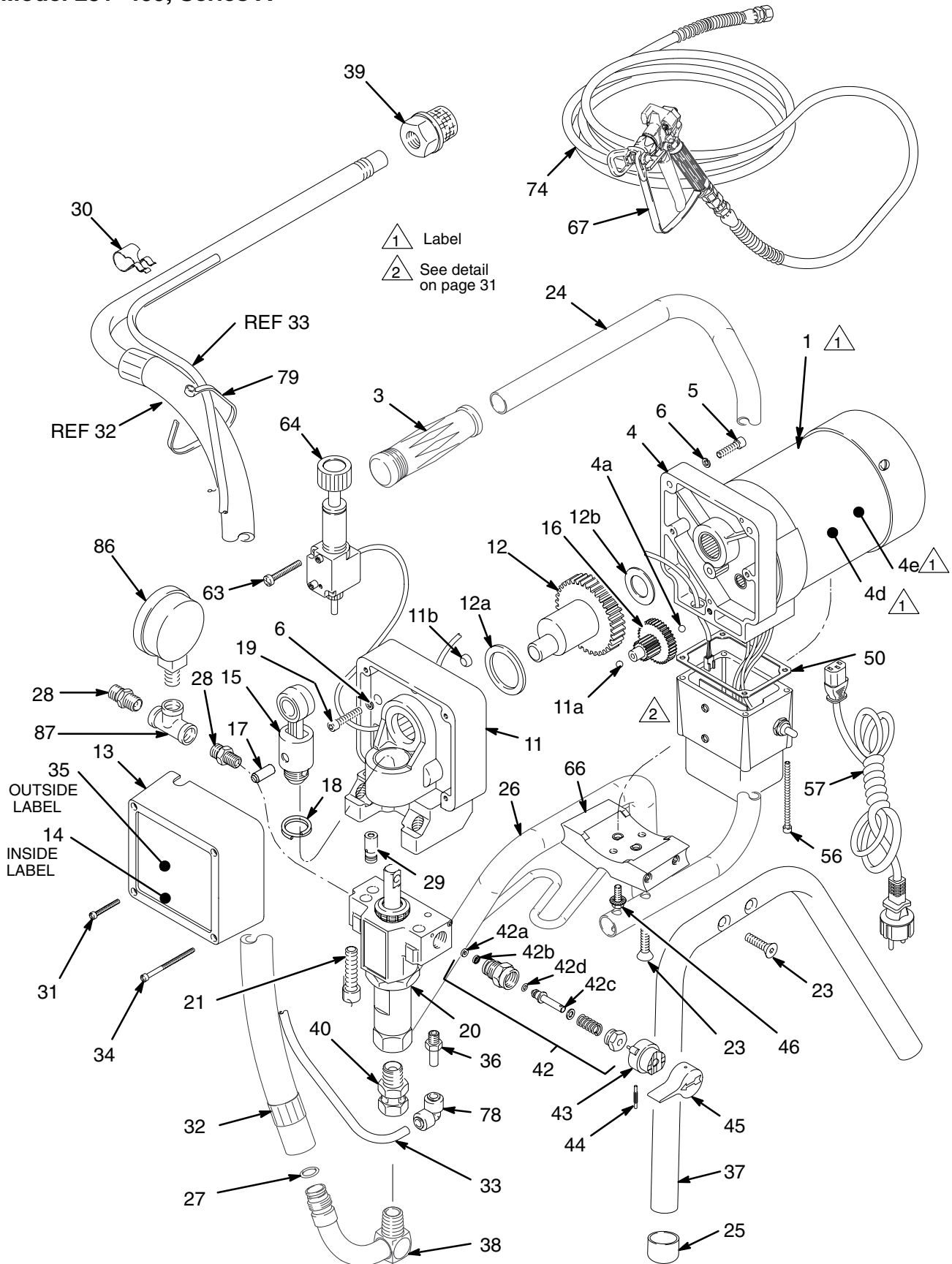
Apply other language here



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# Sprayer Parts Drawing

Model 231-409, Series A

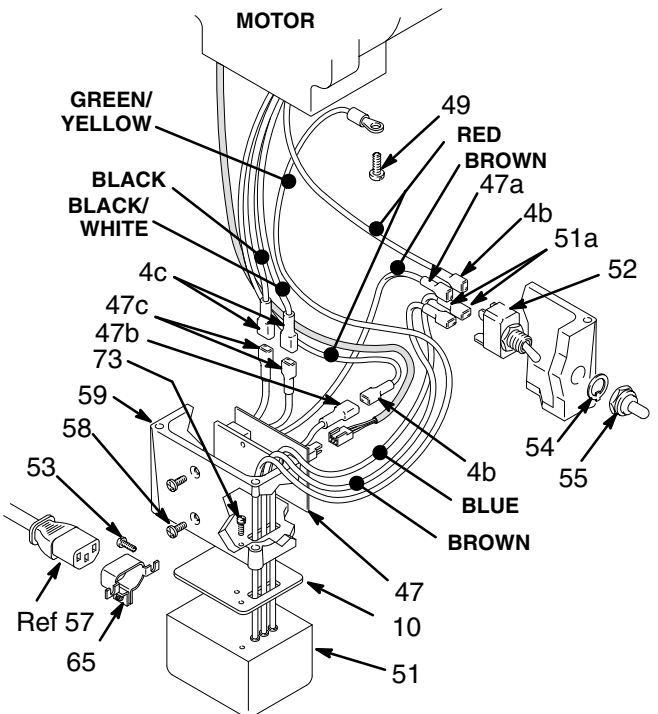


7149B

# Sprayer Parts List

## Model 231-409, Series A

Ref No.	Part No.	Description	Qty	Ref No.	Part No.	Description	Qty
1	187-791	LABEL, DANGER, English	1	51	235-450	FILTER, power inlet <i>Includes 51a</i>	1
3	111-700	GRIP, handle	1	51a	107-260	. TERMINAL, 1/4" F, 16 AWG	
4	238-066†	MOTOR KIT <i>Includes 4a to 4e</i>	1	52	111-826	SWITCH, ON/OFF	1
4a	100-069	. BALL, SST, 1/4" dia.	1	53	111-840	SCREW, panhead, M3 x 10 mm	2
4b	107-262	. TERMINAL, 1/4" F, 16 AWG	2	54	105-658	LOCKING RING	1
4c	107-265	. TERMINAL, 3/16" M, 16 AWG	2	55	105-659	BOOT, switch	1
4d	187-975	. LABEL, Warning, Shock	1	56	111-703	SCREW, filh, 10-24 x 3"	4
4e	187-791*	. LABEL, DANGER, English	1	57		POWER CORD with IEC-320 Connector	1
5	100-643	SCREW, sch, 1/4-20 x 1"	2		239-680	France, Germany, Sweden, (schuko 7/7)	
6	105-510	LOCKWASHER, spring, 1/4"	5		239-681	Italy (CEI 23-16/VII)	
10	187-962	GASKET, inlet filter	1		239-682	Denmark (Asnit 107-2-01)	
11	224-965	DRIVE HOUSING KIT			239-683	Switzerland (SEV 1011)	
		<i>Includes 11a, 11b</i>	1		239-684	Other countries (cord without male plug)	
11a	100-069	. BALL, stainless steel, 1/4" dia.	1	58	100-035	SCREW, panhd, 8-32 x 5/16"	2
11b	111-726	. PLUG	1	59	187-958	JUNCTION BOX	1
12	224-803	CRANKSHAFT <i>Includes 12a, 12b</i>	1	63	111-704	SCREW, filh, 10-24 x 1-5/8"	2
12a	180-131	. BEARING, thrust	1	64	224-828	PRESSURE CONTROL KIT	1
12b	107-434	. BEARING	1	65	111-848	CLAMP, power cord	1
13	187-789	COVER, front	1	66	189-932	BASE, motor	1
14	188-360*	LABEL, Warning	1	67	239-516	FTx-E GUN	
15	218-359	ROD, CONNECTING	1			<i>See manual 308-748</i>	1
16	218-364	GEAR REDUCER	1	68	206-994	TSL, 8 oz.	1
17	176-818	PIN, straight, hds, 3/8" dia. x 1"	1	71	111-827	WRENCH, hex, 3/8" (not shown)	
18	176-817	SPRING, retaining	1			(Use for capscrew #21)	
19	103-345	SCREW, sch, 1/4-20 x 1-1/4"	3	73	111-839	SCREW, panhead w/lockwasher,	
20	236-787	PUMP KIT <i>See manual 308-190</i>	1			6-32 x .375"	2
21	111-706	CAPSCREW, sch, 7/16-14 x 1-3/4"	2	74	238-360	HOSE, grounded, nylon; 1/4" ID;	
23	111-715	SCREW, special, 5/16-18 x 1-1/4"	6			cpld 1/4 npsm(f); 7.5 m;	
24	192-219	HANDLE, sprayer	1			spring guards both ends	1
25	112-759	CAP, tubing	4	78	190-447	ELBOW, union	1
26	239-522	LEG, w/gusset	1	79	103-473	STRAP, wire tie	2
27■	104-938	O-RING	1	86	102-814	GAUGE	1
28	162-453	NIPPLE, 1/4 npsm x 1/4 npt	2	87	104-984	TEE	1
29	235-009	PRESSURE TRANSDUCER	1				
30	114-026	CLIP, spring	1				
31	108-850	SCREW, filh, 8-32 x 1-1/4"	1				
32	187-624	SUCTION HOSE & TUBE	1				
33	190-336	DRAIN HOSE	1				
34	111-705	SCREW, filh, 8-32 x 2-1/2"	3				
35	290-443	LABEL, identification	1				
36	190-446	ADAPTER, stem	1				
37	192-218	LEG, sprayer	1				
38	192-167	TUBE, inlet	1				
39	237-820	STRAINER	1				
40	190-451	ADAPTER, union	1				
42	235-014	DRAIN VALVE KIT <i>Includes 42a-42e</i>	1				
42a	111-699	. GASKET, valve seat	1				
42b	187-615	. SEAT, drain valve	1				
42c	224-968	. STEM, drain valve	1				
42d■	168-110	. O-RING, stem	1				
42e	110-110	. SEALANT, pipe (not shown)	1				
43	224-807	BASE, valve	1				
44	111-600	PIN, grooved, 3/32 x 1"	1				
45	187-625	HANDLE, drain valve	1				
46	110-997	SCREW, washer/hex hd, 5/16"	2				
47	235-578	MOTOR START BOARD					
		<i>Includes 47a, 47b</i>	1				
47a	107-260	. TERMINAL, 1/4" F, 16 AWG	1				
47b	107-266	. TERMINAL, 1/4" M, 16 AWG	1				
47c	107-267	. TERMINAL, 3/16" F, 16 AWG	2				
49	110-037	SCREW, mach, pnhd, 10-24 x 5/8"	1				
50	187-963	GASKET, junction box	1				



\*Extra warning labels available free of charge.

† Motor Brush and Spring Replacement Kit,

P.N. 235-007 is available. Purchase separately.

■ Replace Ref. No. 27 with 114-048 and Ref. No. 42d with 112-319 if using severe solvents such as lacquer thinner and acetone.

# Technical Data

Power Requirements ..... 230 Vac, 50 Hz,  
1 phase, 6A minimum  
Working Pressure Range 0–190 bar (0–19 MPa, 0–2750 psi)  
Motor ..... 1/2 hp  
Cycles/liter ..... 164  
Delivery ..... 0.33 gpm (1.25 lpm)  
Power Cord ..... 1.0 mm<sup>2</sup>, 3 wire, 3 m  
Inlet Paint Strainer ..... 1525 micron  
Stainless Steel Screen, reusable  
Pump Inlet Size ..... 1/2 npt(f)  
Fluid Outlet Size ..... 1/4 npsm  
Sound Data:  
Sound Pressure Level ..... 79 dB(A)\*  
Sound Power Level ..... 88 dB(A)\*  
\*Measured while spraying with a .017 tip. Tested per  
ISO 3744.

Wetted Parts:  
*Displacement Pump* ..... Stainless steel, Carbon steel,  
PTFE®, Aluminum, Polyethylene, Delrin®, Leather  
**NOTE:** PTFE and Delrin are trademarks of the \_\_\_\_\_ Company.

## Dimensions

Weight (dry w/o packaging)	16 kg
Height	483 mm
Length	381 mm
Width	356 mm

## Graco Standard Warranty

Graco warrants all equipment manufactured by Graco 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. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

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

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

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

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

Graco makes no warranty, and disclaims all implied warranties of merchantability and fitness for a particular purpose in connection with accessories, equipment, materials or components sold but not manufactured by Graco. These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

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

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