



INSTRUCTIONS

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

*First choice when  
quality counts.™*

220 VAC, 50 HZ, 12A

## ULTRA<sup>®</sup> Plus+ 1500

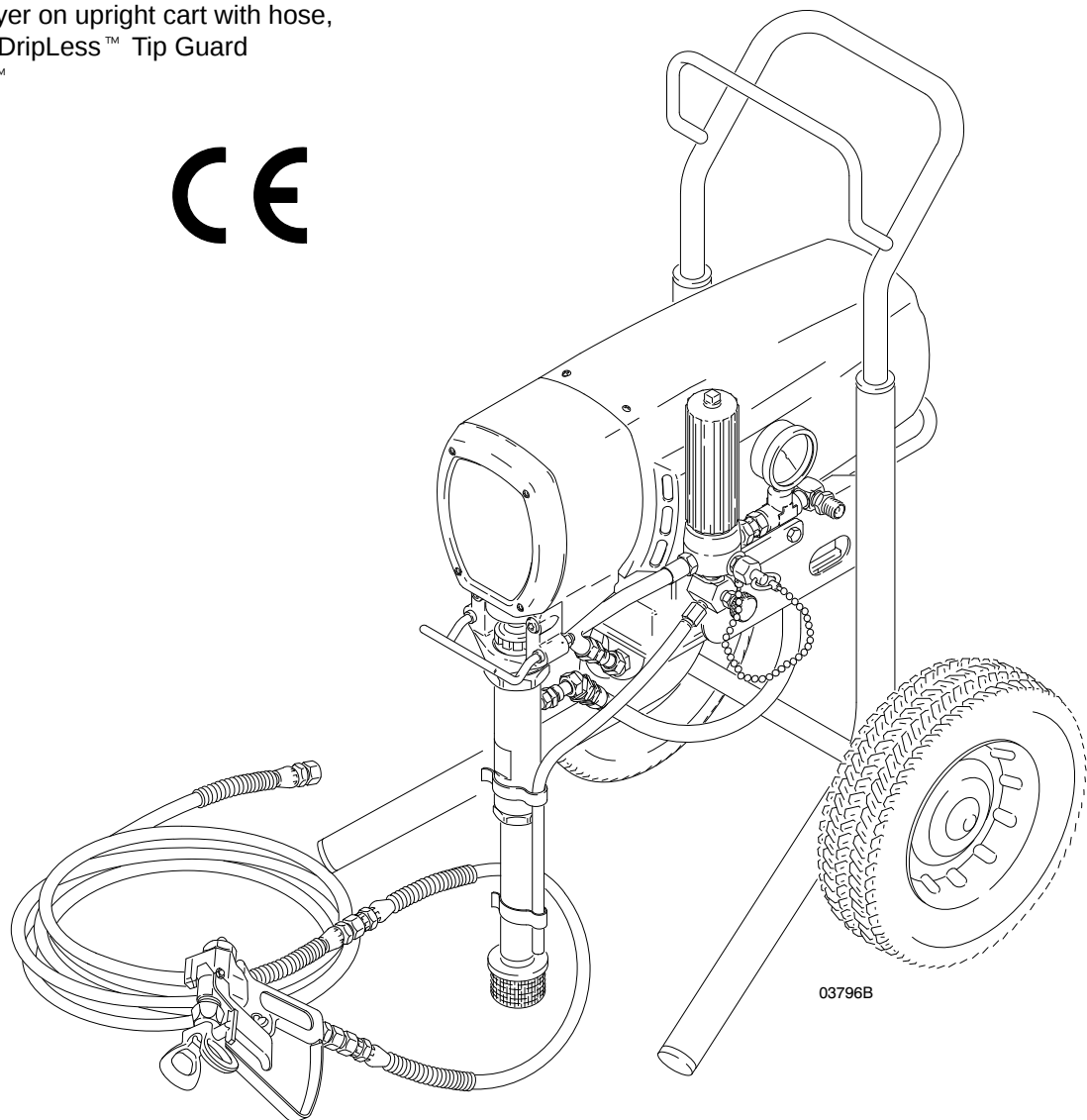
# Airless Paint Sprayer

*21.0 MPa (210 bar, 3000 psi) Maximum Working Pressure*

### Model 231-321, Series B

Complete sprayer on upright cart with hose,  
gun, RAC IV<sup>®</sup>, DripLess<sup>™</sup> Tip Guard  
and SwitchTip<sup>™</sup>

Patents Pending



**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



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 uncertain about usage, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- 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 31 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



### 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 7 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.

## ! WARNING

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.</p> <ul style="list-style-type: none"> <li>• If there is any static sparking or you feel an electric shock while using this equipment, <b>stop spraying immediately</b>. Do not use the equipment until you identify and correct the problem.</li> <li>• Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being sprayed.</li> <li>• Keep the spray area free of debris, including solvent, rags, and gasoline.</li> <li>• Electrically disconnect all equipment in the spray area.</li> <li>• Extinguish all open flames or pilot lights in the spray area.</li> <li>• Do not smoke in the spray area.</li> <li>• Do not turn on or off any light switch in the spray area while operating or if fumes are present.</li> <li>• Do not operate a gasoline engine in the spray area.</li> </ul> |
|  | <p><b>MOVING PARTS HAZARD</b></p> <p>Moving parts can pinch or amputate your fingers.</p> <ul style="list-style-type: none"> <li>• Keep clear of all moving parts when starting or operating the pump.</li> <li>• Before servicing the equipment, follow the <b>Pressure Relief Procedure</b> on page 7 to prevent the equipment from starting unexpectedly.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

**NOTE:** This is an example of the DANGER label on your sprayer.  
This label is available in other languages, free of charge. See page 30 to order.

| ! DANGER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           | !                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FIRE AND EXPLOSION HAZARD |                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SKIN INJECTION HAZARD |
| <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> |                       |
| READ AND UNDERSTAND ALL LABELS AND INSTRUCTION MANUALS BEFORE USE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |

## Major Components

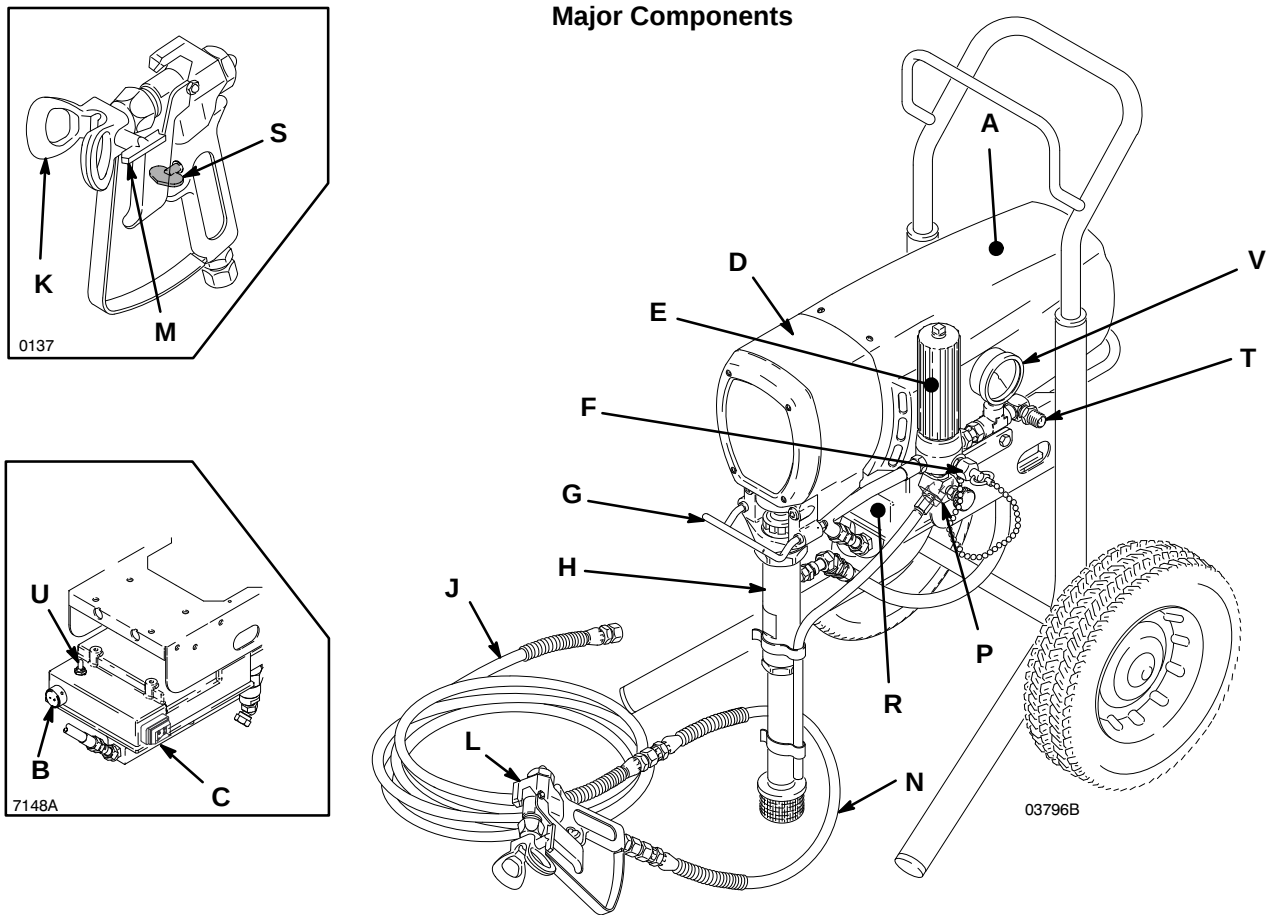


Fig. 1

|          |                            |                                                                                                                  |
|----------|----------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>A</b> | Motor (Under shield shown) | DC motor, 220 Vac, 50 Hz, 12A, 1 phase                                                                           |
| <b>B</b> | Pressure Adjusting Knob    | Controls fluid outlet pressure                                                                                   |
| <b>C</b> | ON/OFF Switch              | Power switch that controls 220 Vac power to sprayer                                                              |
| <b>D</b> | Drive Assembly             | Transfers power from DC motor to the displacement pump                                                           |
| <b>E</b> | Fluid Filter               | Filter of fluid between source and spray gun                                                                     |
| <b>F</b> | Secondary Fluid Outlet     | Second spray gun operation is connected here                                                                     |
| <b>G</b> | Pail Hanger                | Container for fluid to be sprayed may be hung here                                                               |
| <b>H</b> | Displacement Pump          | Pressures fluid to be sprayed through spray gun                                                                  |
| <b>J</b> | 50 ft. (15 m) Main Hose    | 1/4 in. ID, grounded, nylon hose with spring guards on both ends                                                 |
| <b>K</b> | RAC IV Tip Guard           | Reverse-A-Clean (RAC) tip guard reduces the risk of fluid injection injury                                       |
| <b>L</b> | Contractor Gun             | High pressure spray gun with gun safety latch                                                                    |
| <b>M</b> | RAC IV SwitchTip®          | RAC SwitchTip atomizes fluid and removes clogs from spray tip without removing tip from spray gun                |
| <b>N</b> | 3 ft. (0.9 m) Hose         | 3/16 in. ID, grounded, nylon hose used between 50 ft. hose and spray gun to allow more flexibility when spraying |
| <b>P</b> | Pressure Drain Valve       | Relieves fluid pressure when open                                                                                |
| <b>R</b> | Pressure Control           | Controls motor speed to maintain fluid pressure. Works with pressure adjusting knob.                             |
| <b>S</b> | Spray Gun Safety Latch     | Inhibits accidental triggering of spray gun                                                                      |
| <b>T</b> | Primary Fluid Outlet       | Hose and spray gun is connected here                                                                             |
| <b>U</b> | 10/12 Amp Switch           | Allows sprayer to operate on 10A service with reduced performance                                                |
| <b>V</b> | Gauge                      | System pressure indicator, 21.0 MPa (210 bar, 3000 psi)                                                          |

# Setup

## ⚠ 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 4.

## ⚠ 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 **21.0 MPa (210 bar, 3000 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 (50 ft.) 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 sprayer outlet (D) and the hose. See Fig. 2.

1. Connect gun, 1 m hose (78) and 15 m hose (79). Don't install spray tip yet.
2. Two gun hookup. Remove cap (12) from 1/4 npsm(m) secondary hose outlet and attach minimum 15 m long hose. For more flexible gun movement, install 3/16 in. ID, 1 m whip hose between main hose and gun.
3. Fill packing nut/wet-cup (E) 1/3 full with Graco Throat Seal Liquid (TSL), supplied.
4. Check electrical service. Be sure electrical service is 220 V, 50 Hz. Use properly grounded outlet. If plug is wrong, have licensed electrician attach correct plug to power supply cord. Do not remove grounding prong of power supply cord. Do not use an adapter. Extension cords must have 3 wires of minimum 2.5 mm (12 gauge) size. Long extension cords reduce sprayer performance. Set 10/12 Amp switch (C) to correct setting.
5. With ON/OFF switch (A) OFF, plug cord into a grounded electrical outlet located at least 6 m (20 ft.) away from spray area. See Fig. 2
6. Flush pump to remove lightweight oil which was left in to protect pump parts after factory testing. See page 10.

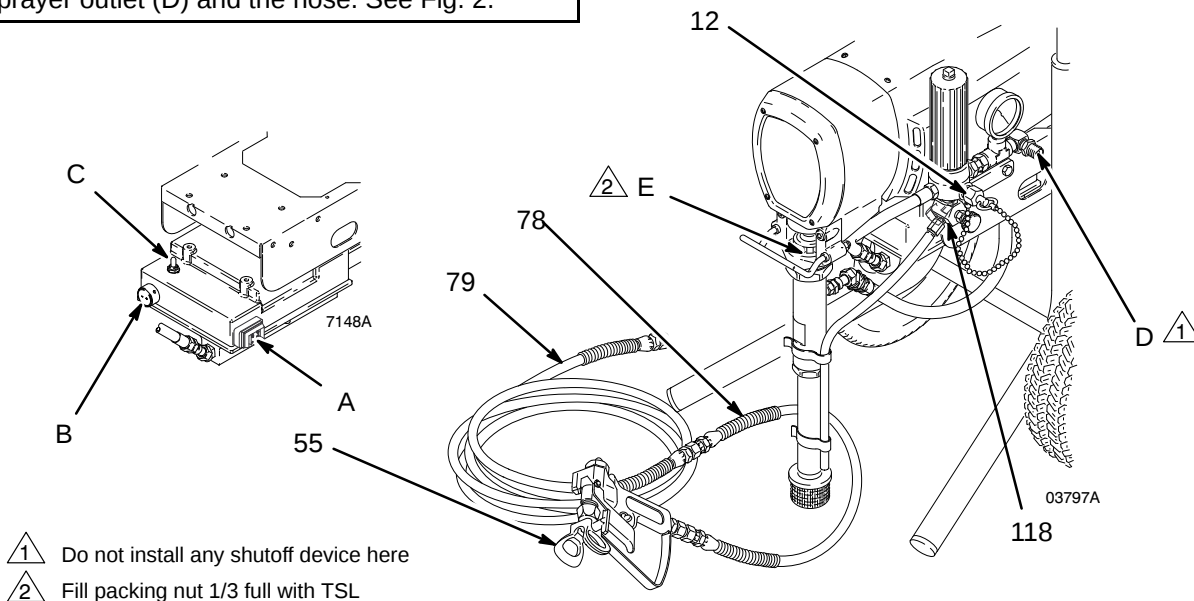


Fig. 2

# Operation

## Pressure Relief Procedure

### WARNING



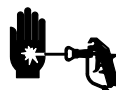
#### PRESSURIZED EQUIPMENT HAZARD

The system pressure must be manually relieved to prevent the system from starting or spraying accidentally. To reduce the risk of an injury from accidental spray from the gun, 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 nozzle.

1. Engage gun safety latch.
2. Turn ON/OFF switch to OFF.
3. Unplug power cord.
4. Disengage gun safety latch. Hold metal part of gun against grounded metal pail and trigger gun into pail to relieve pressure.
5. Engage gun safety latch.
6. Open any fluid drain valves in system. Leave drain valve open until ready to dispense again.

### WARNING



#### INJECTION HAZARD

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

## Startup

Always use this procedure to help ensure sprayer is ready to operate and that you start it safely. See Fig. 2

1. For a first time startup, flush sprayer. See page 10.
2. Close pressure drain valve (118).
3. Don't install spray tip until pump is primed!
4. Put suction tube into paint container.
5. Lower pressure setting by turning pressure adjusting knob (B) all the way counterclockwise.
6. Disengage gun safety latch. See Fig. 3.

 Gun safety latch shown engaged

 Gun safety latch shown disengaged

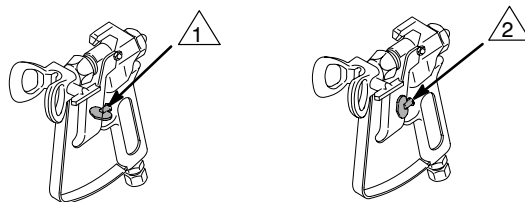


Fig. 3

# Operation

7. To prime pump, hold a metal part of gun firmly against into a metal waste container. See Fig. 4. Squeeze trigger and hold it open, turn ON/OFF switch to ON, and slowly increase pressure setting until sprayer starts. Keep gun triggered until all air is forced out of system and paint flows freely from gun. Release trigger and engage gun safety latch.

## CAUTION

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

8. Check all fluid connections for leaks. If any leaks are found, relieve pressure before tightening connections.

## WARNING



### FIRE AND EXPLOSION HAZARD

To reduce the risk of fluids entering control box, check weep hole (Fig.16, C) regularly. Replace o-ring when any leakage is seen. Also read **FIRE OR EXPLOSION HAZARD** on page 4.

9. Check weep hole (Fig. 16, B) of pressure control for leakage at start up and during operation. If leakage, replace o-ring as instructed in Pressure Control Transducer and O-Ring Replacement on page 17.
10. Engage gun safety latch. Install spray tip. If you are using RAC IV tip guard, refer to manual 308-644 for installation instructions.

11. Adjust pressure.

- a. Turn pressure adjusting knob clockwise until spray from gun is just completely atomized. To avoid excessive overspray and fogging, and to decrease tip wear and extend life of sprayer, always use lowest possible pressure needed to get desired results.
- b. If more coverage is needed, use larger tip rather than increasing pressure.
- c. Test spray pattern. To adjust direction of spray pattern: engage gun safety latch, loosen retaining nut, position tip guard horizontally for horizontal pattern or vertically for vertical pattern then tighten retaining nut.

-  Maintain firm metal-to-metal contact between gun and grounded pail when flushing

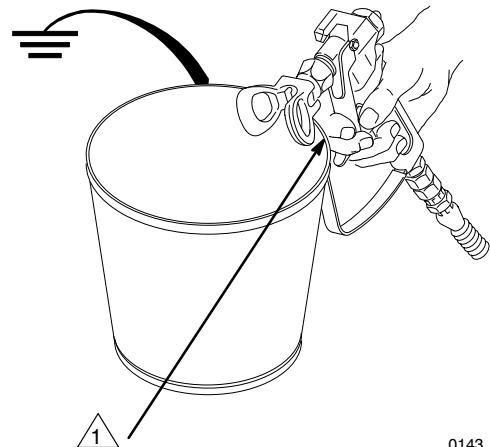


Fig. 4

0143

# Operation

## Cleaning a Clogged Tip

**⚠ WARNING**

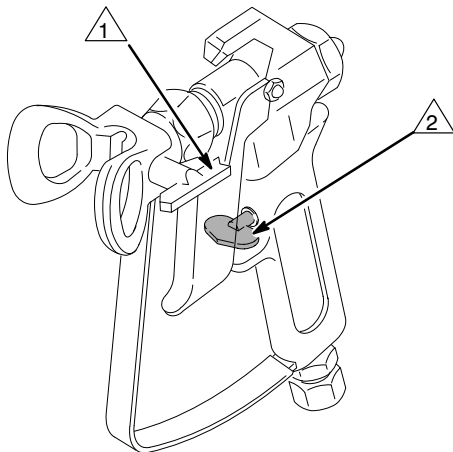


**INJECTION HAZARD**

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 7.

1. If spray tip clogs, release gun trigger, engage gun safety latch, and rotate RAC IV handle 180°. See Fig. 5.
2. Disengage gun safety latch and trigger gun into waste container. Engage gun safety latch again.
3. Return handle to original position. Disengage gun safety latch and resume spraying.
4. If tip is still clogged, engage gun safety latch, shut off and unplug sprayer, and open pressure drain valve to relieve pressure. Clean spray tip as shown in manual 308–644, supplied with RAC IV.

- 1 Tip handle shown in spraying position; turn handle 180°, disengage safety latch and trigger gun to clear clog.
- 2 Trigger safety latch shown engaged.



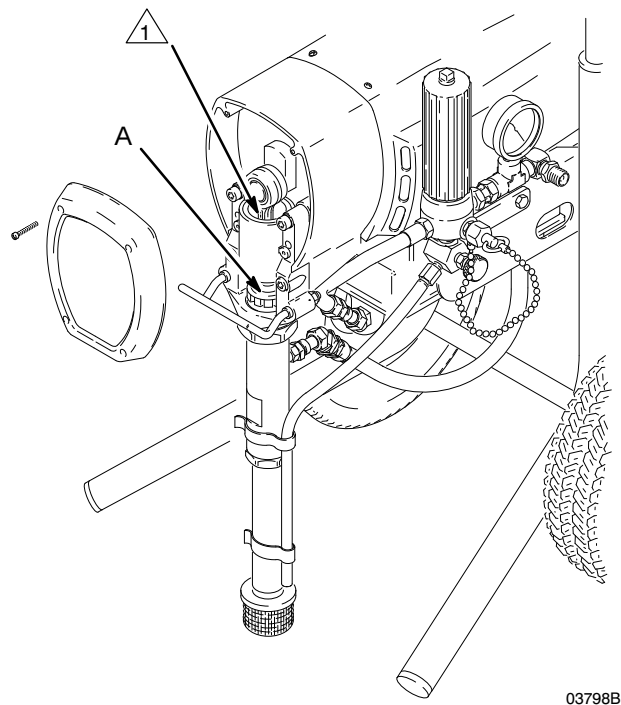
**Fig. 5**

0137

## Shutdown and Care

1. Check packing nut/wet-cup daily. Relieve pressure. Keep packing nut/wet-cup (A) 1/3 full with TSL at all times to help prevent fluid buildup on piston rod and premature wear of packings. Tighten packing nut just enough to stop leakage. Over-tightening may cause binding and excessive packing wear. Use screwdriver and light hammer to adjust nut. See Fig. 6.
2. Clean fluid filter often and whenever sprayer is stored. First relieve pressure. See manual 307–273 for cleaning procedure.
3. Fill connecting rod cavity with motor oil every 100 hours of operation. Relieve pressure. Remove front cover. See Fig. 6.

- 1 Fill connecting rod cavity with motor oil after every 100 hours of operation



03798B

**Fig. 6**

4. For very short shutoff periods, leave suction tube in paint, relieve pressure, and clean spray tip.
5. Coil hose and hang it on hose rack when storing, even overnight, to help protect hose from kinking, abrasion, coupling damage, etc.

# Flushing

## When to Flush

1. New Sprayer. The sprayer is factory tested with lightweight oil which is left to protect pump parts.

*Before using water-base paint*, flush with mineral spirits, then warm, soapy water, and then clean water.

*Before using oil-base paint*, flush with mineral spirits.

2. Changing Colors. Flush with compatible solvent.
3. Changing from water-base to oil-base paint. Flush with warm, soapy water, then mineral spirits.
4. Changing from oil-base to water-base paint. Flush with mineral spirits, then warm, soapy water, and then clean water.

5. Storage. Flush as indicated below, shut off sprayer, open pressure drain valve to relieve pressure and leave open.

*Water-base paint*: flush with water, then mineral spirits. Leave system filled with mineral spirits.

*Oil-base paint*: flush with mineral spirits.

### CAUTION

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

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

## How to Flush

1. Relieve pressure.
2. Remove filter bowl (C) and screen (D). Install bowl (C) and filter support (E) without screen (D) to flush. See Fig. 7.
3. Close pressure drain valve (F).
4. Pour 2 liters of compatible solvent into grounded metal pail. Put suction tube in pail.
5. Remove spray tip from gun.

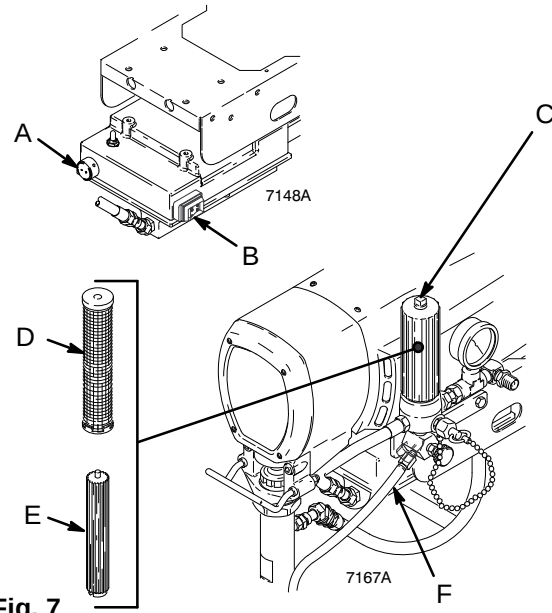


Fig. 7

6. Turn pressure adjusting knob (A) completely counterclockwise to lowest pressure setting.

### 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.

7. Hold metal part of gun firmly against metal waste container. See Fig. 4. Trigger gun, turn sprayer switch (B) on, and slowly increase pressure until sprayer just starts. Keep gun triggered until all air is forced out of system and solvent flows freely from gun. Release trigger and engage gun safety latch.

**NOTE:** If the pump is hard to prime, open the drain valve. When fluid comes from the valve, close it. Proceed as in Step 7.

8. Remove suction tube from pail. Disengage gun safety latch and trigger gun to force solvent from hose. Do not run pump dry for more than 30 seconds to avoid damaging pump packings! Relieve pressure.
9. Leave pressure drain valve (F) open until sprayer is used again.
10. Clean filter screen (D) and reinstall. Reinstall bowl (C), hand tight only.
11. If pump is flushed with mineral spirits and is to be used with water-base paint, flush with soapy water and then clean water. Relieve pressure.

# 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 7.

Check everything in the guide before disassembling the sprayer.

| TYPE OF PROBLEM                | WHAT TO CHECK<br><i>If check is OK, go to next check</i>                                                              | WHAT TO DO<br><i>When check is not OK refer to this column</i>                                                            |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Building circuit breaker opens | Check all electrical wiring for damaged insulation.                                                                   | Replace any damaged wiring.                                                                                               |
|                                | Check for other electrical appliances on circuit.                                                                     | Shutdown other electrical appliances on circuit.                                                                          |
|                                | Check position of 10–12 (Lo–High) amp switch.                                                                         | Put switch in 10 amp (LO) position.                                                                                       |
| Sprayer will not run           | Check pressure control knob setting. Motor will not run if it is at minimum setting (fully counterclockwise).         | Slowly increase pressure setting to see if motor starts.                                                                  |
|                                | Check for a clogged spray tip. Refer to separate gun or tip instruction manual.                                       | Relieve pressure. Refer to separate gun or tip instruction manual for tip cleaning.                                       |
|                                | Check extension cord for visible damage. Use a volt meter or test lamp at extension cord outlet to check.             | Replace extension cord.                                                                                                   |
|                                | Check sprayer power supply cord for visible damage such as broken insulation or wires.                                | Replace power supply cord.                                                                                                |
|                                | Check electrical supply with volt meter. Meter should read 210–250 VAC.                                               | Reset building circuit breaker; replace building fuse. Try another outlet.                                                |
|                                | Check for motor damage. Remove drive housing assembly. See page 17. Try to rotate fan by hand.                        | Replace motor (1) if fan won't turn.                                                                                      |
|                                | Check for locked motor rotor. Unplug cord and try to turn fan blades with a screwdriver.                              | Repair gear train or pump, if damaged. Thaw the sprayer, if frozen; See NOTE 1. Replace the pressure control, if damaged. |
|                                | Check for shorted motor. Use ohmmeter to check for shorts between motor leads or between motor leads and motor frame. | Inspect for damage to motor brush leads. Replace motor, if necessary.                                                     |
| Poor spray pattern             | Defective pressure control transducer.                                                                                | Replace pressure control transducer. See page 17.                                                                         |
|                                | Check for worn spray tip.                                                                                             | Relieve pressure and then replace the tip. See the separate gun or tip manual.                                            |

# Troubleshooting

| TYPE OF PROBLEM                                                       | WHAT TO CHECK<br><i>If check is OK, go to next check</i>                                                                                                                                                      | WHAT TO DO<br><i>When check is not OK refer to this column</i>                                                                                                                    |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motor runs and pump strokes, but output is low or there is no output. | Check extension cord size and length.                                                                                                                                                                         | Replace cord with a larger size, grounding type extension cord.                                                                                                                   |
|                                                                       | Check paint supply.                                                                                                                                                                                           | Refill and reprime pump.                                                                                                                                                          |
|                                                                       | Check for clogged intake strainer.                                                                                                                                                                            | Remove and clean strainer and reinstall.                                                                                                                                          |
|                                                                       | Check for loose suction tube or loose fittings.                                                                                                                                                               | Tighten; use thread sealant or sealing tape on threads, if necessary.                                                                                                             |
|                                                                       | Check for worn spray tip.                                                                                                                                                                                     | Follow <b>Pressure Relief Procedure Warning</b> , then replace tip. See your separate gun or tip manual.                                                                          |
|                                                                       | Check motor brushes; check for loose leads and terminals, minimum 13 mm brush length, broken or misaligned springs, or brushes binding in holders. See page 13.                                               | Replace parts as needed. See page 13.                                                                                                                                             |
|                                                                       | Check motor armature for shorts by using an armature tester (growler).                                                                                                                                        | Replace motor. See page 20.                                                                                                                                                       |
|                                                                       | Check to see if pump continues to stroke when gun trigger is released. With pump on and primed, trigger gun momentarily, then release and engage safety latch. Relieve pressure, turn off and unplug sprayer. | Service pump. See manual 307–806.                                                                                                                                                 |
|                                                                       | Check to see if intake valve ball and piston ball are seating properly.                                                                                                                                       | Remove intake valve and clean. Check balls and seats for nicks; replace if necessary. See manual 307–806. Strain paint before using to remove particles that could clog the pump. |
|                                                                       | Check for leaking around throat packing nut which may indicate worn or damaged packings.                                                                                                                      | Replace packings. See manual 307–806. Also check piston valve seat for hardened paint or nicks and replace if necessary. Tighten the packing nut/wetcup.                          |
| Motor runs but pump does not stroke.                                  | Defective pressure control transducer.                                                                                                                                                                        | Replace pressure control transducer. See page 17.                                                                                                                                 |
|                                                                       | Check displacement pump connecting rod pin (20). See page 15.                                                                                                                                                 | Replace pin, if missing. Be sure retainer spring (35) is fully in groove all around connecting rod. See page 15.                                                                  |
|                                                                       | Check for frozen or hardened paint in the pump (39).                                                                                                                                                          | Thaw. See NOTE 1. Plug in sprayer and turn on. Slowly increase pressure setting to see if motor starts.                                                                           |
| Motor is hot and runs intermittently.                                 | Be sure crank in drive housing rotates; plug in sprayer and turn on briefly to check. Turn off and unplug sprayer.                                                                                            | Check drive housing assembly for damage and replace if necessary. See page 23.                                                                                                    |
|                                                                       | Determine if sprayer was operated at high pressure with small tips, which causes low motor RPM and excessive heat build up.                                                                                   | Decrease pressure setting or increase tip size.                                                                                                                                   |
|                                                                       | Be sure ambient temperature where sprayer is located is no more than 32°C and sprayer is not located in direct sun.                                                                                           | Move sprayer to shaded, cooler area, if possible.                                                                                                                                 |
|                                                                       | Determine if sprayer was turned on, pressurized, but not operating for long periods of time.                                                                                                                  | Turn off sprayer whenever you stop spraying for a while and relieve fluid pressure.                                                                                               |

**NOTE 1:** Thaw the sprayer if water or water-based paint has frozen in it, by placing it in a warm area. Do not try to start the sprayer until it has thawed completely. If paint hardened (dried) in the sprayer, replace the pump packings. See manual 307–806.

# Motor Brush Replacement

## WARNING



### ELECTRIC SHOCK HAZARD

To reduce the risk of Electric Shock: wait 5 minutes after turning sprayer off before servicing to allow stored current to discharge.

**NOTE:** Replace the brushes when they have worn to less than 10 mm. See Fig. 10. Always replace both brushes at the same time. A Brush Repair Kit, p/n 222-157, and spring clip, p/n 110-816, are available.

**NOTE:** To maximize replacement brush life, break in new brushes by operating the sprayer with no load for at least one hour. To operate with no load, remove the pump connecting rod pin.

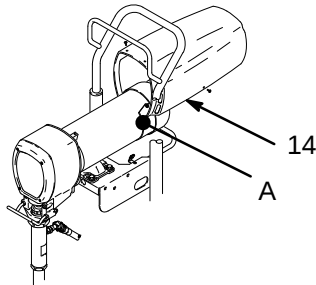
## WARNING



### INJECTION HAZARD

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

**Procedure** on page 7.



**Fig. 8**

03799A

1. Remove motor cover (14) and both inspection covers (A). See Fig. 8.

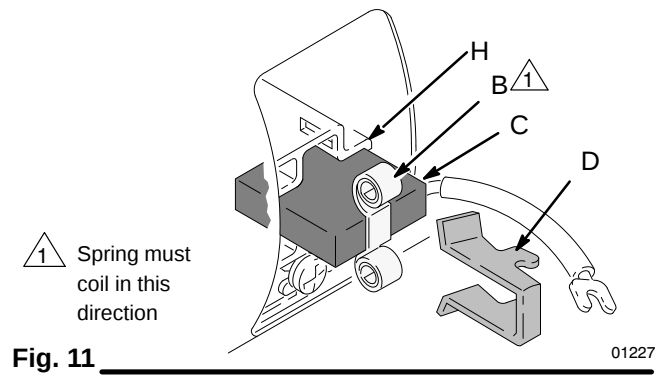
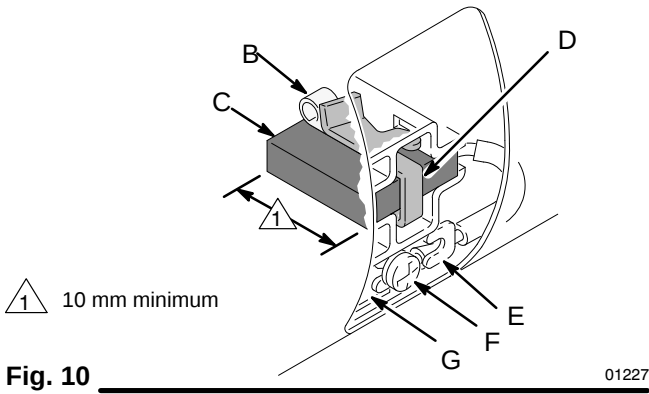
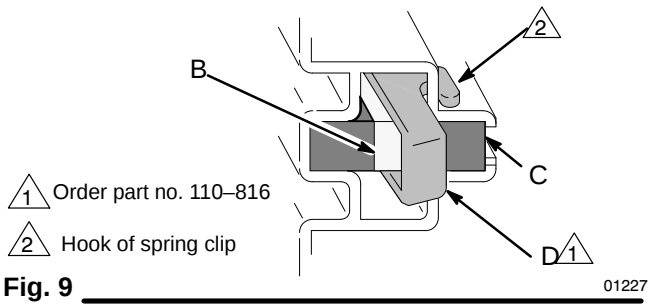
2. Push in spring clip (D) to unhook, and then pull out. See Fig. 9.
3. Loosen terminal screw (F). Pull brush lead (E) away, leaving motor lead (G) in place. Remove brush (C) and spring (B). See Fig. 10.
4. Inspect commutator for excessive pitting, burning or gouging. A black color on commutator is normal. Have commutator resurfaced by qualified motor repair shop if brushes seem to wear too fast.
5. Install new brush (C) so lead is in long slot (H) of holder. See Fig. 11. Slide the terminal (E) under the terminal screw washer. Make sure motor lead (G) is still connected the at screw. Tighten screw (F). See Fig. 10.
6. Place spring (B) on brush as shown in Fig. 11. Spring must coil as shown.
7. Push in and hook spring clip (D). See Fig. 11.
8. Repeat for other side.
9. Test brushes. Remove connecting rod pin (20). See Fig. 13, page 15. With sprayer off, turn pressure control knob fully counterclockwise to minimum pressure. Plug in sprayer. Turn sprayer on. Slowly increase pressure until motor is at full speed. Inspect brush and commutator contact area for excessive arcing. Arcs should not "trail" or circle around commutator surface.

## CAUTION

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 bodily injury.

10. Install brush inspection plates, gaskets, and covers.
11. Break in brushes. Operate sprayer for at least one hour with no load. Then reinstall connecting rod pin (20).

# Motor Brush Replacement



# Removing and Installing Pump

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 7.

## Removal See Fig. 12.

1. Flush pump, if possible. Relieve pressure again. Stop pump with piston rod in lowest position, if possible.
2. Disconnect drain tube (101) from pump (39) and suction tube (42).
3. Remove suction tube (42); hold wrench on pump intake valve (223) to keep pump from loosening.
4. Remove hose (47).
5. Push retaining spring (35) up and push out pin (20).
6. Loosen locknut (38) and unscrew pump from bearing housing (27).

## Installation See Fig. 12 and 13.

1. Screw displacement pump into bearing housing (27) until pin hole in connecting rod assembly (29) and displacement rod (A) align. Install pin (20).
2. Continue to screw pump into bearing housing until top threads of pump cylinder are flush with face of bearing housing and outlet nipple (75) is straight back. Push retaining spring (35) into groove around connecting rod. Tighten locknut (38) to 95 N.m (70 ft-lb).

## ⚠ WARNING



### MOVING PARTS HAZARD

Be sure the retaining spring (35) is firmly in the groove of the connecting rod, all the way around, to prevent it from working loose due to vibration.

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

## ⚠ CAUTION

If the locknut (38) loosens during operation, the threads of the bearing housing (27) will be damaged. Be sure to tighten the locknut firmly.

3. Tighten packing nut/ wet-cup just enough to stop leakage, but no tighter. Fill wet-cup/packing nut 1/3 full with Graco TSL.

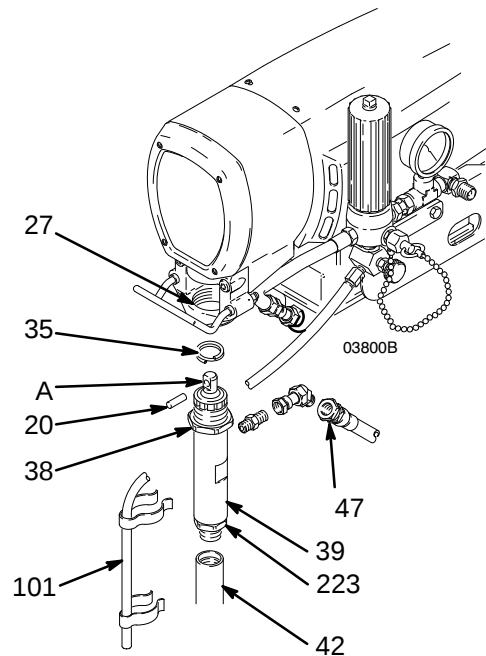


Fig. 12

- 1 Face of bearing housing
- 2 Torque to 95 N.m (70 ft-lb)

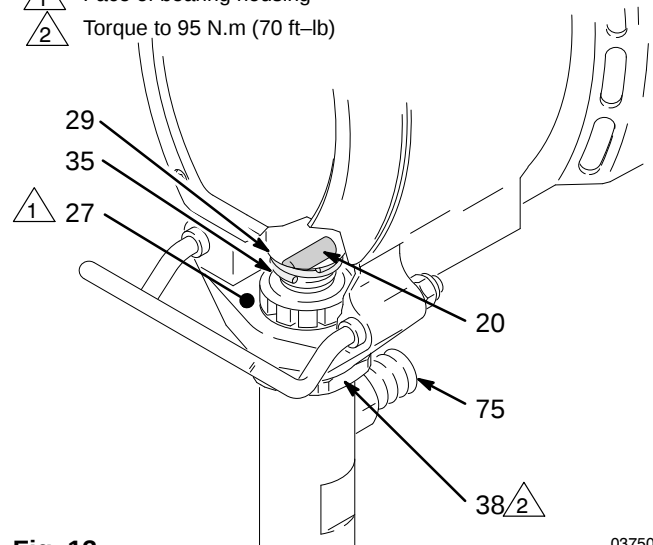


Fig. 13

03750

# Pressure Control

## ⚠ CAUTION

Do not install the pressure control until motor is checked. A defective motor may damage the pressure control. Make sure to test the motor prior to pressure control installation.

## ⚠ WARNING



### ELECTRIC SHOCK HAZARD

To reduce the risk of Electric Shock: wait 5 minutes after turning sprayer off before servicing to allow stored current to discharge.

## Motor Test

With motor shield off and four motor leads disconnected:

1. Check continuity with multimeter from each black motor lead to ground (one at a time). Any reading less than infinite resistance – even very high resistance – means motor is shorted to ground. Replace motor.

## ⚠ CAUTION

A motor that is shorted to ground will damage the pressure control.

2. Remove fan cover from motor.
3. Remove pump pin ( See page 15 for instructions to remove pin).
4. With black motor leads not connected, use motor fan to spin motor quickly. Motor should spin freely in both directions. If not, replace motor.
5. Connect black motor leads together.
6. Use motor fan to turn motor. It should be much harder to turn than in step 4. If there is uneven or no resistance to turning, check brushes and replace if necessary.
7. If there is still uneven or no resistance to turning, replace motor.

8. Install pump pin and fan cover.

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 7.

1. Relieve pressure.
2. Remove ten screws (64) and motor shield (14). See Fig. 15 and parts list, except as noted.
3. Loosen outlet cover on pressure control wiring box. Disconnect motor leads. See Fig 14.
4. Loosen black conduit (22) from pressure control fitting and pull out wires
5. Remove hose (47) from rear of pressure control (116).
6. Remove hose (121) and 45° swivel union (119) from front of pressure control (116).
7. Support pressure control (116) and carefully remove motor mount screws (37). Remove pressure control.
8. Install new pressure control (116) with screws (37).
9. Continue to assemble sprayer.

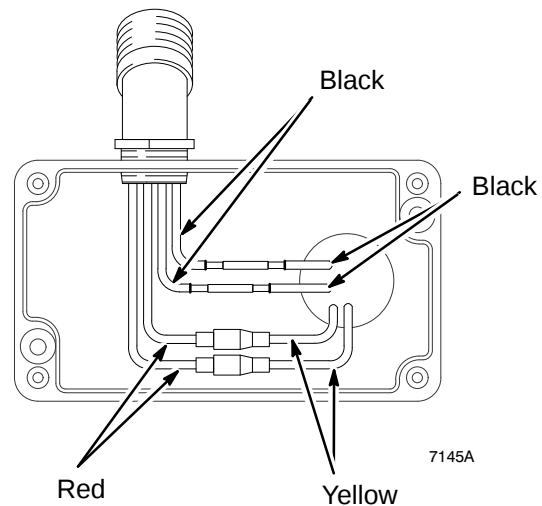


Fig 14

# Pressure Control

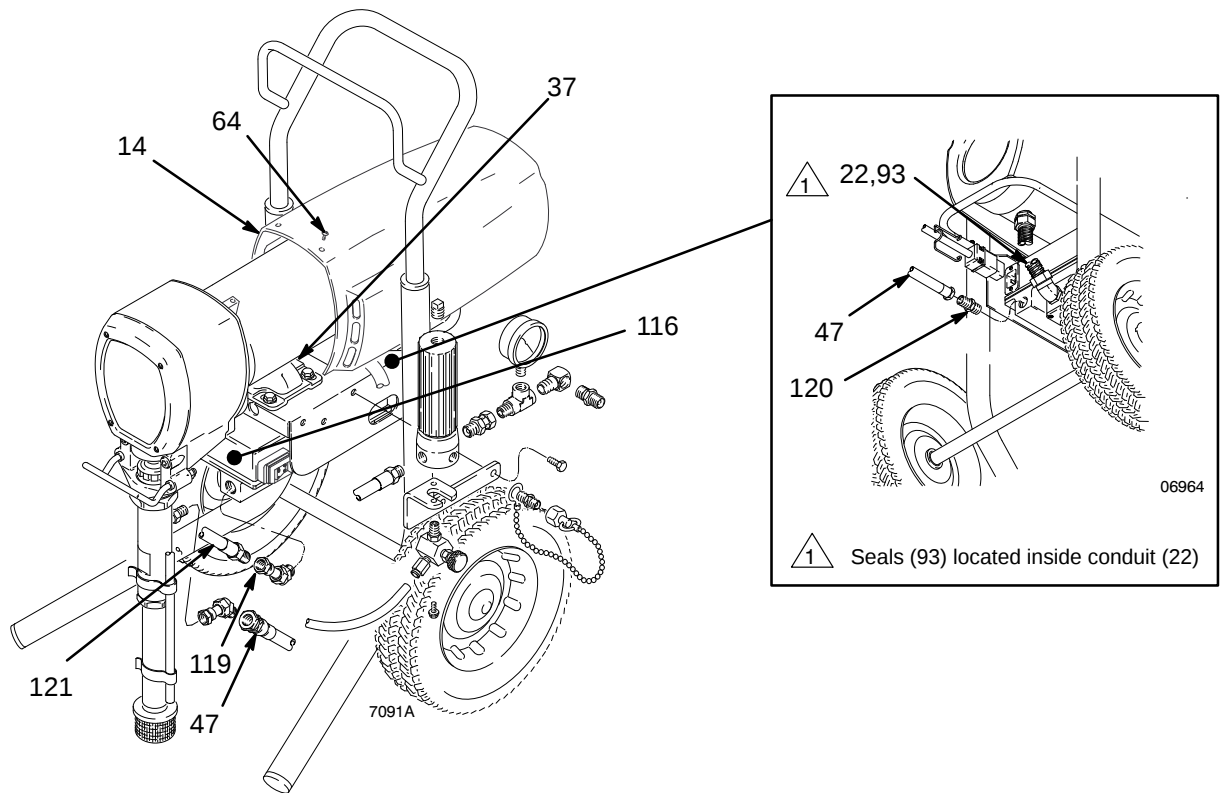


Fig 15

## Pressure Control Repair

### General Repair and Replacement


**WARNING**



**INJECTION HAZARD**

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 7.

1. Relieve pressure.
2. Remove power cord (23) and plug retainer (23a) by removing screws (230) and washers (229).
3. Remove screws (213) and lockwashers (214). Carefully remove control housing (202) from control motor board (201) so internal wiring is not damaged. Lay housing on side next to control motor board. See Fig. 16 and parts list.
4. Remove and replace only those components and wires necessary for repair. Make a diagram showing wire hook-ups for items removed to insure correct wiring when reinstalling. See Fig 17 for wiring information.

5. Install control housing (202) to motor control board (201) using screws (213) and lockwashers (214).

### Pressure Control Transducer and O-Ring Replacement


**WARNING**



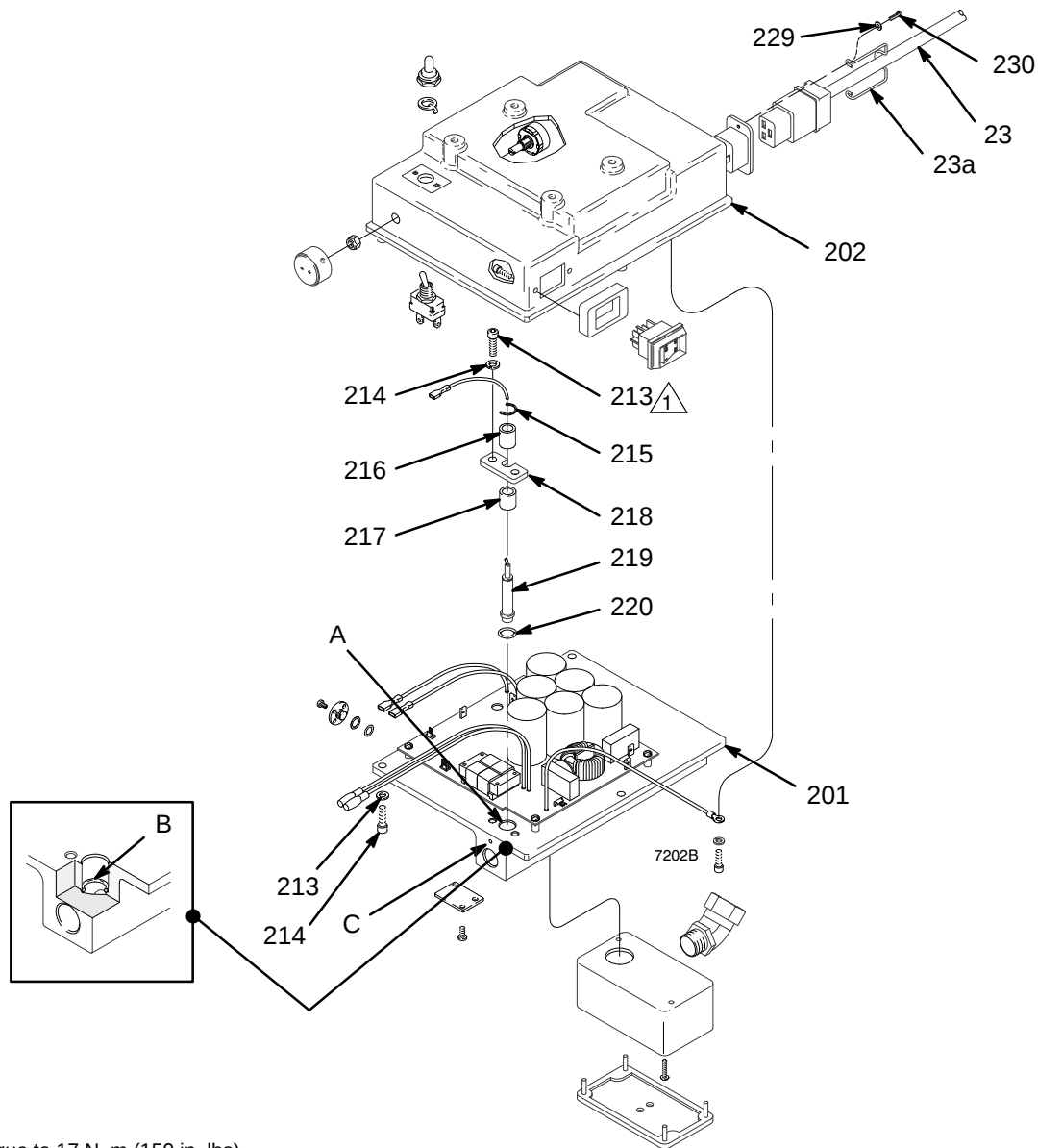
**FIRE AND EXPLOSION HAZARD**

Proper O-ring replacement 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 4.

**NOTE:** Do not replace o-ring unless damaged or if leakage is seen around weep hole, o-ring or transducer.

1. See Fig. 16 and pressure control part list. Disassemble pressure control as in steps 1 through 4 on page 17 and remove old transducer (219) and, if necessary, old o-ring (220).

# Pressure Control Repair



 Torque to 17 N-m (150 in. lbs)

**Fig 16**

2. Carefully slide new o-ring (220) down bore (A) of motor control (201) into o-ring groove (B). Make sure o-ring is in groove around its entire circumference.

**NOTE:** O-ring (220) is made of teflon which is more difficult to work with.

3. Carefully slide new transducer and plastic spacer (217) down bore. Loosely attach bracket (218), screws (213), and washers (214).
4. Seat transducer into o-ring by drawing down screws and washers until bracket is flush with motor control surface.

5. Carefully remove transducer and verify that o-ring is seated correctly and not pushed out of groove. If not seated correctly use new o-ring and repeat steps 2 through 5.

6. When o-ring is correctly installed, reinstall transducer and tighten screws to 17 N-m (150 in. lbs). Install spacer (216) and C-clip (215). Re-connect electrical lead and re-assemble sprayer.

7. Follow Operation Startup procedures for sprayer on page 7 using compatible fluid.

8. Inspect weep hole (C) for any leakage.

9. If any leakage is present, replace o-ring repeating steps 1 through 9.

# Pressure Control Wiring

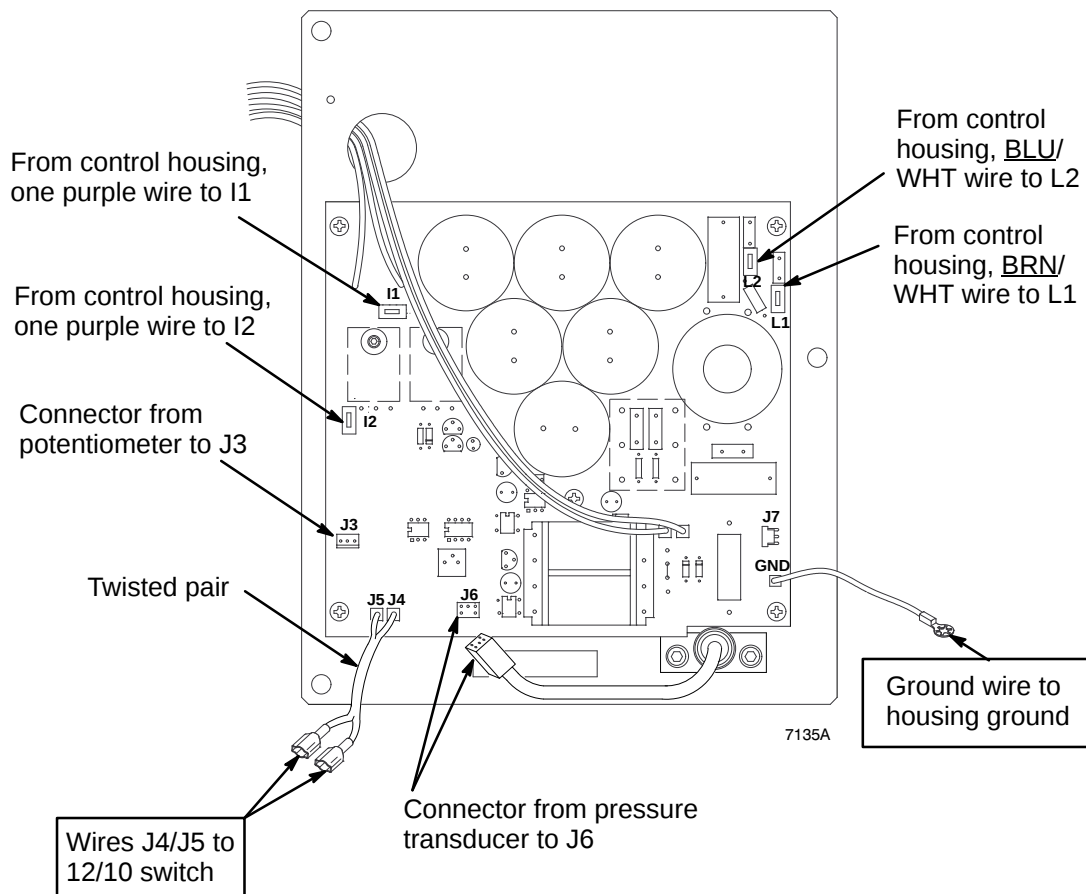
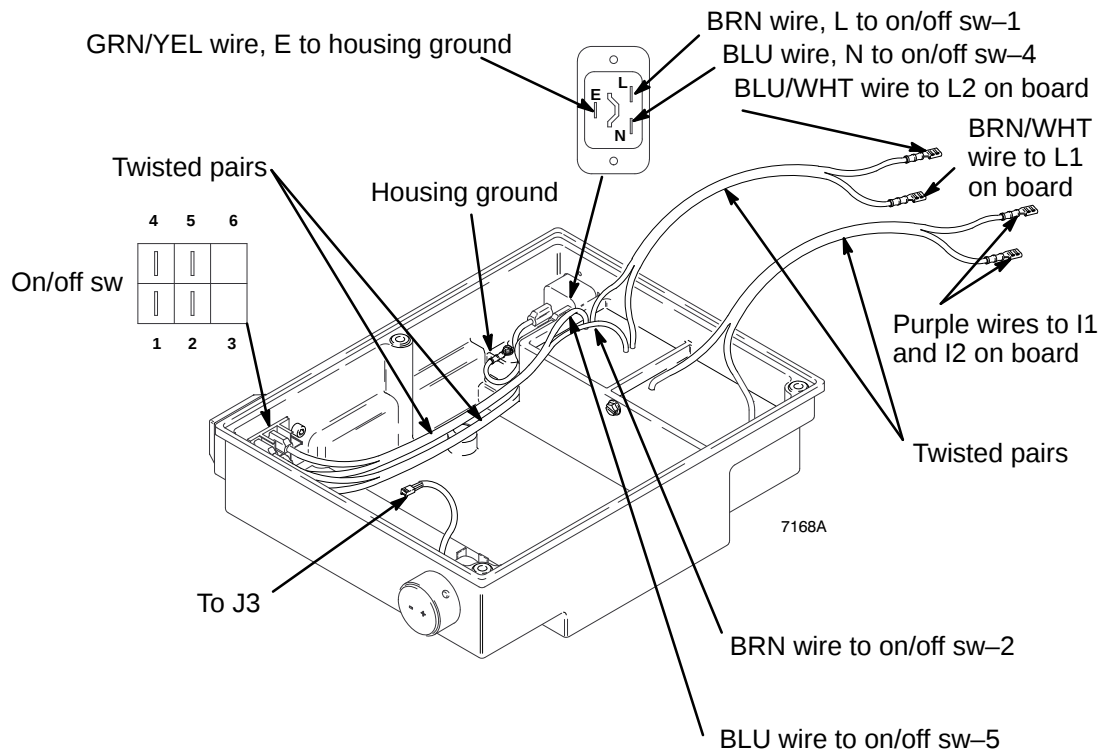


Fig 17

# 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 7.

## WARNING



### ELECTRIC SHOCK HAZARD

To reduce the risk of Electric Shock: wait 5 minutes after turning sprayer off before servicing to allow stored current to dis-

charge.

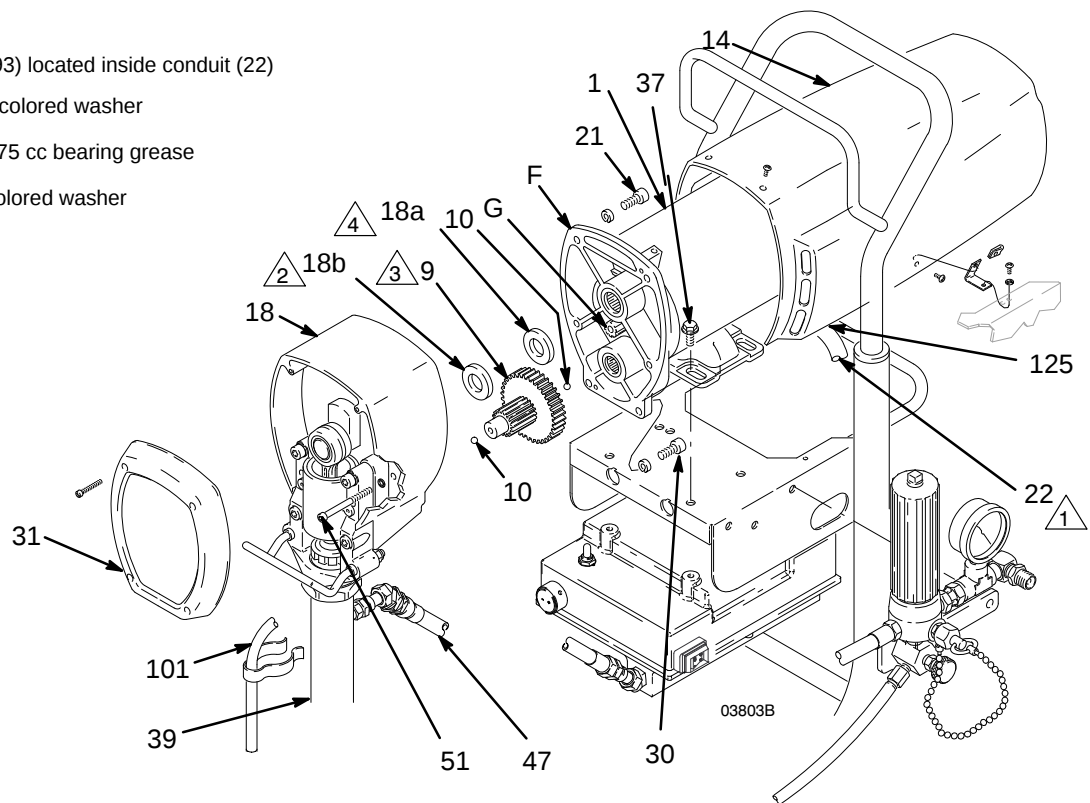
**NOTE:** Refer to Fig. 18 and parts list, except as noted.

1. Relieve pressure.
2. Remove motor shield (14). Remove front cover (31). Disconnect hose (47) at pump. Disconnect drain hose (101) from pump (39).
3. Remove outlet cover on pressure control wiring box. Disconnect four motor leads. See Fig 14.
4. Unscrew conduit connector (125) from motor and pull motor leads from conduit (22).
5. Remove screws (51) from recess of drive housing.
6. Remove screws (21 and 30) from motor bell (F).
7. Use a plastic mallet to tap displacement pump (39) from rear to loosen drive housing (18) from motor bell (F). Pull off drive housing.

**NOTE:** To avoid damage to the drive housing: Do not drop the gear cluster (9), which may stay engaged in the motor bell or in the drive housing. Do not lose the thrust balls (10) or drop them between gears. The balls usually stay in the shaft recesses, but could be dislodged. If the balls are not in place, the bearings wear prematurely.

8. Lower pressure control (116) by unscrewing motor mounting screws (37).
9. Lift off motor (1).
10. Mount and center new motor on frame and attach pressure control (116) with motor mounting screws (37).
11. Insert motor leads through connector (125) and conduit (22) to pressure control. Screw connector (125) two or three threads into motor. Tighten locknut up to motor. Connect four motor leads. See Fig. 14.
12. Liberally grease gear cluster (9) and pinion gear (G) and pack all bearings in motor bell. Be sure thrust balls (10) are in place. (One ball is included with a replacement drive housing.)
13. Place bronze-colored washer (18b) and then silver-colored washer (18a) on shaft protruding from big gear in drive housing (18).
14. Align gears and push drive housing (18) straight onto motor bell (F) and locating pins.
15. Continue to reassemble sprayer.

- △1 Seals (93) located inside conduit (22)
- △2 Bronze colored washer
- △3 Apply 175 cc bearing grease
- △4 Silver colored washer



**Fig. 18**

# Bearing Housing and Connecting Rod

## WARNING

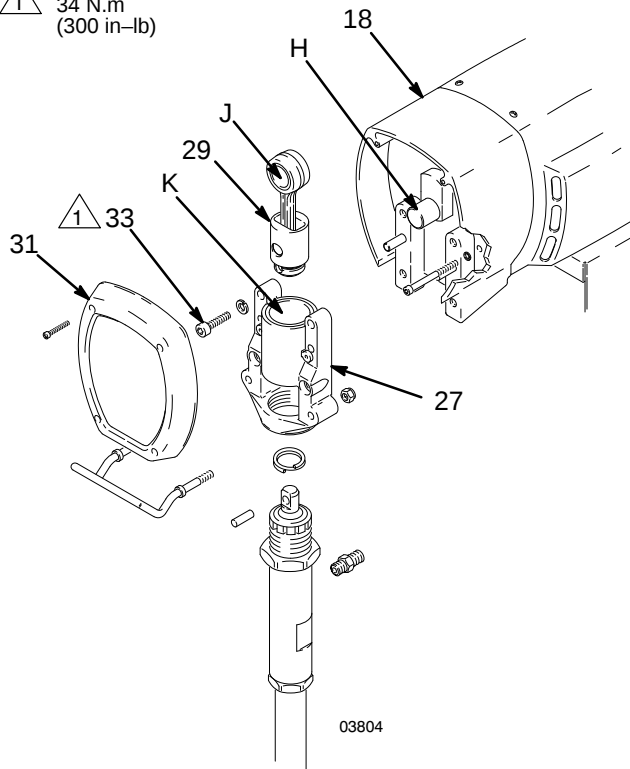


### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 7.

**Procedure** on page 7.

 Torque to  
34 N.m  
(300 in-lb)



**NOTE:** Stop the sprayer at the bottom of its stroke to get the crank (H) in its lowest position. To lower the crank manually, rotate the blades of the motor fan with a screwdriver.

1. Remove pump. See page 15.
2. Remove front cover (31). Remove bearing housing screws (33).
3. Tap lower rear of bearing housing (27) with a plastic mallet to loosen it from drive housing (18). Pull bearing housing and connecting rod (29) straight off drive housing.
4. Remove pail bracket assembly (L) and reinstall it on new bearing housing.
5. Inspect crank (H) for excessive wear and replace parts as needed.
6. Evenly lubricate inside of bronze bearing (K) with motor oil. Liberally pack roller bearing (J) with bearing grease.
7. Assemble connecting rod (29) and bearing housing (27).
8. Clean mating surfaces of bearing and drive housings.
9. Align connecting rod with crank (H) and align locating pins in drive housing with holes in bearing housing (27). Push bearing housing onto drive housing or tap it into place with a plastic mallet.
10. Install bearing housing screws (33). Torque evenly to 34 N.m (300 in-lb).
11. Reinstall all parts. See page 15 to install pump.

Fig. 19

# Drive Housing Replacement

## ⚠ WARNING



### INJECTION HAZARD

To reduce the risk of serious injury, whenever you are instructed to relieve pressure, follow the **Pressure Relief Procedure** on page 7.

**NOTE:** Stop the sprayer at the bottom of its stroke to get the crank (H) in its lowest position. To lower it manually, carefully rotate the blades of the fan with a screwdriver.

1. Remove front cover (31). Remove motor shield (14).
2. Disconnect pump outlet hose (47).
3. Remove screws (33) from bearing housing.
4. Lightly tap lower rear of bearing housing (27) with a plastic mallet to loosen it from drive housing (18). Pull bearing housing and connecting rod assembly straight off drive housing.
5. Remove screws (51) from recess of drive housing.
6. Remove screws (30 and 21) from motor bell (F).
7. Tap drive housing (18) with a plastic mallet to loosen from motor bell, then pull straight off.
- NOTE:** To avoid damage to the drive housing: Do not drop the gear cluster (9), which may stay engaged in the motor bell or in the drive housing. Do not lose the thrust balls (10) or drop them between gears. The balls usually stay in the shaft recesses, but could be dislodged. If the balls are not in place, the bearings will wear prematurely.
8. Use approximately 175 cc of bearing grease supplied with drive housing replacement kit to grease gear cluster (9). Check to be sure thrust balls (10) are in place.
9. Place bronze-colored washer (18b) and then silver-colored washer (18a) on shaft protruding from big gear in drive housing (18).
10. Align gears and push new drive housing straight onto motor bell and locating pins.
11. Continue to reassemble sprayer. Torque screws (33) to 34 N.m (300 in-lb).

1 Torque to 34 N.m (300 in-lb)

2 Bronze color

3 Apply 175 cc bearing grease to this gear

4 Silver color

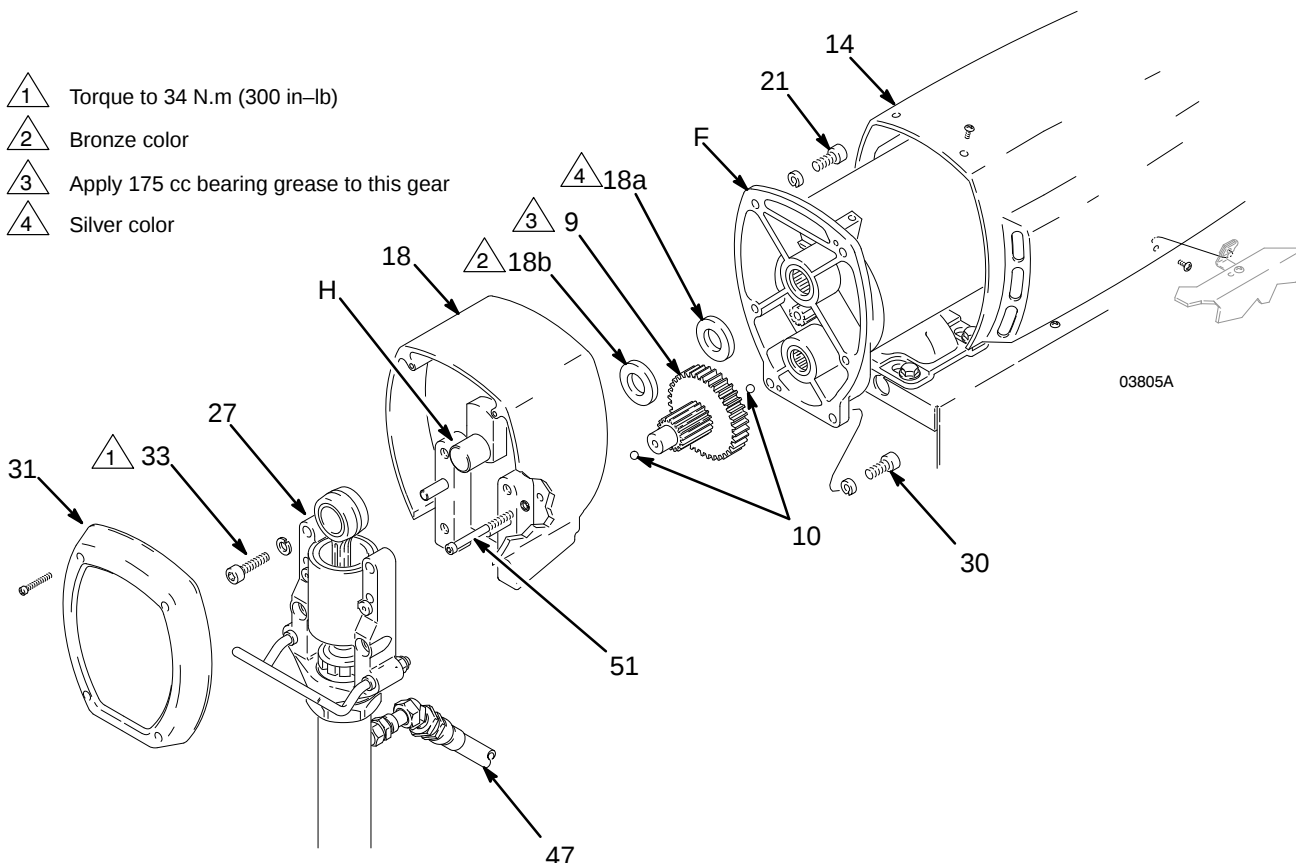


Fig. 20

[illegible]

# Sprayer Parts List

## Model 231–321, Series A

Includes items 1–134

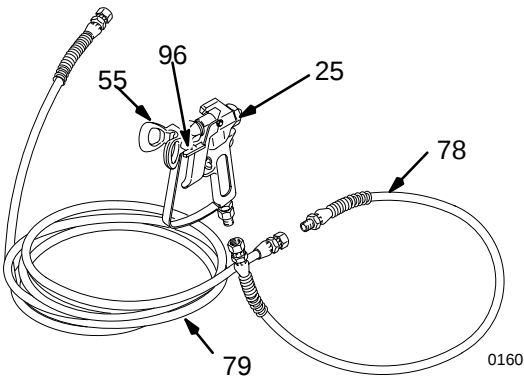
**NOTE:** Items 25, 55, 78, 79, and 96 are shown on page 26.

| Ref No. | Part No. | Description                                                                                | Qty | Ref. No. | Part No. | Description                                   | Qty. |
|---------|----------|--------------------------------------------------------------------------------------------|-----|----------|----------|-----------------------------------------------|------|
| 1       | 235–726  | MOTOR KIT                                                                                  | 1   | 46       | 162–453  | NIPPLE, hex; 1/4 npsm x 1/4 npt, 1–3/16" long | 2    |
| 2       | 290–058  | LABEL, identification, motor cover                                                         | 1   | 47       | 235–542  | HOSE, 3/8 npsm(f) x 14–1/2"                   | 1    |
| 3       | 290–059  | LABEL, identification, motor cover                                                         | 1   | 48       | 214–570  | FLUID FILTER                                  |      |
| 4       | 290–057  | LABEL, identification, front cover                                                         | 1   |          |          | <i>see manual 307–273 for parts</i>           |      |
| 6       | 220–636  | CART                                                                                       | 1   |          |          | <i>includes one of items 46 and 85</i>        | 1    |
| 7       | 181–072  | STRAINER                                                                                   | 1   | 49       | 106–115  | LOCKWASHER, spring; 3/8"                      | 4    |
| 8       | 156–823  | UNION, swivel                                                                              | 1   | 51       | 108–849  | CAPSCREW, sch; 1/4–20 x 3"                    | 2    |
| 9       | 220–637  | GEAR REDUCER                                                                               | 1   | 52       | 110–243  | RING, retaining                               | 2    |
| 10      | 100–069  | BALL, steel; 1/4" dia.                                                                     | 1   | 53       | 108–691  | PLUG, tubing                                  | 2    |
| 11      | 104–811  | HUBCAP                                                                                     | 2   | 54       | 108–460  | CONNECTOR                                     | 1    |
| 12      | 220–285  | CAP                                                                                        | 1   | 57▲      | 178–034  | TAG, WARNING (not shown)                      | 1    |
| 14      | 223–153  | MOTOR SHIELD KIT                                                                           | 1   | 58       | 101–242  | RING, retaining                               | 2    |
| 17      | 111–590  | BUTTON, snap                                                                               | 2   | 59       | 206–994  | THROAT SEAL LIQUID, 0.27 liter                | 1    |
| 18      | 220–879  | DRIVE HOUSING KIT                                                                          |     | 60       | 179–811  | WHEEL                                         | 2    |
|         |          | <i>Includes items 18 a and 18b,</i>                                                        |     | 61       | 220–633  | HANDLE, cart                                  | 1    |
|         |          | <i>and one of item 10</i>                                                                  | 1   | 62       | 187–603  | SLEEVE, cart handle                           | 2    |
| 18a     | 183–209  | .BEARING, thrust                                                                           | 1   | 63       | 105–510  | LOCKWASHER, spring, 1/4"                      | 6    |
| 18b     | 106–227  | .SPACER                                                                                    | 1   | 64       | 108–865  | SCREW, mach, pnh; 8–32 x 3/8"                 | 10   |
| 19      | 189–918  | HANGER, pail                                                                               | 1   | 69       | 112–746  | NUT, retainer                                 | 2    |
| 20      | 183–210  | PIN, straight, 3/8 x 1–1/8"                                                                | 1   | 75       | 183–461  | ADAPTER; 3/8 npsm x 1/4 npt                   | 1    |
| 21      | 100–644  | SCREW, soc head, no. 1/4–20 x 3/4"                                                         | 2   | 80       | 109–032  | SCREW, mach, pnh; 10–24 x 1/4"                | 4    |
| 22      | 065–312  | CONDUIT, electrical                                                                        |     | 81       | 185–384  | BRACKET                                       | 2    |
|         |          | <i>specify length when ordering: 140 mm</i>                                                |     | 82       | 110–240  | NUT                                           | 2    |
| 23      | 239–XXX* | CORD, power                                                                                | 1   | 83       | 183–350  | WASHER, flat; 7/8" ID                         | 2    |
|         |          | * Select power cord part number from list below for country in which sprayer is to be used |     | 85       | 100–040  | PLUG                                          | 1    |
|         | 239–670  | CORD, power                                                                                |     | 91       | 100–020  | LOCKWASHER, .194" ID                          | 2    |
|         |          | ( for Continental Europe, CEE 7/7 )                                                        |     | 93       | 107–447  | SEAL                                          | 2    |
|         | 239–671  | CORD, power ( for Italy )                                                                  |     | 95       | 183–466  | LABEL, Caution                                | 1    |
|         | 239–672  | CORD, power ( for Denmark )                                                                |     | 97▲      | 185–951  | LABEL, WARNING                                | 1    |
|         | 239–673  | CORD, power ( for Switzerland )                                                            |     | 98▲      | 185–952  | LABEL, WARNING                                | 1    |
|         | 239–674  | CORD, power ( none–bare end )                                                              |     | 100      | 186–490  | CLIP, spring                                  | 1    |
| 23a     | 192–149  | PLUG, Retainer (part of 23)                                                                | 1   | 101      | 190–339  | TUBE, drain                                   | 1    |
| 23      | 224–263  | POWER SUPPLY CORD                                                                          | 1   | 102      | 181–102  | CLIP, spring                                  | 1    |
| 24      | 107–264  | TERMINAL, female (not shown)                                                               | 2   | 114      | 102–814  | GAUGE, pressure                               | 1    |
| 26      | 154–636  | WASHER                                                                                     | 2   | 115      | 106–228  | TEE, street                                   | 1    |
| 27      | 220–639  | BEARING HOUSING KIT                                                                        | 1   | 116      | 239–429  | PRESSURE CONTROL KIT                          | 1    |
| 29      | 220–640  | CONNECTING ROD KIT                                                                         | 1   |          |          | <i>See Parts List on page 29</i>              |      |
| 30      | 100–643  | SCREW, socket head, no. 1/4–20 x 1"                                                        | 2   | 118      | 239–279  | PRESSURE DRAIN VALVE                          | 1    |
| 31      | 183–168  | COVER, housing                                                                             | 1   | 119      | 161–889  | UNION, swivel                                 | 2    |
| 32      | 108–850  | SCREW, mach, filh; no. 8–32 x 1–1/4"                                                       | 4   | 120      | 156–849  | NIPPLE, pipe                                  | 1    |
| 33      | 110–141  | CAPSCREW, sch; 3/8–16 x 1–1/5"                                                             | 4   | 121      | 239–278  | HOSE, high pressure, 12 in.                   | 1    |
| 34      | 100–840  | ELBOW                                                                                      | 1   | 122      | 192–135  | BRACKET, filter                               | 1    |
| 35      | 183–169  | SPRING, retaining                                                                          | 1   | 124      | 111–040  | LOCKNUT, nylon, 5/16–18                       | 2    |
| 37      | 110–963  | CAPSCREW, flange head, 5/16–18 x 3/4"                                                      | 6   | 125      | 110–138  | CONNECTOR, conduit                            | 1    |
| 38      | 189–969  | NUT, HEX, 1 13/16 unc–2b                                                                   | 1   | 126      | 110–997  | CAPSCREW, flange hd                           | 2    |
| 39      | 220–872  | DISPLACEMENT PUMP                                                                          |     | 133      | 107–266  | TERMINAL, male (not shown)                    | 2    |
|         |          | <i>see manual 307–806</i>                                                                  | 1   | 134      | 290–447  | LABEL, Warning                                | 3    |
| 42      | 183–423  | TUBE, INTAKE                                                                               | 1   |          |          |                                               |      |

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

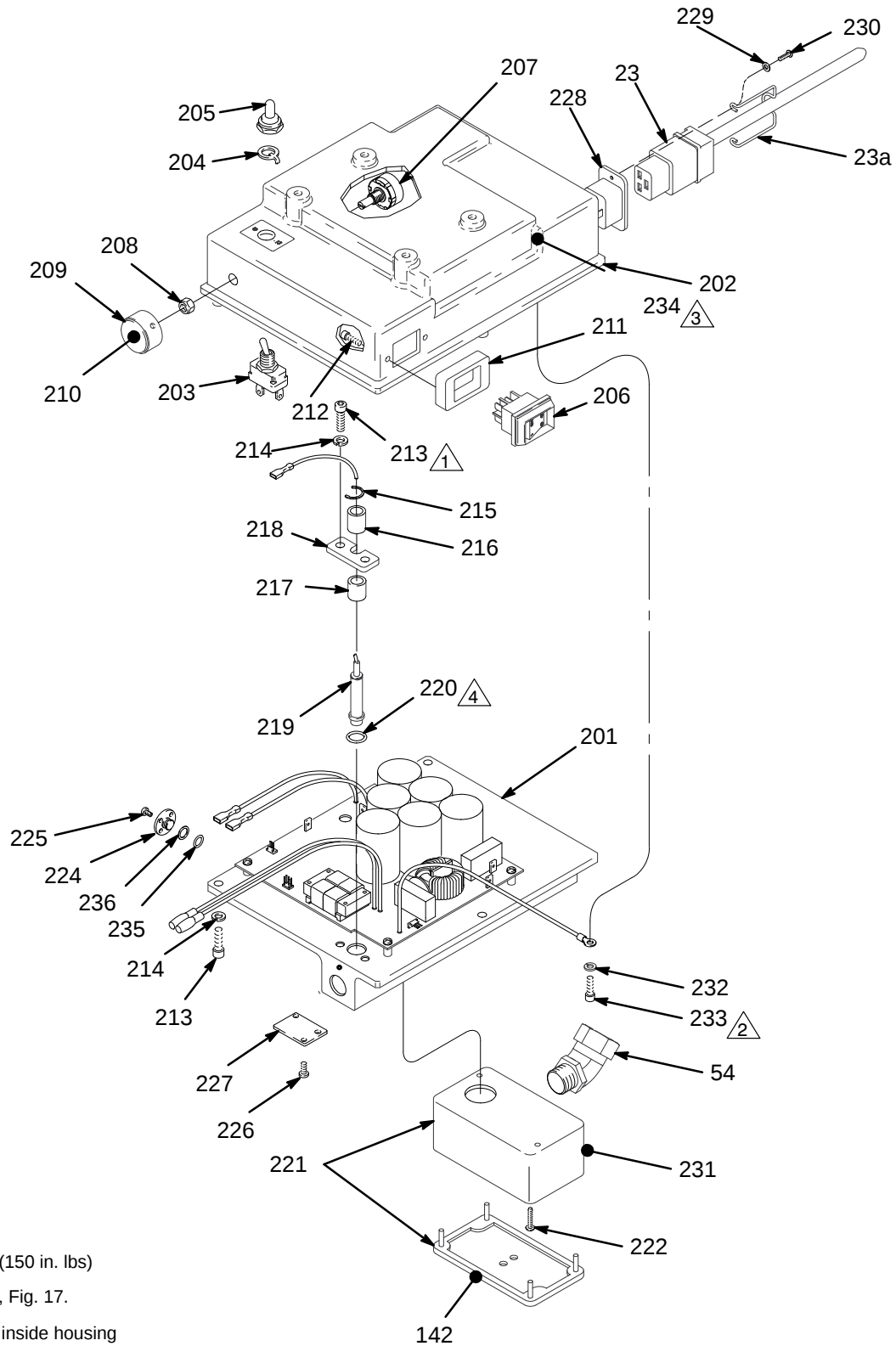
# Hose and Gun Parts Drawing and List

| Ref No. | Part No. | Description                                                                                   | Qty |
|---------|----------|-----------------------------------------------------------------------------------------------|-----|
| 25      | 222-667  | SPRAY GUN<br><i>see manual 307-614 for parts</i>                                              | 1   |
| 55      | 237-859  | TIP GUARD, RAC IV<br><i>see manual 308-644</i>                                                | 1   |
| 78      | 238-358  | HOSE, grounded, nylon; 3/16" ID;<br>cpld 1/4 npsm(f); 3 ft. (9 m);<br>spring guards both ends | 1   |
| 79      | 238-361  | HOSE, grounded, nylon; 1/4" ID;<br>cpld 1/4 npsm(f); 50 ft (15 m);<br>spring guards both ends | 1   |
| 96      | 221-621  | TIP, RAC IV, size 621                                                                         | 1   |



[illegible]

# Pressure Control Parts List



- 1 Torque to 17 N-m (150 in. lbs)
- 2 To housing ground, Fig. 17.
- 3 Located this point, inside housing
- 4 WARNING! See Pressure Control Transducer and O-Ring Replacement on page 17 for correct replacement procedure.

Fig 21

7135A

# Pressure Control Parts List

## Part Number 239–429

Pressure Control

Includes items 201 – 327

| Ref No. | Part No. | Description                                                                    | Qty | Ref No. | Part No. | Description                                                                                                                          | Qty |
|---------|----------|--------------------------------------------------------------------------------|-----|---------|----------|--------------------------------------------------------------------------------------------------------------------------------------|-----|
|         | 239–429  | PRESSURE CONTROL<br><i>See Ref. No. 116 on page 25 for location on Sprayer</i> | 1   | 220     | 104–319  | PACKING, o–ring WARNING! <i>See Pressure Control Transducer and O–Ring Replacement on page 17 for correct replacement procedure.</i> | 1   |
| 201     | 239–283  | MOTOR CONTROL BOARD                                                            | 1   | 221     | 239–428  | ELECTRICAL ENCLOSURE KIT                                                                                                             | 1   |
| 202     | 239–427  | CONTROL HOUSING<br><i>For complete assembly, order part number 238–976.</i>    | 1   | 222     | M71–503  | SCREW                                                                                                                                | 2   |
|         |          |                                                                                |     | 224†    | 192–142  | PLUG                                                                                                                                 | 1   |
| 203     | 111–930  | . SWITCH, toggle (12/10)                                                       | 1   | 225†    | 104–836  | SCREW                                                                                                                                | 4   |
| 204     | 105–658  | . RING, locking                                                                | 1   | 226†    | 110–637  | SCREW                                                                                                                                | 2   |
| 205     | 105–659  | . BOOT, toggle                                                                 | 1   | 227†    | 192–155  | COVER                                                                                                                                | 1   |
| 206     | 111–961  | . SWITCH, rocker (on/off)                                                      | 1   | 228     | 113–799  | INLET, ac power                                                                                                                      | 1   |
| 207     | 236–352  | . POTENTIOMETER (pressure adjust)                                              | 1   | 229     | 114–027  | WASHER, flat                                                                                                                         | 2   |
| 208     | 112–382  | . NUT, shaft sealing                                                           | 1   | 230     | 112–546  | SCREW, machine, phillips, pan hd                                                                                                     | 2   |
| 209     | 112–373  | . KNOB, control                                                                | 1   | 231▲    | 189–930  | LABEL, caution                                                                                                                       | 1   |
| 210     | 290–147  | . LABEL, control knob                                                          | 1   | 232     | 157–021  | WASHER, lock, internal                                                                                                               | 1   |
| 211     | 192–226  | . SPACER, switch                                                               | 1   | 233     | 111–593  | SCREW, grounding                                                                                                                     | 1   |
| 212     | 112–788  | . SCREW, cap hd                                                                | 2   | 234     | 186–620  | LABEL, ground                                                                                                                        | 1   |
| 213     | 100–644  | SCREW, cap                                                                     | 5   | 235†    | 111–710  | O–RING                                                                                                                               | 1   |
| 214     | 100–016  | WASHER, lock                                                                   | 5   | 236†    | 111–711  | RING, backup                                                                                                                         | 1   |
| 215     | 114–031  | CLIP, cee                                                                      | 1   | 323*    | 235–009  | SWITCH TRANSDUCER (not shown)                                                                                                        | 1   |
| 216     | 192–223  | SPACER, transducer                                                             | 1   | 324*    | 192–150  | BLOCK, transducer (not shown)                                                                                                        | 1   |
| 217     | 192–144  | SPACER, transducer                                                             | 1   | 325*    | 108–850  | SCREW, machine, fil hd (not shown)                                                                                                   | 4   |
| 218     | 192–145  | BRACKET, transducer                                                            | 1   | 326*    | 111–704  | SCREW, machine, fil hd (not shown)                                                                                                   | 2   |
| 219     | 236–364  | TRANSDUCER, pressure control                                                   | 1   | 327*    | 239–530  | SWITCH (not shown)                                                                                                                   | 1   |

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

† These parts are included on 231–321 sprayers as shipped, but not on replacement pressure control 239–429.

\* These parts are included with replacement pressure control 239–429, but are not on 231–321 sprayers as shipped.

# Accessories

*Use Only Genuine Graco Parts and Accessories*

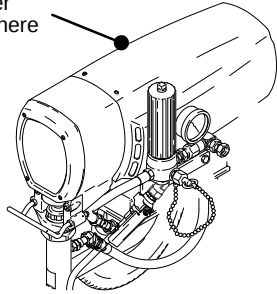
## DANGER LABELS

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.

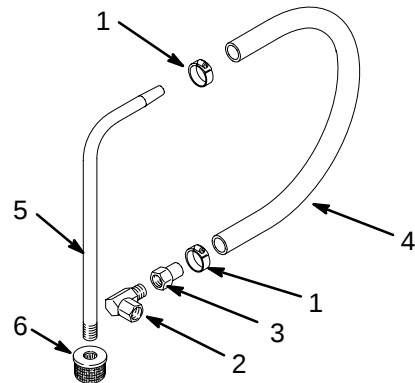
Order the labels directly from your Graco distributor.

Apply other language here

**French** 185-955  
**Spanish** 185-962  
**German** 186-042  
**Greek** 186-046  
**Korean** 186-050



|   |         |               |   |
|---|---------|---------------|---|
| 5 | 170-957 | TUBE, suction | 1 |
| 6 | 181-072 | STRAINER      | 1 |



0161

## 55 Gallon (200 Liter) Suction Tube Kit 208-259

Includes:

| Ref No. | Part No. | Description                                                                   | Qty |
|---------|----------|-------------------------------------------------------------------------------|-----|
| 1       | 156-589  | UNION, 90° ADAPTER, 3/4 npt(f) x 3/4 npsm(f) swivel                           | 1   |
| 2       | 214-961  | HOSE, coupled 3/4 npt(mbe) 3/4" ID; nylon, 6 ft (1.8 m); spring guard one end | 1   |
| 3       | 156-591  | ELBOW, 90°; 3/4 npt x 1-1/2 - 24 NS                                           | 1   |
| 4       | 156-593  | PACKING, o-ring, nitrile rubber                                               | 1   |
| 5       | 100-220  | THUMBSCREW, 5/16-18 x 1"                                                      | 1   |
| 6       | 176-684  | ADAPTER, bung                                                                 | 1   |
| 7       | 156-592  | TUBE, riser                                                                   | 1   |
| 8       | 159-100  | RETAINER, screen                                                              | 1   |
| 9       | 161-377  | SCREEN, filter                                                                | 1   |
| 10      | 159-101  | NUT, screen retainer                                                          | 1   |

## Motor Brush Kit 222-157

## Displacement Pump Packing Kit 220-877

See contents on page 20. Repair instructions are provided in this manual and are also supplied with the kit.

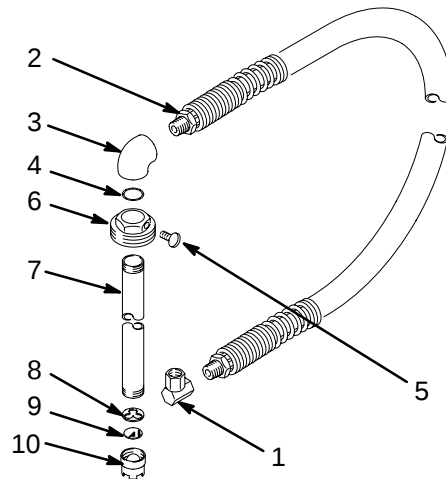
## Sleeve Removal Tool 224-788

Required to remove a pump sleeve.

## 5 Gallon (19 Liter) Suction Tube Kit 208-920

Includes:

| Ref No. | Part No. | Description                       | Qty |
|---------|----------|-----------------------------------|-----|
| 1       | 101-818  | CLAMP, hose                       | 2   |
| 2       | 160-327  | UNION, 90° swivel; 3/4 npt(m x f) | 1   |
| 3       | 170-705  | ADAPTER, intake                   | 1   |
| 4       | 170-706  | HOSE, 1" ID x 48"; nylon          | 1   |



0162

# Technical Data

|                                                          |                                                                       |
|----------------------------------------------------------|-----------------------------------------------------------------------|
| Power Requirements (full output)                         | 220 VAC, 50Hz,<br>1 phase, 12 Amp minimum                             |
| Working Pressure Range                                   | 0–21.0 MPa (0 – 210 bar, 0–3000 psi)                                  |
| Cycles/Liter (gallon)                                    | 27.5 (104)                                                            |
| Power Cord                                               | 1.5 mm <sup>2</sup> , 3 wire, 3 m (10')                               |
| Inlet Paint Strainer                                     | 16 mesh (1190 micron)<br>Stainless Steel Screen, reusable             |
| Outlet Paint Filter                                      | 60 mesh (250 micron)<br>Stainless Steel Screen, reusable              |
| Pump Inlet Size                                          | 3/4 npt(m)                                                            |
| Fluid Outlet Size                                        | 1/4 npsm from fluid filter                                            |
| Sound Data                                               |                                                                       |
| Sound pressure level                                     | 85.3 db(A)                                                            |
| Sound power level                                        | 95.2 db(A)                                                            |
| Measured under maximum operating conditions per ISO–3744 |                                                                       |
| Wetted Parts:                                            |                                                                       |
| <i>Displacement Pump</i>                                 | Carbon steel, Polyurethane,<br>Polyethylene, Teflon® Delrin®, Leather |
| <i>Filter</i>                                            | Aluminum, Carbon steel, Stainless Steel,                              |

**NOTE:** Teflon® and Delrin® are a registered trademarks of the DuPont Company.

## Dimensions

|                                     |                    |
|-------------------------------------|--------------------|
| Weight (w/o packaging, hose or gun) | 55.5 kg (122 lb)   |
| Height                              | 813 mm (32 in.)    |
| Length                              | 616 mm (24.25 in.) |
| Width                               | 572 mm (22.5 in.)  |

# Graco Warranty

Graco warrants all equipment listed in this manual which is 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.

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, gas engines, 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.

## LIMITATION OF LIABILITY

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.

## ADDITIONAL WARRANTY COVERAGE

Graco does provide extended warranty and wear warranty for products described in the "Graco Contractor Equipment Warranty Program".

# Graco Phone Number

**TO PLACE AN ORDER**, contact your Graco distributor, or call this number to identify the distributor closest to you:  
**1-800-367-4023 Toll Free**

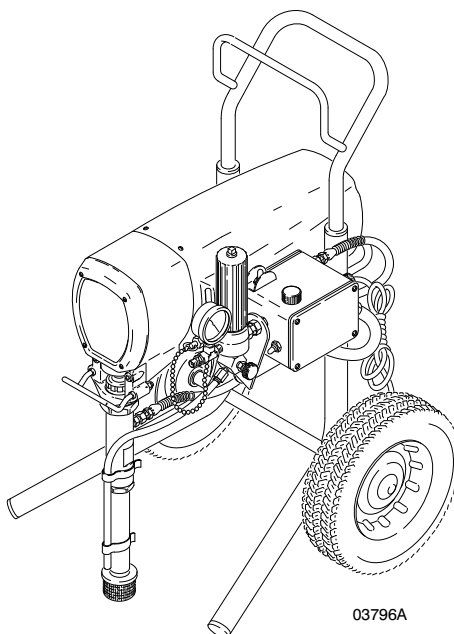
*All written and visual data contained in this document reflects the latest product information available at the time of publication.  
Graco reserves the right to make changes at any time without notice.*

**Sales Offices:** Atlanta, Chicago, Detroit, Los Angeles  
**Foreign Offices:** Belgium, Canada, England, Korea, Switzerland, France, Germany, Hong Kong, Japan

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

PRINTED IN U.S.A. 308-552 December 1994, Revised April 1997

# E-Z REFERENCE ULTRA Plus+ 1500



Model 231–321 Complete sprayer  
with 15.2 m (50 ft) long 1/4 in. I.D. hose, 0.9 m (3 ft) long 3/16 in. I.D. whip  
hose, Contractor gun, RAC IV DripLess™ Tip Guard, and 621 SwitchTip™

## TECHNICAL DATA

Maximum Working Pressure . . . . . 210 bar (3000 psi)  
Motor . . . . . 1.5 HP, DC  
Power Requirements . . . . . 220 VAC, 50 Hz,  
1 phase, 12 amp minimum  
Cycles Per Liter (Gallon) . . . . . 27.5 (104)  
Delivery . . . . . 4.75 lpm (1.25 gpm)  
Tip Size . . . . . 1 gun with 0.035 inch tip  
2 guns with 0.025 inch tip  
with waterbase paint at 138 bar (2000 psi)  
Fluid Inlet Size . . . . . 3/4 npt(m)  
Fluid Filter Outlet Size . . . . . 1/4 npsm(m)  
Fluid Filter . . . . . aluminum, stainless steel,  
carbon steel, 250 micron (60 mesh)  
reusable SST screen  
Inlet Paint Strainer . . . . . 1190 micron (16 mesh)  
reusable SST screen

Spray Hose Requirements . . . . . grounded,  
15.2 m (50 ft) minimum, non-wire braid,  
spring guards on both ends  
Pump Material . . . . . carbon steel, stainless steel,  
polyurethane, Delrin®  
Pump Packing Material . . . . . polyethylene, leather,  
polyurethane

## APPLICATION

Sprays full range of architectural coatings, heavy  
mastics, elastomerics, polyurethanes, and epoxies. **Do  
not** use with solvents such as methylene chloride or  
other HHCs.

Patents pending.

## DIMENSIONS

Height . . . . . 813 mm (32 in)  
Length . . . . . 616 mm (24.3 in)  
Width . . . . . 572 mm (22.5 in)  
Weight  
(without packaging, hose, or gun) . . . 55.5 kg (122 lb)



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

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# 3Z8-552

Rev A

# E-Z REFERENCE

Supplement to instruction manual 308-552.

## Ultra Plus+ 1500 Airless Paint Sprayer

### ⚠ WARNING



#### INJECTION HAZARD

This is only a quick reference to the features and frequently ordered parts of this sprayer. To reduce the risk of serious injury, including fluid injection, while operating or repairing this sprayer, follow the warnings and instructions in manual 308-552.

Model 231-321, Series A Complete sprayer

| Ref No. | Part No. | Description          |
|---------|----------|----------------------|
| 1       | 181-072  | Strainer             |
| 2       | 183-423  | Intake Tube          |
| 3       | 181-102  | Spring Clip          |
| 4       | 186-495  | Drain Tube           |
| 5       | 186-490  | Spring Clip          |
| 6       | 220-872  | Displacement Pump    |
| 6a      | 183-186  | . Packing Nut        |
| 6b      | 183-181  | . Cylinder           |
| 6c      | 188-148  | . Sleeve             |
| 6d      | 220-630  | . Piston Rod         |
| 6e      | 235-499  | . Piston Valve       |
| 6f      | 220-629  | . Intake Valve       |
| 7       | 220-639  | Bearing Housing Kit  |
| 8       | 220-640  | Connecting Rod Kit   |
| 9       | 220-879  | Drive Housing Kit    |
| 10      | 235-726  | Motor Kit            |
| 11      | 220-637  | Gear Reducer         |
| 12      | 220-633  | Handle and Hose Rack |
| 13▲     | 185-951  | Danger Label         |
| 14      | 220-636  | Cart                 |
| 15      | 224-385  | Pressure Control Kit |
| 16      | 214-570  | Fluid Filter         |
| 17      | 112-153  | Circuit Breaker      |
| 18      | 105-659  | Boot                 |
| 19      | 105-679  | Switch               |
| 20      | 221-077  | Pressure Drain Valve |
| 21      | 102-814  | Pressure Gauge       |

▲ Extra danger labels are available for free.

**Packing Repair Kit 220-877**  
Includes all parts marked with a ★

**Sleeve Removal 224-788**

**Motor Brush Kit 222-157**  
**Motor Brush Spring Clip 110-816**

